Final Revision 1

Munitions and Explosives of Concern RCRA Facility Investigation Work Plan:

FTRU-001-R-01 Anti-Tank/Rocket Grenade Range, FTRU-003-R-01 Infiltration/Grenade Range, and FTRU-004-R-01 .22-Caliber Target Butt

Fort Rucker, Alabama

Contract No. W91ZLK-05-D-0014
Contract Task Order No. 0001

Prepared for:

U.S. Army Environmental Command

Prepared by:

CH2MHILL®
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November 2011

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Installation Certification

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the 335-14-8-.02 8-13 information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

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Susan Cowart
Installation Restoration Manager
Fort Rucker, Alabama

DATE ___________________________

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Alfred T. Townsend
Chief, Environmental and Natural Resources Division
Fort Rucker, Alabama

DATE ___________________________

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Edwin P. Janasky
Director, Public Works
Fort Rucker, Alabama

DATE ___________________________

Groundwater Scientist Certification

"I certify that I am a qualified groundwater scientist who has received a baccalaureate or post-graduate degree in the natural sciences or engineering and has sufficient training and experience in groundwater hydrology and related fields as demonstrated by State registration, professional Certifications, or completion of accredited university programs that enable me to make sound professional judgments regarding groundwater monitoring, contaminant fate and transport, and corrective action. I further certify that this Report was prepared and/or reviewed by myself or by a subordinate working under my direction."

Mark A. Sherrill	PG No. 885 Expires February 28, 2012

DATE ______________

CH2M HILL Response to Additional ADEM Comments on the Redline Version of the Fort Rucker RFI Work Plan
Provided October 26, 2011

Comment 15: The DFW specified in Section 4.3.1 still don't match the DFW identified in Table 4-1. The table below shows the differences:

Section 4.3.1 DFW	Table 4-1 DFW
Mobilization/site preparation	Planning/premobilization activities
Boundary survey	Mobilization
Vegetation clearing	Site preparation (mobilization)
Surface clearance	Site preparation (site survey)
DGM	Site preparation (vegetation removal)
Instrument-assisted walkabout	Surface clearance
Intrusive investigation	IVS
Management of MPPEH/MDEH/MDAS including inspection, demilitarization, certification, verification, and disposition	DGM
Demilitarization of MEC (note this DFW is included in the one above)	DGM data processing
Demobilization	Instrument-assisted site walkabout
	Intrusive investigation
	MPPEH/MDEH/MDAS management
	Demobilization
	Report preparation and approval

Developing DFWs is one of the building blocks of a QC program and it is important that the DFW used throughout the document remain consistent. The Department recommends establishing DFWs in Section 4.3.1 (as has been done) and then using those exact DFWs in the DFW column in Table 4-1.

CH2M HILL RESPONSE: Concur. To ensure complete agreement between Section 4.3.1 and Table 4-1, the DFWs have been revised as:
- **Planning/Premobilization Activities**
- **Mobilization/site preparation**
- **Transect survey**
- **Vegetation clearing**
- **Surface clearance**
- **DGM**
- **Instrument-assisted walkabout**
- **Intrusive Investigation**
- **Management of MPPEH/MDEH/MDAS, including inspection, demilitarization, certification, verification, and disposition**
- **Demobilization**
- **Report Preparation and Approval**

Comment 16: A few requirements from the work plan are still missing from Table 4-1 and should be added. For example, the process and inspection to verify the areas of the MRS that are determined to be homogenous, agreed upon in the August 1, 2011 meeting is not incorporated into the work plan.

CH2M HILL RESPONSE: Concur. Table 4-1 has been revised to include:

- **Planning of QC locations and IVS installation (under Mobilization/Site Preparation)**
- **Boundary survey by CH2M HILL (under Mobilization/Site Preparation)**
- **Soil sampling (under Instrument-assisted site walkabout)**
- **Application of the Estimating a Proportion statistical method for anomaly selection over areas of homogenous anomaly density (under Intrusive Investigation)**
- **Soil sampling in areas of grouped MEC/MPPEH (under Intrusive Investigation) and**
- **Pre- and post-BIP sampling (under Management of MPPEH/MDEH/MDAS)**

Comment 26: SOP 6, Section 10.1.2 still does not establish that authorized visitors are allowed to enter the EZ in accordance with, and under the conditions established by, EM 385-1-97, Chapter 1.2G.02.04 dated September 15, 2004. The text in this section still only allows "the minimum number of mission essential personnel" to enter the EZ during UXO operations. The Department requests revision of the SOP to allow for authorized visitors to enter the EZ during UXO operations according to the Army reference cited above.

CH2M HILL RESPONSE: Concur. The revised SOP is provided.

Comment 27: Figure 3-2 is still the same as Figure 3-1. This must be corrected and a figure showing the Infiltration/Grenade Range MRS and the investigation transects planned for that site must be included in the work plan.

CH2M HILL RESPONSE: Concur. The revised figure is provided.

CH2M HILL Response to Additional ADEM Comments
Provided by Colin Mitchell
September 20, 2011

Comment 12: We agree that each condition requiring a change or re-performance of work will have to be considered on a case-by-case basis, but these should not all be subjective. For example, in the case of DGM it can be stated that any nonconforming data will be recollected. This is additional work and it should be stated that inadequate data will be recollected. However, there are some instances where recollection of data is not required. For example, if a blind seed is missed but it is determined that the data was good and the seed was mistakenly placed in the wrong location. In this case, recollection of data is obviously not needed. ADEM is requesting the addition of text that discusses these decisions and provides some guidelines. For example, "if the failure results in nonconforming data, the data will be recollected".

CH2M HILL RESPONSE: Concur. The text provides specific corrective measures for DGM in Attachment 3-1, Section 20.11. Section 4.3.2.3 addresses the implementation of project-wide corrective measures.

Comment 16: To clarify, the examples cited are just examples and the list is not all-inclusive. The Department provided these examples to show the type and level of QC inspection that the Department hopes to see implemented on the project. Taking the actions indicated in the response is positive.
However, the Department also hopes that the document is reviewed to extract all of the "requirements" and that these "requirements", if truly requirements (meaning they must be performed adequately for the project results to be achieved), are subjected to some specified level of QC inspection. This is the only way to ensure that the requirements are achieved and the project meets its goals and objectives.

CH2M HILL RESPONSE: The work plan has been reviewed to ensure that all definable features of work are subjected to QC inspection.

August 10 Comment regarding MC Sampling: The Department concurs that Groundwater sampling is not warranted at this time. The intention of the comment was not to suggest that Groundwater sampling is needed right now. However, if soils are found to be contaminated, groundwater sampling will be necessary to confirm the presence of contamination within groundwater. Also, the Department requires that MC sampling will be necessary in any area where MEC is discovered.

CH2M HILL RESPONSE: Comment acknowledged.

August 18, 2011

CH2M HILL Response to Additional ADEM Comments
Provided by Colin Mitchell
August 10, 2011

MC Sampling:
For any area that MEC is discovered, MC sampling including both soils and groundwater should be performed. Samples should be analyzed for metals, explosives, and other COPCs.

CH2M HILL RESPONSE: Groundwater sampling is not warranted at this time. Since soils are the primary transport pathway for exposure of humans and ecological receptors to MC, surface soil samples should indicate presence of MCs if impacted. Laboratory analysis for soil samples collected for the 2005 SI, did not indicate that any explosives residues were present in surface soils above regulatory screening values. Metals typically are not very mobile once adsorbed to soils. As discussed in the August 1 meeting, sampling will not be performed at the location of each MEC discovery location, but where MEC/MPPEH or MD are found grouped together. Anticipated munitions at the site were used to determine the appropriate laboratory analytes- 1) explosives and metals (arsenic, cadmium, chromium, lead, mercury, and selenium)(for the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range) 2) metals (lead, antimony, copper, and zinc)(for the .22 Caliber Target Butt). No other COPCs were identified.

Pre- and post-BIP sampling:
Pre- and post-BIP soil sampling should be performed. This is necessary to determine whether contamination is a result of the detonation or existed before the detonation. 4.4.2) and 4.4.3)
=http://uxoinfo.com/blogcfc/client/enclosures/MC%20Tech%20Update%20Final_USACEMar05Sampling.pdf
<blockedhttp://uxoinfo.com/blogcfc/client/enclosures/MC%20Tech%20Update%20Final_USACEMar05Sampling.pdf>

CH2M HILL RESPONSE: Pre- and post-BIP sampling will be incorporated into the field sampling plan.
The MC Technical Update for MC Sampling (USACE, March 2005) has been superseded by Engineer Manual 1110-1-4009.

Liquid-filled munitions:
The State of Alabama does not allow liquid-filled munitions to be blown in place. Therefore, it will be necessary to confirm or refute the presence of a liquid-fill before any MEC is BIP. Also, a contingency plan should be included in the Work Plan to address the discovery of any liquid-filled MEC.

CH2M HILL RESPONSE: CWM items will not be addressed by this work plan. Initial identification of such items is performed, however. If encountered, personnel will retreat and contact the Fort Rucker IRP Manager and Fort Rucker EOD. Section 2.3, Chemical Warfare Materiel Contingency Procedures, has been added to the Work Plan.

MC sampling at the .22 Caliber Range:
MC sampling will only be performed if MEC is encountered during the investigation. This should be stated in the Work Plan.

CH2M HILL RESPONSE: Based on our discussion on August 1, the work plan has been revised to state that MC sampling at this MRS will be performed if small arms or other munitions items are observed. Small arms are not MEC, therefore the MC sampling approach that we discussed on August 1, is a more conservative approach for assessing presence of MC.

Reviewer: Stephen Cobb, ADEM

Document: RCRA Facility Investigation (RFI) Work Plan for FTRU-001, FTRU-003, and FTRU-004, Fort Rucker, Alabama
Date: 05-Jul-11

Comment Number	Worksheet and/or Section	Comment	Response
1	General Comment	The Department requests that a Conceptual Site Model (CSM) be included in the RFI Work Plan. A CSM should describe the expected MEC contamination, how the MEC was delivered, and the expected MEC characteristics. The CSM should also include any known firing points, range fans, and target areas. If information is not available to develop an adequate CSM, then this should be stated in the Work Plan.	Discussion of the CSM has been added as Section 1.9.2. Since the precise locations of firing points, range fans, and target areas are not known for any of the MRSs, this has been stated.
2	General Comment	The Department notes that the Data Quality Objectives (DQOs) provided throughout the Work Plan do not provide necessary information and the DQOs used in planning are not consistent throughout the document. Without adequate DQOs, the Department cannot determine whether the data collection proposed in the Work Plan will provide data on which future decision making can be based. The Department requests that all DQOs associated with the RFI Work Plan be revised using the EPA Seven-Step Process for DQO Development.	The project DQOs have been revised to follow EPA's Seven-Step Process for DQO development. The DQOs have been revised to include overall remedial investigation, DGM, intrusive investigation, instrument-assisted site walkabout, and MC sampling objectives and are presented in Section 3.4.
3	Section 3.4	This section on DQOs does not provide necessary information for DQOs including quantity and quality of data needed for future decision-making. Some basic information that is missing for the Section 3.4 DQOs includes: boundaries of the study; descriptions of the sampling approach, optimization of the sampling approach. Examples of incomplete information include: for DGM there is no justification for the proposed transect spacing or the required depth of detection; because DGM sampling is focused on finding a target area 30 meters in diameter, any variation in a 30 meter transects will result in a data gap that is larger than 30 meters; the 'walkabout" survey at the small arms range has no DQOs associated with it. The determination of whether the survey is acceptable will not be possible without DQOs. Pease refer to general Comment 2 regarding DQO development.	The DQOs have been revised as requested. A typical Anti-Tank/Rocket Grenade Range or Infiltration/Grenade Range will have a far larger radius of affected area than 15 m. With a MFD-H for the MGFD for the Anti-Tank/Rocket Grenade Range, the 3.5-inch M28A2 HEAT Rocket, of 432m (1420 ft), and HFD of 72m (235 ft), 15m is very conservative. For the infiltration/grenade range the MGFD is the M31 rifle grenade, MFD-H = 119m (392 ft), HFD= 17m(57ft). The 15m target radius has been selected as a conservative value and variations up to 20% are unlikely to affect results.

Comment Number	Worksheet and/or Section	Comment	Response
4	Section 3.7	Additional DQO information is stated in this section but is not adequately explained. For example, Table 3-3 states that the intrusive investigation will be performed on a statistically representative set of anomalies that will be determined from the DGM results. However, there is no explanation of how anomalies will be selected for excavation. Similarly, there is no rationale presented for the use of 10% coverage for the instrument-assisted site walkabout. Please refer to General Comment 2 regarding DQO development.	Table 3.3 is intended as a summary of investigation activities at each site. A reference to Section 3.8.9.1, the section that describes statistical selection of anomalies, has been added. Section 3.7 has been revised to indicated that 10% coverage for instrument-assisted site walkabout was selected based on a 15 m target/affected area radius. Assuming a 1.5 m wide footprint for the instrument assisted walkabout, one transect will be completed approximately every 15 meters. The assumption is that any affected area will have a radius of at least 15 meters and would be encountered it if present. This is a very conservative assumption as typical small arms firing ranges will have a far larger radius of affected area.
5	Sections 3.7.1 and 3.9	The text states that soil sampling will be conducted underneath locations where MEC was detonated. However, there is no justification for this sampling within the work plan in the form of the CSM or DQO. The Department requests the justification for soil sampling underneath locations where MEC was detonated be included in the work plan.	The added DQO for MC sampling in Section 3.4 (Table 3.5) for the Anti-Tank/Rocket Grenade Range (FTRU-001-R-01) and Infiltration/Grenade Range (FTRU-003-R-01) indicates that such sampling will be performed to indicate whether or not soil has been impacted by MCs.
6	Section 3.8.7.1	The section references itself at the end of the paragraph. Please correct the reference.	The reference has been corrected to cite Attachment 3-1, the Geophysical Investigation Plan.
7	Section 3.8.8	The instrument-assisted site walkabout is described as having approximately 10% coverage. The Department requests that an exact number or an acceptable range of coverage be provided in the Work Plan to allow the Department to make a determination of whether activities at the site have been adequately performed.	The text has been revised to state that the instrument-assisted site walkabout will cover "at least 10%" of the MRS.
8	Section 3.8.9.1	These calculations were completed using a pre-determined 90% confidence interval and a 5% margin of error. There should be DQOs for these numbers. Also, Figure 3-4 is blank. Please address these issues in the revised work plan.	The 90% confidence interval and 5% margin of error for identifying the proportion of non-MEC to MEC items from the population of anomalies has been added to Table 3-2, DQOs for DGM. Figure 3-4 has been corrected in the PDF document.
9	Section 3.8.9.5	This section regarding intrusive activities is not mentioned in Section 4: Quality Control of the Work Plan. These detailed instructions should be included in Section 4 for clarity. Please address this in the revised plan.	Section 3.8.9.5 has been moved to Section 4.3.2.5. In addition, Table 4-1 has been revised to include re-inspection of at least 10% of intrusively investigated anomaly location and recovery of all QC seed items during intrusive investigation.
10	Section 3.8.9.5, Bullet 2	The text states that approximately 10% of the excavated anomalies will be inspected. The Department requests that an exact number or an acceptable range of excavated anomalies to be inspected to be provided in the Work Plan.	See response to Comment #9.

Comment Number	Worksheet and/or Section	Comment	Response
11	Section 3.8.9.5, Bullet 5	The text states that additional investigation will be performed by the CH2M HILL Project Geophysicist. The Department requests that the Work Plan include details regarding how it will be determined if reinvestigation is necessary and what actions will be performed.	The following text has been added: "This will include a qualitative review of the intrusive results against the original amplitude to determine, using professional judgment, whether a significant mismatch exists (i.e. the discovered source could not have created an anomaly of the amplitude recorded.)" The text has been moved in Section 4.3.2.5 in response to Comment #9. Reference to use of MRSIMS for tracking these actions has also been added.
12	Section 3.8.9.5, Bullet 6	The text states that change in procedures or repeat performance of work may be required. The Department requests that the conditions requiring changes or the performance of additional work be stated in the text.	Conditions requiring change or reperformance of work are identified on a case-by-case basis, therefore they will not be listed in the Work Plan. For example, during intrusive investigation, in the case that a QC seed is not found at the recorded location a root-cause analysis will be performed and there may be many reasons for a failure: survey error, instrument error, reacquisition error, intrusive investigation error, etc. Once the root cause is determined, an appropriate corrective action will be taken, which may include rework. The text has been moved in Section 4.3.2.5 in response to Comment #9.
13	Sections 3.8.10, 3.8.13, and 3.8.14	These sections describe the inspections to be performed for all MPPEH, including: -"The SUXOS and UXOSO will provide 100% visual inspection, verification, and certification of Material Documented as Safe (MDAS)." The EERG will "collect the MDAS and perform and inspection to confirm that segregation of MDAS has been done correctly. - the "SUXOS will perform random checks to confirm that the MD and range-related debris is free from explosive hazards." - The UXOQCS will perform daily audits of MPPEH inspections (Section 3.8.13); - The SUXOS is required to "physically inspect the material in the containers to ensure that they are free of dangerous items." (Section 3.8.14);	The text in Section 3.8.13 has been moved to Section 3.8.10 so that the information pertaining to MEC/MPPEH/MD processing is located in one section. Tasks associated with inspection and certification remaining in Section 3.8.14 (renumbered as 3.8.13). The resulting Sections 3.8.10 and 3.8.13 have been revised to clarify project responsibilities and the inspection processes.

Comment Number	Worksheet and/or Section	Comment	Response
		- - A technically qualified U.S. Government representative (U.S. citizen) will perform a 100% reinspection of the material (Section 3.8.14); - "Each item placed into an inert-certified box will be inspected" (Section 3.8.14). Section 3.8.14 later notes that this method "includes three distinct inspection performed by persons of increasing levels of responsibility." The Department notes that the description of the MPPEH inspection plan explained within these three sections is difficult to analyze for completeness and continuity. The Department requests that the plan be modified to simplify the description of the MPPEH inspection plan due to the significant safety risks involved in disposal of MPPEH.	
14	Section 4.4	The text states that the Inspection Schedule and Tracking Form will be used by the UXOQCS for planning and scheduling procedures. The Department requests that Fort Rucker either provide the audit plan and schedule to the Department for review prior to approval of the RFI Work Plan, or provide an explanation as to why audit scheduling and planning should be conducted once field work has begun.	As discussed during the installation meeting August 1, receipt of the planned audit schedule will be not be required. It was explained that daily QC inspections are recorded in MRSIMS, the QC logbook, and daily QC reports.
15	Table 4-1	The Department notes that Table 4-1 uses different DFW's than provided in Section 4.3.1. The Department requests that the same DFW's be utilized in both sections of the Work Plan.	Section 4.3.1 has been revised to agree with Table 4.1.
16	Table 4-1	The Department notes that some of the Work Plan requirements are not included in Table 4-1, including but not limited to: - Section 3.8.4: A qualified ecologist/biologist will be consulted prior to vegetation removal.	As discussed during the installation meeting August 1, biologist/ecologist consultation is not required. This task has been deleted.
		- Section 3.8.9: The Directorate of Plans, Training, Mobilization, and Security Airspace will be contacted prior to conducting intrusive operations.	The requirement has been added to Table 4.1.
		- Section 3.8.9.5: Additional QC analysis of intrusive investigation results versus original amplitude of DGM anomalies will be performed by the CH2M HILL Project Geophysicist.	The task listed in Table 4.1 has been reassigned from the UXOQCS to the Project Geophysicist.
		-Section 3.8.10 and 3.8.11L Additional requirements for inspections and spot-checks of MPPEH. -	This task is covered by the task "MPPEH/MDEH/MDAS Management - Verify inspections conducted IAW the Work Plan."
		-Section 3.8.13: The UXOQCS will perform daily audits to ensure that the specific procedures and responsibilities for processing MDAS/MDEH are followed.	This task is covered by the task "MPPEH/MDEH/MDAS Management - Verify inspections conducted IAW the Work Plan."
		- Section 3.10: "All data will be cross-referenced into the GIS database and the CSM."	This requirement has been added to Table 4.1 under "report preparation and approval".
		-The blind seed requirement.	The requirement has been added to Table 4.1.
		Also the Department requests more information on the cross-referencing of data, including the CSM that this will be based on. The Department requests that Table 4-1 be revised to include all necessary elements.	Additional information regarding the relationship between data and the GIS database has been added to Section 3.10. The CSM has been added as Section 1.9.2. Table 4.1 has been revised to more completely follow the project tasks.
17	Table 4-1	The Department notes that the addition of a "Reference" column to Table 4.1 may help to ensure that all the checks listed on Table 4-1 are performed adequately.	Revised as recommended.

Comment Number	Worksheet and/or Section	Comment	Response
18	Attachment 3-1, Table 1	The text lists each of the various Potential Munitions associated with each site. The Department requests that additional description of the Potential Munitions be provided (e.g. grenades, rockets, projectiles, etc.) Please revise the plan to address this issue.	Revised as recommended.
19	Attachment 3-1, Section 18	The text states that the DQOs for the DGM activities at the site are provided in the GSV plan (Section 3-2). However, the DQOs stated in Table 1.2 of the GSV Plan are only applicable to GSV activities. The Department requests that separate DQOs for the DGM activities be included in the Work Plan.	Section 3.4 of the Work Plan has been revised to include DQOs for DGM (Table 3-2) and the text has been revised to indicate that GSV measurement quality objectives are provided in Attachment 3-1.
20	Attachment 3-1, Section 20.3	This section does not clearly state why some anomalies will be selected and others will not. The Department requests that this section be revised to provide clarification regarding the specific selection criteria.	The text has been revised to indicate that anomalies will be randomly selected for intrusive investigation.
21	Attachment 3-1 Figure 1, Table 2, and Section 20.8	These three separate portions of the text identify different QC operations to be performed. However, it is not indicated who should perform these checks and how often they will be performed. The Department requests that this information be added to the Work Plan and that these sections be summarized in a table similar to Table 4.1 to provide a reference for personnel in the field.	Text has been added to Sections 20.8 and 20.10 to clarify who performs the tests; the frequency for each check is defined in each bullet. During the installation meeting on August 1st, CH2M HILL explained that the use of MRSIMS requires the user to step through QC operations, therefore reference to MRSIMS (in Section 20.7) has been added rather than adding a reference table of tasks.
22	Attachment 3-1, Section 20.11	The text lists Corrective measures associated with different situations that may occur in the field. However, the text does not list all the problems that may be encountered in the field, such as the SUXOS finding MEC remaining on the site or if holes are not properly cleared and anomalies remain in place. The Department requests that this section be expanded to address any quality failures and the corrective measures that will be performed.	Reference to Section 4.5 of the Work Plan has been added for overall project deficiency identification and resolution procedures.
23	Attachment 3-2, Section 1.5	This section incorrectly states that Table 1.1 illustrates the IVS Process and Procedures. Table 1.1 illustrates the IVS Transects Descriptions and Purpose. Please revise for accuracy.	The reference to table 1.1 has been deleted.
24	Attachment 3-2, Page 5	After Figure 1-3, the numbering restarts but appears that is should continue from above the figure. This should be corrected or presented more clearly.	The numbering has been corrected to follow the step defined in Figure 1-2, IVS Process.
25	Attachment 3-2, Table 1-2	The DQOs presented appear to be incomplete. The quantity and quality of data that must be collected is not described. Please refer to General Comment 2 regarding DQO development.	Table 1-2 has been revised as recommended.
26	SOP 0006, Section 10.1.2	This section only allows "essential personnel" to enter the exclusion zone. This should be corrected to allow "authorized visitors" to enter the EZ during intrusive operations, according to EM 385-1-97 Chapter 1.2.G.02.04, dated September 15, 2004. The Department requests that the SOP be corrected to allow for authorized visitors to enter the EZ during intrusive operations according tot eh aforementioned Army reference.	Revised as recommended.
27	Figures 3-1 and 3-2	Figures 3-1 and 3-2 are listed as the Anti-Tank/Rocket Grenade Range and the Infiltration/Grenade Range. However, both of these figures are the same map. Please revise the plan to address this issue.	Figure 3-2 has been corrected in the PDF document.

U. S. ARMY ENGINEERING AND SUPPORT CENTER – HUNTSVILLE CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS PROJECT: CN: 09-129-10 NAME: Fort Rucker, AL SD: 30-SEP-10

☐ SITE DEV & GEO
☒ ENVIR PROT& UTIL
☐ ARCHITECTURAL
☐ STRUCTURAL

☐ MECHANICAL
☐ MFG TECHNOLOGY
☐ ELECTRICAL
☐ INST & CONTROLS

☐ SAFETY
☐ ADV TECH
☐ ESTIMATING
☐ SPECIFICATIONS

☐ SYSTEMS ENG
☐ VALUE ENG
☐ OTHER

REVIEW Modification 01, Contract
DATE September 30, 2010
NAME Michael D'Auben / 256-895-1460

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
•		**Work Plan**	
2	Table 2-1 Page 2-3	The Project Responsibilities table should also include key personnel from the analytical laboratory (Lab PM and QAO) as well as any other key subcontractors.	A- Key subcontractor POCs (EERG; NAEVA; Donaldson, Garrett, and Associates, and Empirical Laboratories) have been added to Table 2-1.
		Appendix E – Field Sampling Plan	
	Table 2-1 Page 2-4	The Project Responsibilities table should also include key personnel from the analytical laboratory (Lab PM and QAO) as well as any other key subcontractors.	A- Since Table 2-1 lists CH2M HILL project responsibilities, Table 2-2 "Subcontractors to be Used for Project Activities" has been revised to include contact information for key subcontractor personnel.
	2nd Bullet Page 3-1	The previous bullet for FTRU-001-R-01 indicates the criteria for sampling (MEC/MPPEH locations). A similar brief explanation of where soils samples in FTRU-004-R-01 should be added to this bullet.	A- The second bullet has been revised to read: "MC soil sampling (see **Attachment 1** of this FSP for shallow soil sampling procedures) at biased locations or based on a systematic grid sampling design (if there is no evidence of munitions or munitions use)."

ACTION CODES
A - ACCEPTED/CONCUR
D - ACTION DEFERRED
W - WITHDRAWN
N - NON-CONCUR
VE - VE POTENTIAL/VEP ATTACHED

U. S. ARMY ENGINEERING AND SUPPORT CENTER – HUNTSVILLE CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS PROJECT: CN: 09-129-10 NAME: Fort Rucker, AL SD: 30-SEP-10

☐ SITE DEV & GEO
☒ ENVIR PROT& UTIL
☐ ARCHITECTURAL
☐ STRUCTURAL

☐ MECHANICAL
☐ MFG TECHNOLOGY
☐ ELECTRICAL
☐ INST & CONTROLS

☐ SAFETY
☐ ADV TECH
☐ ESTIMATING
☐ SPECIFICATIONS

☐ SYSTEMS ENG
☐ VALUE ENG
☐ OTHER

REVIEW Modification 01, Contract
DATE September 30, 2010
NAME Michael D'Auben / 256-895-1460

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
	1st Paragraph Page 3-2	The laboratory data packages and the data validation should be equal to USEPA Level IV (CLP-like) standards.	D- A level IV data package was not specified in the work plan. In addition, it was not specified as needed in the references attached to the PWS. At this time, the text will remain as submitted and a level III laboratory data package will be provided.
	3rd Paragraph Page 4-2	The metal iron is not normally considered a major constituent of small arms ammunition. In addition, it is a common soil constituent and an essential nutrient. It is recommended that iron not be included in any soil sample analyses.	A- Iron will be excluded from any soil sample analyses as requested. Section 2.2.2, Section 3.9, and Table 3-2 of the Work Plan have also been revised to reflect this.
	Table 4-1 Page 4-2	For FTRU-001 and FTRU-003, please provide a listing of the intended target metals, or a reference to where such a listing can be found in the FSP.	A- Table 4-1 has been revised to list the target metals (arsenic, cadmium, chromium, lead, mercury, selenium) for FTRU-001-R-01 and FTRU-003-R-01.
	Table 4-1 Page 4-2	For FTRU-004, the metal iron is not normally considered a major constituent of small arms ammunition. In addition, it is a common soil constituent and an essential nutrient. It is recommended that iron not be included in any soil sample analyses.	A- Iron will be excluded from the soil sample analyses as requested.
	Table 4-2 Page 4-3	The holding times for methods 7410/7471 are 28 days, rather than the 6 month holding time for 6010. If both methods are proposed please indicate both holding time limits.	Table has been modified to display 28 days for the holding time using methods 7470 and 7471.
	Table 4-3 Page 4-4	The total number of field duplicates and MS/MSD samples appear to be incorrect for the 8330A samples. Please review and revise as necessary.	A-Table 4-3 has been revised from- 3 MS/MSD samples.
WD		**Appendix E – Quality Assurance Project Plan**	

ACTION CODES
A - ACCEPTED/CONCUR
D - ACTION DEFERRED
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VE - VE POTENTIAL/VEP ATTACHED

U. S. ARMY ENGINEERING AND SUPPORT CENTER – HUNTSVILLE

CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS

PROJECT: CN: 09-129-10

NAME: Fort Rucker, AL

SD: 30-SEP-10

☐ SITE DEV & GEO
☒ ENVIR PROT& UTIL
☐ ARCHITECTURAL
☐ STRUCTURAL

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☐ ESTIMATING
☐ SPECIFICATIONS

☐ SYSTEMS ENG
☐ VALUE ENG
☐ OTHER

REVIEW Modification 01, Contract
DATE September 30, 2010
NAME Michael D'Auben / 256-895-1460

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
	General QAPP	The QAPP portion of the SAP for all USACE projects should be created using the current version of the UFP-QAPP.	The requirement for a UFP-QAPP was not mandatory during the time of preparation of this QAPP document. Please see correspondence between Mark Sherrill/CH2M HILL, Dennis Mayton/USACE and Jan Dunker/ USACE attached.
	Section 1.1 Page 1-1	DoD policy requires all laboratories performing environmental analytical work on DoD projects to hold a current DoD ELAP certification. Please include a confirmation in the text that Empirical Labs does hold such a certification and include a copy as an attachment to the QAPP.	A-The text has been revised to indicate that Empirical Laboratories is ELAP certified. The certification has been added as Attachment 1.
	Section 1.3 Page 1-2	Unless the PWS explicitly stated that no QA samples were required, the collection and analysis of QA samples is considered standard procedure for USACE projects. If QA samples are to be collected, a second laboratory should be subcontracted by CH2M HILL and the results generated from any QA samples sent directly to the USACE Project Chemist.	A- The text has been revised to indicate that QA samples will be collected as directed by the Contracting Officer.
	Section 5.4.2 Page 5-6	DoD policy requires all laboratories performing environmental analytical work on DoD projects to hold a current DoD ELAP certification. Please include a confirmation in the text that Empirical Labs does hold such a certification and include a copy as an attachment to the QAPP.	A-The text has been revised as suggested. Additionally, Empirical Laboratories' ELAP certification has been added as Attachment 1.
	Section 5.7.2 Page 5-11	Section 5.7.2 indicates that Lead, Selenium and Thallium may be analyzed for using 7000-series methods, while Attachment 1 only lists the control limits for these metals by Method 6010. Please include the associated limits for methods 7421, 7740 and 7841 in the table or remove the references to them from the text.	The graphite furnace methods have been removed. These metals will be analyzed by method 6010.

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REVIEW Modification 01, Contract
DATE September 30, 2010
NAME Michael D’Auben / 256-895-1460

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
	Section 7.2.5 Page 7-5	The USAEC generally requires that data be submitted in ERIS file format. USACE generally requires that data be submitted in SEDD Stage 2A or 2B file format. Please review the PWS for specific data deliverable requirements for this project and review the text if necessary.	The project data manager will be responsible for uploading sample collection data into the database. Data received from analytical labs in electronic data deliverable format will be checked for completeness by comparing them to the sample collection form before appending them directly into the database, and will be considered preliminary until validated. After validation the data is considered final and is transferred to CH2M HILL SQL Server Data warehouse. The text has been revised to indicate that CH2M HILL will provide an electronic deliverable submission in the ERIS format. ERIS is a web based data management system designed to accommodate analytical and geographical data collected at Fort Rucker sites. Specific codes and data forms have been developed to allow consistent and efficient input of information to the system. CH2M HILL will provide the database information via TEXT (*.txt) files specific to ERIS file structure. The information transferred will include all required chemical analysis results and sample location information. Where applicable information such as; well characteristics; and hydrogeologic, geologic, physical, information will also be uploaded. The PWS did not define SEDD stage 2A or 2B format.

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REVIEW Modification 01, Contract
DATE September 30, 2010
NAME Michael D'Auben / 256-895-1460

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
	Attachment 1 Page A-1	The target metals list appears excessive. Normally, the USACE prefers to smaller, more targeted lists of metals selected based on the components of the specific munitions known to have been used at the site. It is recommended that the contractor do a search of munitions component databases for the known munitions and eliminate the metals not likely to be associated with these munitions.	The target metals list for FTRU-001-R-01 and FTRU-003-R-01 has been reduced to include only arsenic, cadmium, chromium, lead, mercury, and selenium. The target metals list for FTRU-004-R-01 is has been revised to antimony, copper, lead, and zinc. Attachment 1, now renumbered as Attachment 2 has been revised as requested.
	Attachment 1 Page A-1	The table is labeled "Precision and Accuracy Limits" but only included the limits for accuracy (%R). Please add another column specifying the associated precision limits (RPD).	Table has been edited to include RPD.
	Attachment 1 Page A-1	Section 5.7.2 indicates that Lead, Selenium and Thallium may be analyzed for using 7000-series methods, while Attachment 1 only lists the control limits for these metals by Method 6010. Please include the associated limits for methods 7421, 7740 and 7841 in the table or remove the references to them from the text.	Metals will be analyzed using 6010B.
	Attachment 2 Page A-2	The table is labeled "Precision and Accuracy Limits" but only included the limits for accuracy (%R). Please add another column specifying the associated precision limits (RPD).	Table has been edited to include RPD.
	Attachment 2 Page A-2	Attachment 3 includes references to methods 8260, 8270, 8081, 8151, ect. Precision and Accuracy for these methods should be included in table for similar to Attachments 1 and 2.	Tables have been added to include accuracy and precision for these parameters.

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From: Mayton, Dennis H SAM [Dennis.H.Mayton@usace.army.mil]
Sent: Thursday, September 17, 2009 12:03 PM
To: Sherrill, Mark/ATL
Subject: FW: UFP QAPP

Mark,

Per the CX the UFP-QAPP is not mandatory on Army projects. So unless you just want to use the new method you are not obligated to use it on the PBA project at Rucker.

Dennis

-----Original Message-----
From: Dunker, Jan W HNC@NWO
Sent: Thursday, September 17, 2009 10:56 AM
To: Mayton, Dennis H SAM
Cc: Kinsella, Richard J SAM
Subject: RE: UFP QAPP

Dennis,

No it is not mandatory (as yet) to use the UFP-QAPP, however, we are encouraging districts to adopt the UFP-QAPP. We are trying to be pro-active as the use of the UFP-QAPP will become mandatory at some time.

Jan W. Dunker, Ph.D.
U.S. Army Corps of Engineers
Environmental & Munitions Center of Expertise CEHNC-CX-ES
1616 Capitol Ave, Ste 9200
Omaha, NE 68102-9200
402-697-2566

-----Original Message-----
From: Mayton, Dennis H SAM
Sent: Thursday, September 17, 2009 7:26 AM
To: Dunker, Jan W HNC@NWO
Subject: UFP QAPP

Mr. Dunker,

I got your name as a POC for questions concerning UFO QAPPs. I am a technical manager for several environmental projects at the Mobile District.

I was trying to find out if it has become mandatory to use the UFP QAPP format on Army Projects?

Thanks for any information you can provide.

Dennis H. Mayton, P.G.
U.S. Army Corps of Engineers
CESAM-EN-GG
109 Saint Joseph St.
Mobile, AL 36602-3630
email: dennis.h.mayton@usace.army.mil
(251) 694-3684 (work)
(251) 656-2180 (cell)
(251) 690-2674 (fax)

U. S. ARMY ENGINEER DIVISION HUNTSVILLE CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS PROJECT RI/FS FT RUCKER, AL 104AL072200

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REVIEW Draft RI/FS WP 09-129-10
DATE 30 September 2010
NAME MICHAEL GIFUN 256-503-5419

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
		I have reviewed this remedial Investigation and Feasibility Study Work Plan dated September 2010 and have the following comments:	
1.	All Work plan Title pages	For tracking purposes include the complete date	A-The complete date has been added as requested on the cover and all sub plan title pages.
2.	Page 2-19, paragraph 2.10.1	What job Level of UXO Technician (Tech I, Tech II,Tech III) will be required to escort personnel?	A-The text has been revised to read; “Whenever non-MEC qualified personnel enter an area where MEC may be present, they are required to be escorted by at least one individual qualified as a UXO Technician Level II or higher.”
3.	Page 3-2 Paragraph 3.2	Are key personnel the only personnel that must meet state/federal requirements for working on a hazardous material site, as stated in the second paragraph?	A-The text has been revised to read: “All personnel conducting HAZWOPER-regulated tasks must meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training.”
4.	Geophysical Plan ,page 2 paragraph 2.0	The first paragraph states that if an item of MEC is found Base personnel will be contacted for further action relating to the item using base resources. Does this indicate that local EOD resources will be used to destroy the item?	A-Base EOD resources will not be used to destroy MEC/MPPEH items. The statement regarding base resources has been deleted. The last two sentences now read: “Upon encountering a potential MEC/MPPEH item, DGM personnel will retreat to a designated rally point and immediately inform the SUXOS. The SUXOS will inform DGM personnel when it is safe to re-enter an area, escorted by a UXO Technician Level II or higher.”

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CEHND FORM 7 (Revised)
15 Apr 89

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

U. S. ARMY ENGINEER DIVISION HUNTSVILLE CORPS OF ENGINEERS

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Draft RI/FS WP
30 September 2010
MICHAEL GIFUN 256-503-5419

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
5.	Siting Plan page 2 paragraph 6.b	This paragraph states that the magnetometers will be checked daily. They should be checked twice daily, before usage and after work.	A-Since the ESP has been accepted by the DDESB, clarification that handheld all-metals detectors will be checked twice daily has been added to Sections 3.85 and 3.8.9.3 of the Work Plan.
6.	ESS page 5 paragraph 8.d	This paragraph states that all MEC that is not aceptable to move will be destroyed utilizing sand bag mitigation do you really want to use mitigation if it is not necessary?	A- CH2M HILL will use sand bag mitigation or BEM as stated in the ESP.
7.	Attachment 5-1	The Notice of Clearance and License/Permit are expired	A-The expired documentation has been replaced with valid certificates.
8.	Appendix D APP/SSHP	The use of the X-Ray Fluoroscope does not seem to be addressed in the AHA section.	A- Addressed and added to AHA #9, Soil Sampling.
9.	Paragraph 2.4 page D-11 SSHP	The last bullet of the Assumption Set states that there is no potential of exposure to Radiological Hazards. I believe that improper use of the x-ray fluoroscope would potentially expose personnel.	A-The text has been revised to read: “There is no potential worker exposure to biological waste or Chemical Warfare Agents (CWA) in connection with this project. The XRF unit will be operated in strict accordance with the manufacturers specifications to avoid any exposure to radiological hazards.”
10.	Appendix D-49	A map to medical facilities is included however written directions should also be included.	A-Written directions have been added to Figure 9-1 “Route to Hospital”

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30 September 2010
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ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
11.	Appendix D page D-119	The mobilization AHA under adverse weather it states that the 30-30 rule will be utilized. Explain the 30-30 rule.	A-The text has been revised to read; “Implement the 30–30 Rule: Take shelter when you can count 30 seconds or less between lightning and thunder. Remain sheltered for 30 minutes after the last thunder.”
12.	Appendix D AHA’s	In most if not all AHA’s it states that use of a radio or telephone while driving on a military base is a crime punishable by loss of driving privileges. Is it not from a safety standpoint unacceptable to utilize these devices at all times while driving?	A-The statements in each AHA have been revised to read: “Never use a phone or two-way radio while driving due to the distraction these devices pose.”
13.	Appendix D page D-167 AHA	First statement under recommended controls references EP 385-1-95a. This publication has been superseded by EM 395-1-97 dated 15 September 2008 with Errata Sheet #1 dated 1 June 2009.	A-The reference has been corrected to EM 385-1-97.
14.	General	Include detailed demolition operations in the work plan, company SOP’s are not acceptable.	A-The steps to be taken for demolition operations have been added to Section 3.8.11.3.

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DESIGN REVIEW COMMENTS PROJECT Draft RIF WP,Fort Rucker, AL; CN: 09-129-10; S: 30 Sept 2010

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REVIEW Draft
DATE 21 Sept 2010
NAME Goggin 5-1635 / ED-CS-G

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
	General	Geotechnical Branch has reviewed the Draft Work Plan for Fort Rucker and has the following comments:	
1	3.7.1	Suggest changing to “This coverage ensures that a 15m radius circle placed anywhere within the site will be crossed by at least one transect and thus any target of that dimension will **likely** be identified.” Traversal and detection (target identification) are not synonymous. In this case 100% probability of detection would require tighter spacing.	A- The text has been revised as suggested. The intent is not 100%probability of detection but characterization of the area. However, if a target is traversed and the resulting intrusive investigations reveal MEC or MD, additional, more tightly spaced transects will be placed to determine the extent of the target.
2	3.7	Transects alone may not provide sufficient information for defining the nature (type and density) of MEC on the site. Consider incorporating grids into your sampling plan.	Grids were considered, however, the concept of VSP designed transects has been applied precisely because there may not be homogeneity across the site. A grid sampling approach, such as UXO Estimator, is designed for a site in which MEC is assumed to be homogeneously distributed. The VSP transects are designed to locate “clusters” of anomalies that may represent a “contaminated” area. Although not preferable, grids could be applied to this approach by performing the transects to locate areas of varying density of anomalies across the site and, instead of intrusively investigating the anomalies, placing small mag&dig grids in the different areas to determine the nature of the sources of the anomalies in those areas. This method would achieve the same result as the current design, but would not provide any additional useful information.

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DESIGN REVIEW COMMENTS

PROJECT Draft RIF WP,Fort Rucker, AL; CN: 09-129-10; S: 30 Sept 2010

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REVIEW Draft
DATE 21 Sept 2010
NAME Goggin 5-1635 / ED-CS-G

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
3	3.8.9.1	This approach assumes that the sample area be relatively homogeneous. The entire MRS cannot be considered homogeneous because it is composed of a variety of MEC contaminated and non-contaminated areas. If this statistical sampling is utilized for transects spanning the entire MRS then the calculated confidence level will not be valid. While true homogeneity is improbable, this method would be more applicable for small, strategically placed grids or if the transects were divided by density contours and calculations performed for individual sections. Suggest re-evaluating your statistical sampling approach.	The statistical sampling approach assumes homogeneity within a population of anomalies and the intent is just as the reviewer suggests. If the population of anomalies as a whole appears heterogeneous, the transects will be divided by density contours and the approach applied to sub-populations consisting only of the anomalies within areas of relative homogeneity. The method will not be applied across a population that has clear differences in density. The text in Section 3.8.9.1 has been modified for clarity to read: “Using the following statistical sample size formulas for categorical data, it is possible to determine the necessary sample size of DGM anomalies to be intrusively investigated and classified within a population of anomalies (e.g., within a transect**,** *group of transects*, or site) when that population can be assumed to be homogeneous (or having an equal chance of encountering a MEC item at any location). *If the population of anomalies as a whole appears heterogeneous, the transects will be divided by density contours and the approach applied to sub-populations consisting only of the anomalies within areas of relative homogeneity.*”
4	General	Clarify how you will ensure that you have determined the extent of the MEC contamination on the sides of the MRS not bounded by the active ranges?	Because we are searching for “clustering” of anomalies associated with munitions operations, it will be apparent in the anomaly distribution whether (1) clustering exists at the site, (2) the sampling has

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DESIGN REVIEW COMMENTS PROJECT Draft RIF WP,Fort Rucker, AL; CN: 09-129-10; S: 30 Sept 2010

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ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
			extended beyond the clustering and the anomalies do not represent munitions items associated with munitions activities, or (3) the edge of the “contamination” has not been reached and additional sampling is necessary. If additional sampling is determined to be necessary, additional transects will be used to identify the extent within the non-operational areas.
5	20.3	Clarify how you will determine your threshold for amplitude, footprint, decay, etc.?	The following footnote has been added to the section: “The threshold will be determined through evaluating known EM61-MK2 response curves for specific munitions items potentially present within each area and the background geophysical “noise”. A threshold will be selected beneath the smallest expected amplitude but with a signal to noise ratio of at least 3 to 1.” (This approach is discussed in detail in the July 2009 ESTCP document, “Geophysical System Verification [GSV]: A Physics-Based Alternative to Geophysical Prove-Outs for Munitions Response”.)
6	20.9, GSV Plan	Seeding on transects is unusual because it is hard to ensure that the field crew will traverse the item. Clarify how you will deal with this issue. One suggestion is to visually mark seed locations for field crews, but still make the locations unknown to the data processor. This tests the instrument functionality and anomaly selection process rather than the ability to walk in a straight line.	If the transects are in the woods, there will be stakes spaced at approximately 75-ft intervals (see Section 3.8.6) between which the DGM crews pass directly between and a QC seed placed in that path that will be traversed. For open areas in which transects are not bounded by cut vegetation and stakes, PVC pin flags will be placed approximately 30-50 feet apart and the DGM crew will be instructed to pass from one flag to the other. The QC seed will be placed along the section between the two flags but the location will be obscured such

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DESIGN REVIEW COMMENTS PROJECT Draft RIF WP,Fort Rucker, AL; CN: 09-129-10; S: 30 Sept 2010

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REVIEW Draft
DATE 21 Sept 2010
NAME Goggin 5-1635 / ED-CS-G

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
			that the team does not know where it is placed. The text in section 2.1 of the GSV has been modified to read: "During the vegetation removal or survey of the transect stakes, QC ISOs (Nelson et al., 2009) will be placed along transects, *directly between survey stakes so the data collection crews will pass over them, and* an Alabama-licensed PLS will record these locations. *For open areas in which transects are not bounded by cut vegetation and stakes, the QC seed will be placed along the section between the two flags but the location will be obscured such that the team does not know where it is placed*."
		- End of Comments -	

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DESIGN REVIEW COMMENTS Ft Rucker, AL

PROJECT CN: 09-129-10 SD: 30 SEP 2010

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REVIEW Draft RIFS WP
DATE 30 September 2010
NAME Nixon, ED-CS-P

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
1	MC Delineation	If MC exceeds PRGs explain: • If a step out approach will be conducted for horizontal bounded • How the vertical bounds will be achieved	D-The following statement has been added to Section 3.9: "If exceedances are reported, the results will be presented to the project team and the extent of additional sampling (the number of samples and the step out horizontally and vertically) will be determined."
		Iron is an essential nutrient explain the purpose for it analysis. [Note from PM: you may not analyze for iron on MMRP sites. – Cochrane]	A-Iron has been deleted from all soil analyses.
2	3.13	If there are MC exceedances explain if a HH SLRA and/or and SLERA be conducted. If the MC exceed the SLRA explain what action(s) will follow.	D- Section 3.13 has been revised to read: "The RFI will provide data necessary to identify the need for and scope of appropriate MEC removal actions and to complete a MEC risk analysis for the sites. Detected concentrations of MC will be compared against soil background values for metals (if available) and human health and ecological risk screening levels to assess if there is a potential for impact to human health or ecological receptors at each MRS. If a site has detected levels above screening levels, additional human health and

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CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS Ft Rucker, AL

PROJECT CN: 09-129-10 SD: 30 SEP 2010

☐ SITE DEV & GEO
■ ENVIR PROT& UTIL
☐ ARCHITECTURAL
☐ STRUCTURAL
☐ MECHANICAL
☐ MFG TECHNOLOGY
☐ ELECTRICAL
☐ INST & CONTROLS
☐ SAFETY
☐ ADV TECH
☐ ESTIMATING
☐ SPECIFICATIONS
☐ SYSTEMS ENG
☐ VALUE ENG
☐ OTHER

REVIEW
DATE 30 September 2010
NAME Nixon, ED-CS-P

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
			ecological risk assessments will be conducted. The risk assessment methodology is detailed in **Attachment 3-5** (Risk Assessment Protocol).” Attachment 3-5 has been added to provide additional details of the risk assessment.

ACTION CODES
A - ACCEPTED/CONCUR
D - ACTION DEFERRED
W - WITHDRAWN
N - NON-CONCUR
VE - VE POTENTIAL/VEP ATTACHED

U. S. ARMY ENGINEER DIVISION HUNTSVILLE

CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS

PROJECT Fort Rucker RIFS Work Plan (TO 01) CN: 09-129-10

☐ SITE DEV & GEO
☐ ENVIR PROT& UTIL
☐ ARCHITECTURAL
☐ STRUCTURAL
☐ MECHANICAL
☐ MFG TECHNOLOGY
☐ ELECTRICAL
☐ INST & CONTROLS
■ SAFETY
☐ ADV TECH
☐ ESTIMATING
☐ SPECIFICATIONS
☐ SYSTEMS ENG
☐ VALUE ENG
☐ OTHER

REVIEW Draft
DATE 30 Sept 10
NAME Kellie Williams / SO/ 256-895-1584-

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
1.	General	CEHNC-SO has reviewed the document and has no comment.	A-Comment acknowledged.

ACTION CODES
A - ACCEPTED/CONCUR
D - ACTION DEFERRED
W - WITHDRAWN
N - NON-CONCUR
VE - VE POTENTIAL/VEP ATTACHED

CEHND FORM 7 (Revised)
15 Apr 89

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

PAGE 1 OF 1

Draft Work Plan Review

MMRP RFI

Ft Rucker

Reviewed by: Karl Blankinship 256 682-7546

6 October 2010

Responses to comments are in bold.

1. Page 3-2 para 3.4: This paragraph as well as numerous other places reference Attachment 3-2 and Appendix E for presentation of project specific DQO's. I have yet to find any project specific DQO's. Recommend that a clear concise presentation of all DQO's be included in one place in the work plan with corresponding pass fail criteria, not scattered thru attachments and appendices.

   A summary of DQOs (Table 3-1) has been added to Section 3 of the Work Plan as suggested.

2. Page 3-5: It will be difficult to effectively map a transect which is cleared to the minimum width as stated in the work plan with a 1" high survey stake located along the center line at 75" intervals.

   CH2M HILL has been performing transect surveys on multiple sites using the method described without issues. To clarify, vegetation is typically cleared to a width of approximately 5 to 8 feet and the professional land surveyor will place stakes rising no higher than 1 ft above ground surface along the center of the established transects at approximately 75-ft intervals. The following addition to Section 3.8.6 has been added: "The stakes are no greater than 1 ft above ground surface in order that the EM61 can pass over them without contacting them (and forcing them out of the ground.)"

3. Page 3-11 para 3.8.9.5: This QC procedure appears to only apply to the selected dig locations. What is QC procedure for verifying that geophysical target selection is adequate. i.e. anomalies below the selected threshold.

   Section 3.8.7.3 references the GIP (Attachment 3-1) for QC procedures for geophysical target selection.

   This section has been revised to also indicate that blind seed locations will be compared against selected targets to ensure 100% selection of blind seed locations, failure to achieve 100% selection of blind seed locations, will result in root cause analysis and re-evaluation of geophysical raw data.

4. Page 3-17 para 3.9: MC discussions do not appear to include biased sampling at identified/suspected target locations or firing points. It appears that the plan is to collect soil samples only at the RFI demo sites, which may not even exist based on the field investigation. Suggest that a comprehensive plan to characterize the nature and extent of MC across the ranges be developed and included in the work plan.

   Section 3.7.1 and 3.7.2 have each been clarified to express our intent to also collect samples in a grid sampling design in areas where significant anomalies are found grouped together. Collection of soil samples will be biased towards areas that have evidence of or potential for MEC/MPPEH as determined by field activities. The final paragraph in each section now reads: "Up to 25 soils samples will be collected from this MRS. These samples will include: 1) discrete soil samples will be collected underneath the locations where MEC was detonated at this MRS and 2) soil samples collected using a grid sampling approach in an area where the significant anomalies are found grouped together, as directed by the PM. Samples will be analyzed for explosives and select metals (arsenic, cadmium, chromium, lead, mercury, and selenium)."This change has also been carried forward into Section 2.2.1, where no mention of the biased sampling had been made previously.

   Sample locations and extents of grid sampling designs have not been established at this time, because they will be based on field observations.

5. Page 5-5 para 14: This paragraph should be revised as it implies that explosives will be stored on site which conflicts with the ESP and remainder of the WP.

   Section 5.6, Bullet 14, has been revised to read: "The ERRG Alabama-Licensed Blaster will conduct a physical inventory of *just-in time* delivered explosive stocks, keeping track of explosives issued that day until the total explosives on hand equate to zero, he will also record the date shift codes/lot numbers as applicable for each delivered quantity in a bound project logbook for explosives management. No pages will be removed from this logbook; mistakes will be annotated with a single strike-through, and initialed by the author. The logbook will be used to record the date, person by full name, time of action, purpose of action, and description of action, manufacturer of explosives, type of explosive materials involved in action, applicable date shift codes/lot numbers, and quantities. The logbook will track cradle-to-grave the starting, running, end inventory by each just in time delivery, and track with deliver manifests, consumption to shot logs by date and time. The logbook will be used to document shot logs by date, time, person, type of explosive, quantity of explosive materials, applicable date shift code, lot number/munitions destroyed by date and quantity."

6. Page 5-9 para 5.22: Suggest that someone should immediately notify Ft Rucker security if explosives are lost or stolen on base.

   Section 5.22 has been revised to include the Demolition Team Supervisor immediately contacting the Fort Rucker Installation Safety Office.

7. General: It is very difficult to review a workplan with numerous references to appendices and attachments for key information in digital format. Recommend that all future review submittals include a hard copy.

   Comment and recommendation acknowledged.

Contents

Tables

Figures

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Appendices

Acronyms and Abbreviations

°F	degrees Fahrenheit
ADCNR	Alabama Department of Conservation and Natural Resources
ADEM	Alabama Department of Environmental Management
AFB	Air Force Base
AHA	activity hazard analysis
APP	Accident Prevention Plan
ARAR	applicable or relevant and appropriate requirement
ATF&E	Bureau of Alcohol, Tobacco, Firearms, and Explosives
CAP	Corrective Action Plan
CAR	Corrective Action Request
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CH2M HILL	CH2M HILL Constructors, Inc.
CMS	Corrective Measures Study
COR	Contracting Officer's Representative
CSM	conceptual site model
DD	Decision Document
DDESB	Department of Defense Explosives Safety Board
DFOW	definable features of work
DGM	digital geophysical mapping
DID	Data Item Description
DoD	U.S. Department of Defense
DoDI	U.S. Department of Defense Instruction
DQO	data quality objective
DRMO	Defense Reutilization and Marketing Office
EM	Engineering Manual
EMP	Explosives Management Plan
EOD	Explosive Ordnance Disposal
EP	Engineering Pamphlet
ERM	Environmental Remediation Manager
ERRG	Engineering Remediation Resources Group, Inc.
ESP	Explosives Site Plan
ESQD	explosives safety quantity distance
ESRI	Environmental Systems Research Institute, Inc.
EZ	exclusion zone
FS	feasibility study
FSP	Field Sampling Plan

GIP	Geophysical Investigation Plan
GIS	geographic information system
GPS	global positioning system
GSV	geophysical system verification
HAZWOPER	Hazardous Waste Operations and Emergency Response
HFD	hazardous fragment distance
HE	high explosive
HRR	historical records review
HSM	Health and Safety Manager
HSWA	Hazardous and Solid Waste Amendments
HTRW	hazardous, toxic, or radioactive waste
IAW	in accordance with
ID	identification
IDW	investigation-derived waste
IRP	Installation Restoration Program
ISO	Industry Standard Object
IVS	Instrument Verification Strip
KO	Contracting Officer
MC	munitions constituents
MD	munitions debris
MDAS	material documented as safe
MDEH	material documented as an explosive hazard
MEC	munitions and explosives of concern
MFD	maximum fragmentation distance
MFD-H	maximum fragmentation distance - horizontal
MGFD	Munition with the Greatest Fragmentation Distance
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MR	munitions response
MRS	Munition Response Site
MRSIMS	Munitions Response Site Information Management System
MSD	minimum separation distance
msl	mean sea level
NCP	National Contingency Plan
NFA	no further action
PDF	portable document format
PG	Professional Geologist
PLS	Professional Land Surveyor
PM	Project Manager
POC	point of contact
PPE	personal protective equipment

PVC	polyvinyl chloride
PWS	Performance Work Statement
QA	quality assurance
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QC	quality control
QCP	Quality Control Plan
RCRA	Resource Conservation and Recovery Act
RCWM	Radioactive and Chemical Warfare Materiel
RFI	RCRA Facility Investigation
RG	Registered Geophysicist
RI	remedial investigation
ROD	Record of Decision
RPM	Remedial Project Manager
RTK	real-time kinematic
SAP	Sampling and Analysis Plan
SB	Statement of Basis
SDSFIE	Spatial Data Standards for Facilities, Infrastructure, and Environment
S&H	Safety and Health
SI	site inspection
SM	Site Manager
SME	subject matter expert
SOP	Standard Operating Procedure
SSHP	Site Safety and Health Plan
SUXOS	Senior UXO Supervisor
TM	Technical Manager
TMP	Technical Management Plan
TP	Technical Paper
TPP	Technical Project Planning
USC	U.S. Code
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Command
USATCES	U.S. Army Technical Center for Explosives Safety
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UTM	Universal Transverse Mercator
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer
WP	White Phosphorus

Section 1. Introduction

CH2M HILL is conducting munitions response (MR) services to support a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Fort Rucker, Alabama for the following Military Munitions Response Program (MMRP) sites:

- FTRU-001-R-01 Anti-Tank/Rocket Grenade Range
- FTRU-003-R-01 Infiltration/Grenade Range
- FTRU-004-R-01 .22-Caliber Target Butt

This section provides the purpose and scope of the RFI, as well as background information such as project location, site description and history, current and anticipated land use, summaries of previous site investigations, and an initial summary of risks posed by munitions and explosives of concern (MEC) at Fort Rucker.

1.1 Project Authorization

Each of the three MMRP sites is managed under the U.S. Department of Defense (DoD) MMRP. The MMRP is operated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). However, the Alabama Department of Environmental Management (ADEM) has identified the MMRP sites as areas of concern for corrective action under Fort Rucker's RCRA Hazardous and Solid Waste Amendments (HSWA) permit. As a result, these three MMRP sites will be managed through the RCRA corrective action framework. The RFI that is being conducted is equivalent to a remedial investigation (RI)/feasibility study (FS) under CERCLA and meets the requirements of Section 104 of CERCLA and Section 300.400 of the National Contingency Plan (NCP). This project is being performed for the U.S. Army Environmental Command (USAEC) under Contract No. W91ZLK-05-D-0014, Task Order 0001.

1.2 Purpose and Scope

An archives/historical records review (HRR) (Malcolm Pirnie, 2004) and site inspection (SI) (Malcolm Pirnie, 2005) has been completed for Fort Rucker. The findings indicate that MEC is potentially present at the three MMRP sites included in this RFI. The purpose of performing the MR services is to collect data to be used in characterizing the extent of MEC over the three identified MMRP sites. These data will be used in completing the Corrective Measures Study (CMS) and preparing the Statement of Basis (SB).

The requirements for this RFI Work Plan are specified in the Task Order Scope of Work, provided as **Appendix A**. The objectives of this Task Order are (1) to complete an RFI in compliance with Fort Rucker's RCRA permit, the Defense Environmental Restoration Program, and DoD and Army policy and (2) to achieve Contracting Officer's Representative (COR) and ADEM acceptance of the Record of Decision/Decision Document (ROD/DD) (the RCRA SB) at the MMRP sites when the investigation is complete.

The following activities (discussed in detail in the subsequent sections) will be conducted:

- Anti-Tank/Rocket Grenade Range Munition Response Site (MRS) and Infiltration/Grenade Range MRS:
  - Instrument-assisted surface clearance
  - Digital geophysical mapping (DGM)
  - Intrusive investigations
  - Munitions constituent (MC) soil sampling
- .22-Caliber Target Butt MMRP site:
  - Instrument-assisted walkabout
  - MC soil sampling based on results of instrument-assisted walkabout (if small arms ammunition or other munitions are observed)

Utility clearance, vegetation clearing, and surveying services will be conducted in support of these tasks.

1.3 Work Plan Organization

This Work Plan identifies the activities to be conducted in support of the MR services at Fort Rucker. In addition, it provides detailed implementation instructions for the project team. The Work Plan, which was prepared in accordance with MMRP Data Item Description (DID) 09-001 and associated sub-plan DIDs, is organized as follows:

Section 1, Introduction—provides background information on Fort Rucker, including project location, site description and history, current and projected land use, summaries of previous site investigations, and an initial summary of risks posed by MEC that may be present at the sites.

Section 2, Technical Management Plan (TMP) — discusses how the RFI will be implemented by identifying project objectives, project organization and personnel, and communication procedures. This section also identifies project deliverables, presents the project schedule, and establishes subcontractor and field investigation management protocols.

Section 3, Field Investigation Plan—presents the overall approach to MR activities, identifies the areas of concern at the site, and specifies MEC identification, handling, and disposal procedures. This section also introduces the Geophysical System Verification (GSV) Plan; Geophysical Investigation Plan (GIP), and the MC Sampling and Analysis Plan (SAP) (consisting of the Field Sampling Plan [FSP] and Quality Assurance Project Plan [QAPP]).

Section 4, Quality Control Plan (QCP)—provides the approach, methods, and operational procedures to be used for quality control (QC) during MR activities.

Section 5, Explosives Management Plan (EMP)—addresses the management of explosives in accordance with applicable regulations; the Explosives Site Plan (ESP) is presented in **Attachment 3-4.**

Section 6, Environmental Protection Plan—identifies the approach, methods, and operational procedures to be used to protect the natural environment during the performance of the RFI tasks.

Section 7, Property Management Plan—placeholder only; not applicable as no Government Furnished Property or Government Furnished Equipment will be used on this project.

Section 8, Interim Holding Facility Siting Plan for Radioactive and Chemical Warfare Materiel (RCWM) Sites—placeholder only; not applicable.

Section 9, Physical Security Plan for RCWM Project Sites—placeholder only; not applicable.

Section 10, References—list of references cited in the preceding sections.

Appendix A, Task Order Scope of Work

Appendix B, Site Maps

Appendix C, Local Points of Contact

Appendix D, Accident Prevention Plan/Site Safety and Health Plan (APP/SSHP)

Appendix E, Munitions Constituents Sampling and Analysis Plan

Appendix F, Forms

Appendix G, Contractor Personnel Qualifications Certification Letters

Appendix H, Technical Project Planning (TPP) Work Sheets

Supporting tables, figures, and attachments are also included in this Work Plan.

1.4 Project Location

Fort Rucker is located in southeast Alabama, approximately 20 miles northwest of Dothan, Alabama, and is bounded by the towns of Enterprise on the west, Daleville on the south, and Ozark on the east. Fort Rucker encompasses 62,430 acres, primarily in Dale and Coffee Counties. **Figure 1-1 (Appendix B)** shows the location of Fort Rucker. **Figure 1-2 (Appendix B)** shows the location of each of the MMRP sites.

1.5 Site Description

1.5.1 Topography

Fort Rucker lies within the southern edge of the Southern Red Hills district of the East Gulf Coastal Plain physiographic section. The installation's elevation ranges from 164 feet (ft) above mean sea level (msl) to 515 ft above msl; within the main runway complex, the elevation ranges from 305 to 325 ft above msl. The main runway complex has wooded slopes in both eastward and westward directions that fall away to the floodplains (164 ft above msl) of Claybank Creek and the Choctawhatchee River (Malcolm Pirnie, 2005; McGee, 1987; 1204th Engineer Co., 1995; Rust Environment and Infrastructure, 1999).

In general, the topography of Fort Rucker is narrow and winding, with ridgetops that are highly divided near creeks and Lake Tholocco in the eastern areas of the installation; in the western and outermost eastern areas, the topography is gently rolling. The *Integrated Natural Resource Management Plan* (Fort Rucker, 2001) describes side slopes at Fort Rucker as gently rolling in the western part of the installation and steep in the eastern portion.

1.5.2 Climate

The climate at Fort Rucker is temperate subtropical, characterized by long, hot summers and short, mild winters. Daily summer temperatures average 81 degrees Fahrenheit (°F) and daily winter temperatures average 51°F.

Fort Rucker receives an annual average of 53 inches of precipitation, ranging from a monthly average low in October (3 inches) to a monthly average high in March (5.8 inches). Snowfalls are infrequent and typically brief, with accumulations of less than 1 inch.

Prevailing winds tend to be light and variable, to the east-southeast at an average of 7 miles per hour (Malcolm Pirnie, 2005).

1.5.3 Vegetation

Vegetation at Fort Rucker consists primarily of longleaf pine forest and southern mixed hardwood forest. The three MMRP sites are partially to mostly covered by longleaf pine, shortleaf pine, and mixed hardwood varieties of forest that are mostly undisturbed, with moderate to thick undergrowth.

1.5.4 Geology

Fort Rucker lies in the East Gulf Coastal Plain physiographic section, with sedimentary origins dating to the Cretaceous, Tertiary, and Quaternary ages. Fort Rucker soils overlie the Buhrstone Escarpment, a formation held up by Early Tertiary shale and sandstone (Roberts, 1996).

Geologic formations that outcrop on Fort Rucker are Tertiary to Holocene in age and include the Tuscahoma Sand, Hatchetigbee and Tallahatta Formations, Lisbon Formation, Residuum, Alluvial High Terrace Deposits, and Low Terrace Deposits. These formations strike east-west, dipping to the south at a rate of 15 to 40 ft per mile (Fort Rucker, 2001).

1.5.5 Soils

Soils at Fort Rucker consist primarily of Red Bay, Orangeburg, Troup, and Eustis soils at the higher elevations; Lucy Luverne and Lakeland soils at the mid to high elevations; and Cuthbert, Boswell, Shubata, and Angie soils at low elevations. The alluvial soils on the site are Bibb, Eunola, and Myatt soils.

These soils are classified in one of two associations. The Norfolk-Ruston-Shubuta Association is composed of well-drained soils on ridge tops and side slopes that include Norfolk, Ruston, Shubuta, Red Bay, and Lakeland soils, with subsurface soil composed of friable fine sandy loam. The Shubuta-Cuthbert Association contains Shubuta, Cuthbert, Boswell, Ruston, and Eustis soils (Fort Rucker, 2001). The surface soil types range from highly to moderately permeable sandy/silty clays, and vary in color from moderate reddish orange to moderate reddish brown.

1.6 Site History

Fort Rucker began operations in 1942 in response to the United States military escalation following the attack on Pearl Harbor. Originally named the Ozark Triangular Division Camp, it became Camp Rucker in 1943 and was renamed Fort Rucker in 1955.

Fort Rucker has been the site of an infantry training ground, aviation school flight training facilities, and heliport. Since 1973, the mission at Fort Rucker has been to maintain and operate facilities and provide services and material to support rotary and fixed-wing pilot training for Army aviation enlisted specialists and related test activities.

The site history of each MMRP sites is summarized below.

The Anti-Tank/Rocket Grenade Range MRS was historically used as an anti-tank rocket and grenade range. The HRR (Malcolm Pirnie, 2004) determined that training took place at this site between 1942 and 1951. It is assumed, since specific training dates are not available, that the range was used for artillery training during this period.

The Infiltration/Grenade Range MRS was used historically as an infiltration and grenade range. It has since been developed for other purposes.

The boundaries of the .22-Caliber Target Butt MMRP site are based only on a 1944 operational map. It is assumed that the site was used only for small arms training. The HRR identified small arms (.22-caliber) as potentially being used at this site.

No chemical warfare materiel (CWM) was reported to have been used at the three sites.

1.7 Current and Projected Land Use

Fort Rucker encompasses nearly 98 square miles. It contains airfields, stage fields, tactical sites, and leased land for rotary-wing pads and fixed-wing airstrips. Fort Rucker is primarily used for helicopter and tactical maneuver training.

The Anti-Tank/Rocket Grenade Range covers approximately 57 acres and is located in both the operational and nonoperational ranges of Fort Rucker. The nonoperational range area includes 52 acres. Only these 52 acres will be investigated during the RFI. Approximately 39 acres of the area to be investigated consists of a well-maintained golf course and the remaining 18 acres are wooded. No change to land use is projected.

The Infiltration/Grenade Range is adjacent to but not contiguous with the Anti-Tank/Rocket Grenade Range. The site is composed of approximately 44 acres in the nonoperational range. The majority of the Infiltration/Grenade Range site, approximately 34 acres, consists of an equestrian center and golf course driving range. The remaining 10 acres are wooded. No change to land use is projected.

The .22-Caliber Target Butt covers approximately 2.4 acres in the central portion of the cantonment area. The site is heavily wooded, with uneven terrain and several small streams. A dirt road extends east to west through the northern portion of the area. A cleared power line right-of-way cuts east to west through the southern portion of the area. A fitness trail with exercise stations extends through the site. No change to land use is projected.

1.8 Previous Investigations of Site

The Final SI (Malcolm Pirnie, 2005) investigated six MMRP sites for both MEC and MC issues. The objective of the SI was to collect sufficient data to draw a conclusion as to whether each site required immediate response, required an RI/FS, or qualified for no further action (NFA) status. The SI Report identified three sites for further MEC investigation: the Anti-Tank/Rocket Grenade Range, the Infiltration/Grenade Range, and the .22-Caliber Target Butt. No MC contamination was identified.

Several other previous investigations were identified during the HRR that contained data associated with munitions use and/or environmental data at Fort Rucker. However, the information in these reports was not pertinent to the three sites addressed in this Work Plan. Summaries of the previous investigations are presented in Section 3.4 of the HRR (Malcolm Pirnie, 2004).

1.9 Initial Summary of Risk from MEC

1.9.1 Overview

The findings of the 2005 SI Report (Malcolm Pirnie, 2005) and HRR (Malcolm Pirnie, 2004) indicated that MEC is potentially present at all three MMRP sites. The MEC findings reported in those documents are summarized below.

Anti-Tank/Rocket Grenade Range (FTRU-001-R-01): During the 2005 SI, four munitions debris (MD) items were discovered. The MD consisted of a fragment from a practice rifle grenade, a fragment of an expended 2.36-inch rocket, and fragments from two expended M28 3.5-inch rockets. Based on the HRR, M28 3.5-inch rockets were not expected to be present on the site; however, this type of munition is consistent with other historical activities known to have occurred in this area. The HRR identified several other munitions that could be present at the site: M6A1 2.36-inch rockets; M9A1 HEAT Rifle Grenades; MII A1-MII A4 Practice Grenades, M17 Fragmentation Grenades, and M19A1 White Phosphorus (WP) Smoke Grenades.

Infiltration/Grenade Range (FTRU-003-R-01): During the 2005 SI, no MEC or MD items were observed. Information from Fort Rucker Range Control identified two Explosive Ordnance Disposal (EOD) responses to MEC items in 2003. Both items, rifle grenades, were destroyed by EOD personnel. The HRR identified several munitions that could be present at the site: MII A1 – MII A4 Practice, M2/MK2, and M17 Fragmentation Grenades.

.22-Caliber Target Butt (FTRU-004-R-01): The HRR indicates that no MEC is expected to be present in this MMRP site. During the 2005 SI, however, an expended M48 Trip Flare (a non-fragment-producing munition) was found. The flare, installed at the base of a tree, appeared to have been undisturbed since its setup. Trip flares are often used in maneuver areas as a part of defensive training scenarios and are not an indication of a dud hazard impact area.

Table 1-1

Potential Munitions lists the types of munitions items potentially present in each of the MRSs as identified in the SI (Malcolm Pirnie, 2005) and HRR (Malcolm Pirnie, 2004).

TABLE 1-1
Potential Munitions by MRS
MEC RFI, Fort Rucker, Alabama

Potential Munitions	MRS Anti-Tank/Rocket Grenade Range (FTRU-001-R-01):	Infiltration/Grenade Range (FTRU-003-R-01)	.22-Caliber Target Butt (FTRU-004-R-01)
Small Arms			■
MII A1-MII A4 Practice Grenades	■	■	
M2/MK2 Grenades		■	
M17 Fragmentation Grenades	■	■	
M19A1 WP Smoke Grenades	■		
M31 Rifle Grenade		▲	
M9A1 HEAT Rifle Grenades	■		
M6A1 2.36-inch rockets	■		
M28A2 3.5 inch Rocket	▲		

▲ Triangle indicates the item is identified in the Explosives Site Plan as the Munition with the Greatest Fragmentation Distance (MGFD) for a particular MRS (See Attachment 3-4).

1.9.2 Conceptual Site Model

The CSM relates potentially exposed receptor populations with potential source areas based upon physical site characteristics and complete exposure pathways. Important components of the CSM are the identification of potential source areas, methods on interaction (i.e., transport pathways, access, exposure media, exposure pathways and routes), and receptor groups. Actual or potential exposures of receptors associated with a site are determined by identifying the most likely, and most important, pathways of release, transport and interaction. A complete exposure pathway has three components: (1) a source that results in a release to the environment; (2) a method of interaction or pathway of transport through an environmental medium; and (3) a receptor. The main objective of the CSM is to identify any complete and critical exposure pathways that may be present.

The preceding sections have presented the physical setting, site history, land use (past, present and projected), and results of previous investigations at the three MRSs. Based on this information, the following subsections discuss potential source areas, transport pathways, and exposure pathways for the three MRSs. The CSM forms the basis for the technical approach presented in this Work Plan for each of the MRSs. Information obtained during this RFI will be used to update and refine the CSM.

1.9.2.1 Potential Source Areas

The primary source of potential contamination at the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range MRSs is MEC resulting from historical impact areas. MEC may be present on the surface or in the subsurface. No source of MEC is expected in the .22-Caliber Target Butt MRS, where only small arms ammunition was used. The precise locations of firing points, range fans, and target areas are not known for any of the MRSs.

The Anti-Tank/Rocket Range is comprised of three distinct sub-sites operated from approximately 1942 through 1951, including: Anti-Tank Rocket Range No. 1, Anti-Tank Grenade Range No.1, and an Unnamed Range as identified in the HRR (Malcolm Pirnie, 2004). In the HRR, areas clear of vegetation in aerial photographs from 1948 and 1953 were assumed to be firing points, although historical photograph analysis could not confirm this purpose.

At each sub-site, multiple firing points were likely situated along a single firing line. Targets such as trucks and tank hulls may have been placed in a V-shape downrange of the firing points. In Anti-Tank Rocket Range No.1, munitions were fired from potentially 2.36″ and 3.5″ shoulder-fired rocket weapons systems. In Anti-Tank Grenade Range No.1 and the Unnamed Range, munitions were potentially fired from 2.36″ and 3.5″ shoulder-fired rocket weapons systems and M1 rifles with rifle grenade attachments (Malcolm Pirnie, 2005). Sources of MEC would include partially to fully functioned grenades/fuzes and rockets/fuzes. The depth of penetration of these items would be expected within the first foot below ground surface, since the items were launched at low velocity and low angle. The Maximum Fragmentation Distance-Horizontal defines the horizontal distance that an individual munitions item may impact. Combined with a degree of scatter for munitions not reaching the target (statistically most reaching the target and fewer falling long or short of the target) , the impact area is expected to be larger than the MFD-H for a single item. The anticipated munition with the smallest maximum fragmentation distance-horizontal (MFD-H) at the range, the MK2 grenade (121m)(Department of Defense Explosives Safety Board [DDESB], 2011), indicates that anticipated impact areas at the range will be larger than 121m.

The Infiltration/Grenade Range is comprised of three distinct subsites: Infiltration Range No. 2, Grenade Range No. 1, and the Rifle Grenade Fragmentation Range (Malcolm Pirnie, 2004). Small arms and 0.30-caliber blank ammunitions would have been employed at Infiltration Range No. 2, fired from machine gun emplacements as troops passed by. Grenade Range No. 1 would have been used for hand throwing M2/MK2 hand grenades from behind a barricade or wall at targets. A typical hand grenade range consists of three targets, located 20m apart, approximately 35m from the barricade/wall (Department of the Army, 2003). At the Rifle Grenade Fragmentation Range, M17 and MII A1/MII A4 practice grenades and M17 fragmentation grenades may have been fired from M1 rifles with rifle grenade attachments at down range targets. Sources of MEC would include partially to fully functioned grenades/fuzes. These munitions would not be expected to penetrate more than a few inches beneath the ground surface, since the items were grenades hand tossed or launched at low velocity and low angle. The anticipated munition with the smallest MFD-H at the range, the MK2 grenade (121m)(DDESB, 2011), indicates that anticipated impact areas at the range will be larger than 121m due to scatter in reaching the intended target. It is not the purpose of this investigation to identify single occurrences of MEC items, such as those potentially present from intentional disposal and random discards. Rather, the purpose of the investigation is to identify impact areas.

A potential secondary source of contamination is environmental media potentially contaminated by MC associated with MEC or small arms ammunition. These items have the potential to have released metals, energetic, and explosives. However, as discussed previously, past investigation of these MRSs has not identified human health or ecological risk related to MC at these sites. Therefore, the primary source of contamination for the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range MRSs is MEC. If additional information becomes available that indicates a potential for MC associated with MEC or small arms ammunition, the RFI will also address MC as described in this Work Plan.

1.9.2.2 Transport Pathways

A transport pathway describes the mechanisms whereby site-related constituents, once released, may be transported from a source area to exposure media (such as surface soil) where receptor exposures may occur. The primary mechanisms for transport of constituents from the potential source areas include:

- Direct deposit of munitions in the surface and/or subsurface via disposal operations, random discards, or firing (impact areas)
- Transport or migration of munitions items by erosion, soil disturbance or recreational users/trespassers
- Transport of contaminated soil particulates via overland surface runoff to down gradient terrestrial areas and/or surface water bodies
- Transport of contaminated soil particulates via wind or soil disturbing activities to surrounding terrestrial areas and/or surface water bodies
- Leaching of chemicals from surface/subsurface soils into groundwater via infiltrating precipitation (and potential discharge of contaminated groundwater into down gradient surface water bodies)
- Uptake by biota from soil and trophic transfer to upper trophic level receptors

1.9.2.3 Exposure Pathways

An exposure pathway describes the mechanisms whereby receptors come into contact with site-related constituents or hazards. Exposure, and thus potential risk, can only occur if complete exposure pathways exist.

1.9.2.4 MEC

A MEC exposure pathway requires both access and interaction. The receptor must not only have access to an area that contains MEC, but the receptor's activities must be such that there is interaction with the MEC item. While Fort Rucker is a restricted access facility, base personnel and visitors have access to the three MRSs. The Anti-Tank/Rocket Grenade Range MRS consists of a golf course and a wooded area. The Infiltration/Grenade Range MRS consists of an equestrian center, a golf course driving range, and a wooded area. Fencing associated with the golf course limits access only to that area. No barriers to access exist at the Anti-Tank/Rocket Grenade Range MRS and Infiltration/Grenade Range MRSs.

Interaction with MEC items may include handling/tread underfoot for MEC items located on the surface and unearthing subsurface MEC during golf course, equestrian center/trail maintenance or other intrusive activities. Intrusive activities in these areas currently do not require a permit.

The pathway analysis for MEC is illustrated on **Figure 1-3**.

1.9.2.5 MC

As discussed above, past investigation of the three MRSs has not identified human health or ecological risk related to MC at these sites. Therefore, the exposure pathway for MC is currently considered incomplete. It is possible that additional information regarding MC at the MRSs will become available over the course of the RFI field efforts, in which case the CSM will be updated to include potential exposure pathways discussed below and a graphical representation of the CSM will be developed.

1.9.2.5.1 Ecological Exposures

Exposures for ecological receptors are typically limited to surface water, surface sediment, and surface soil. Groundwater is generally considered only as a transport medium because there are no ecological exposures to groundwater until it discharges to a water body or surfaces as a seep, at which case it transitions to surface water. Therefore, groundwater is not considered as part of the ecological exposure scenario.

Concentration of MCs from the potential source areas through the appropriate pathway(s) will be evaluated to determine if there are any links between site contamination and potential ecological receptors (habitats and biota). The following subsections summarize the key aspects that will be investigated to determine the potential for exposures for ecological receptors at these sites if a potential risk from MC is identified during the RFI.

Based on the habitats and biota present, and what is known about the nature of the potential source area, there are potentially complete exposure pathways for terrestrial and semi-aquatic receptors (e.g., plants, invertebrates, amphibians, reptiles, birds and mammals) using the habitats at and adjacent to the MRSs (i.e., exposure to contaminated surface soil).

An exposure route describes the specific mechanism(s) by which a receptor is exposed to a chemical present in an environmental medium. Lower trophic level receptors, such as terrestrial plants are exposed mainly through root surfaces to chemicals present in surface soils during water and nutrient uptake. Other lower trophic level receptors, such as soil invertebrates (e.g., insects and earthworms) are exposed via direct contact with contaminated soil within or upon which they live and feed.

The primary routes of potential exposure for upper trophic level receptors (birds and mammals) at the MRSs are expected to be:

- Incidental ingestion of contaminated abiotic media (soil) during feeding activities

- Ingestion of contaminated plant and/or animal tissues for chemicals which have entered food webs
- Direct (dermal) contact with contaminated abiotic media

Based upon the general fate properties (e.g., relatively high adsorption to solids) of the site-related chemicals present and the protection offered by hair or feathers, potential dermal exposures for upper trophic level receptors are not considered significant relative to ingestion exposures. The upper trophic level receptors that will be considered are unlikely to be exposed via inhalation to significant airborne sources of chemicals because the potential MCs do not volatilize, suggesting that exposure via inhalation is limited. Incidental ingestion of soil during feeding, preening, or grooming activities is, however, considered in the risk estimates. Wetland areas are not anticipated to be present.

1.9.2.5.2 Human Health Exposures

Based on site use, the medium of potential concern for human exposure under the current land use is surface and subsurface soil. Potential current receptors could be exposed to surface and subsurface soil. Potential current receptors could include maintenance workers and trespassers/visitors/recreationalists exposed to the soil through incidental ingestion, dermal contact, and inhalation of particulates. Inhalation of volatile organic compound emissions is not considered a complete exposure pathway because site-related constituents are not volatile.

Potential future receptors who could be exposed to soil include the current receptors, and if the site is developed for future use, future residents, construction workers, or site workers. Exposure routes for future exposure to soil are the same as those for current exposure to surface soil. Subsurface soil could be a medium for human exposure if intrusive work is performed. Exposure routes for subsurface soil are the same as those for surface soil.

Human exposure to MC via vegetation is extremely unlikely as there are no farming activities. Hunting is permitted within the Infiltration/Grenade Range, therefore the potential exists for human exposure to MC will be via ingestion of game animals.

Fort Rucker's potable water supply is provided by groundwater from the Nanafalia/Clayton and Providence Sand/Ripley formations. The Nanafalia-Clayton aquifer is the middle aquifer unit and consists of geologic material of the Nanafalia and Clayton Formations. This aquifer serves as a source of drinking water for Fort Rucker and surrounding towns. Recharge to the Nanafalia-Clayton aquifer is to the north of Fort Rucker, where the formations are at the ground surface. Regional groundwater flow in this aquifer is to the south, with localized cones of depression at Fort Rucker and surrounding areas as a result of pumping wells. Groundwater exposure routes are expected to be incomplete because recharge to the Nanafalia-Clayton aquifer, the source of Fort Rucker's potable water supply, does not occur in the vicinity of the MRSs.

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Section 2. Technical Management Plan

2.1 General

The purpose of this TMP is to identify the approach, methods, and operational procedures to be used during the MEC RFI.

2.2 Project Objectives

The performance requirements specified in the Performance Work Statement (PWS) are to achieve a ROD/DD for the three MMRP sites (see Table 1 in **Appendix A**). The ROD/DD provides general information about the selected corrective measure(s) and an explanation of the process and corrective measures selection criteria for each site. The performance requirement does not include removal of detectable military munitions. The objective of the MEC RFI is to support achievement of an approved ROD/DD at the three MMRP sites through the collection of additional data as discussed in the following subsections.

2.2.1 Anti-Tank/Rocket Grenade Range (FTRU-001-R-01) and Infiltration/Grenade Range (FTRU-003-R-01)

The primary onsite RFI activities at the Anti-Tank/Rocket Grenade Range and the Infiltration/Grenade Range will include the following:

- Perform instrument-assisted surface clearance of MEC, MD, and range residue (for removal of metal debris on the ground surface) along planned DGM transects.
- Perform DGM surveys, data processing, and data interpretation to select a statistically representative sample of DGM anomalies that may be representative of MEC for intrusive investigation.
- Reacquire and intrusively investigate the selected anomalies to obtain data regarding the nature and extent of MEC contamination.
- Collect MC soil samples using a grid sampling approach for laboratory analysis for explosives and select metals (arsenic, cadmium, chromium, lead, mercury, and selenium) where MEC, MPPEH, or MD items are found grouped together, , to determine any MC impact to site soils.

2.2.2 .22-Caliber Target Butt (FTRU-004-R-01)

The primary onsite RFI activities at the .22-Caliber Target Butt will be the following:

- Perform geophysical instrument-assisted walkabout for evidence of munitions or munitions-related features.
- Sample surface soils based on the results of the walkabout, if small arms ammunition or other munitions are observed. If there is a lack of evidence of munitions use in the MRS, no samples will be collected. Collected samples will be analyzed for select metals consistent with small arms ranges (lead, antimony, copper, and zinc) to evaluate MC impact to site soils.

2.3 Chemical Warfare Materiel Contingency Procedures

Based on the documented history of DoD activities at the sites, it is not anticipated that CWM will be discovered. However, if CWM is identified, all work will immediately cease, personnel will retreat from the area, and the Fort Rucker IRP Manager and Fort Rucker EOD will be notified.

2.4 Project Organization

The key organizations that will be involved in the Fort Rucker MEC RFI are the U.S. Army Environmental Command (USAEC); U.S. Army Corps of Engineers (USACE), Mobile District; USACE, Engineering and Support Center, Huntsville, Alabama; Fort Rucker Environmental Division (within the Directorate of Public Works), Fort Rucker Office and Aviation Branch Safety Office; ADEM; and CH2M HILL. Local points of contact (POCs) are identified in **Appendix C**. Project execution will be conducted by CH2M HILL and its major subcontractors:

- Engineering Remediation Resources Group, Inc. (ERRG) - MEC services
- NAEVA Geophysics, Inc. (NAEVA) – DGM services
- Donaldson, Garrett, and Associates – land surveying services
- Empirical Laboratories, Inc. (Empirical) - analytical laboratory services

CH2M HILL will conduct competitive subcontract procurement for vegetation clearing.

2.4.1 CH2M HILL—Prime Contractor

As the prime contractor, CH2M HILL is the primary POC with the Army. CH2M HILL will manage the overall project, providing day-to-day oversight and related management support to execute the project successfully. Project duties controlled by CH2M HILL include the following:

- Project planning, implementation, and reporting
- Subcontractor selection, management, and control
- Program- and project-level QC

- Program- and project-level safety and health (S&H) oversight
- Site management
- Technical direction for DGM operations, geographic information system (GIS) activities, and database management
- Performance of RFI field activities
- Analysis of data and preparation of the RFI report
- Project closeout

2.4.2 Subcontractors

The following services will be provided by subcontractors:

- MEC services (surface clearance, MEC avoidance, intrusive investigation of DGM anomalies, MEC identification and disposal)
- DGM services
- Vegetation clearing
- Land surveying
- Laboratory services

These services are discussed in **Section 2.11.**

2.5 Project Personnel

The organizational structure of this project includes personnel from the USAEC, USACE, Fort Rucker, ADEM, CH2M HILL, and its subcontractors. **Table 2-1** provides contact information for key project team members.

TABLE 2-1
Key Project Team Member Contact Information
MEC RFI, Fort Rucker, Alabama

Name and Contact Information	Telephone/E-mail	Project Function
Ms. Alison Gannon Research Development and Engineering Command Contracting Center Aberdeen Installation Contracting Division USAEC E4460 Beal Road APG-EA, MD 21010	(410) 436-1661/Alison.gannon@us.army.mil	Contracting Officer (KO)
Mr. Ramon Cintron-Ocasio IMCOM/AEC-CMRD (East Oversight Branch) 2450 Connell Road Fort Sam Houston, TX 78234-1223	(210) 466-1729/ramon.a.cintronocasio@us.army.mil	USAEC Environmental Remediation Manager (ERM)
Mr. William Woodall USACE, Mobile District Attn: EN-GE 109 Saint Joseph Street Mobile, AL 36602	(251) 694-4364/William.l.woodall@usace.army.mil	COR
Mr. Dennis Mayton USACE, Mobile District Attn: EN-GG 109 Saint Joseph Street Mobile, AL 36602	(251) 694-3684/Dennis.H.Mayton@usace.army.mil	USACE Technical Manager
Mr. Richard Kinsella 109 Saint Joseph Street Mobile, AL 36602	(251) 690-2688/Richard.J.Kinsella@usace,army.mil	USACE Project Chemist
Mr. Karl Blankinship USACE, Mobile District 106 Highland Place Sheffield, AL 35660	(256) 682-7546/karl.e.blankinship@usace.army.mil	USACE Project Manager (PM) (MEC)
Ms. Chris Cochrane USACE, Ordnance and Explosives Design Center Huntsville Center 4820 University Square Huntsville, AL 35816-1822	(256) 895-1696/Chris.cochrane@usace.army.mil	USACE Program Manager (MEC)
Ms. Susan Cowart IMSE-RCK-PWE Building 1121 Fort Rucker, AL 36362	(334) 255-1652/susancowart@us.army.mil	Fort Rucker Acting Installation Restoration Program (IRP) Manager
Mr. Robert Saliewicz Fort Rucker Installation Safety Office Fort Rucker, AL 36362	(334) 255-3210/robert.saliewicz@us.army.mil	Fort Rucker Installation Safety Officer

TABLE 2-1
Key Project Team Member Contact Information
MEC RFI, Fort Rucker, Alabama

Name and Contact Information	Telephone/E-mail	Project Function
Mr. Mark Harrison ADEM Hazardous Waste Branch-Land Division 1400 Coliseum Blvd. Montgomery, AL 36110	(334) 270-5610/mdharrison@adem.state.al.us	ADEM Remedial Project Manager (RPM)
Mr. Mark Sherrill CH2M HILL Northpark 400 1000 Abernathy Road Suite 1600 Atlanta, GA 30328	(678) 938-0923/Mark.Sherril@ch2m.com	CH2M HILL PM
Mr. Kevin Lombardo CH2M HILL 15010 Conference Center Drive Suite 200 Chantilly, VA 20151	(703) 376-5175/Kevin.Lombardo@ch2m.com	Senior Munitions Response Technical Consultant
Mr. George DeMetropolis CH2M HILL 402 W. Broadway Ste. 1450 San Diego, CA 92101	(619) 687-0120 x37239/george.demetropolis@ch2m.com	CH2M HILL Corporate MR Safety and QC Officer
Mr. Mike Goldman CH2M HILL Northpark 400 1000 Abernathy Road Suite 1600 Atlanta, GA 30328	(770) 604-9182 x54133/Michael.goldman@ch2m.com	CH2M HILL Health and Safety Manager (HSM)
Mr. Tamir Klaff CH2M HILL 15010 Conference Center Drive Suite 200 Chantilly, VA 20151	(703) 669-9611/tamir.klaff@ch2m.com	CH2M HILL MR Geophysicist
Ms. Theresa Rojas CH2M HILL Northpark 400 1000 Abernathy Road Suite 1600 Atlanta, GA 30328	(678) 530-4297/Theresa.rojas@ch2m.com	CH2M HILL Corporate Quality Assurance (QA) Manager
Mr. Chris Rose CH2M HILL	(360) 705-7070/Chris.Rose@ch2m.com	CH2M HILL Senior UXO Supervisor (SUXOS)/Site Manager (SM)
Mr. Cliff Walden CH2M HILL	(352) 335-5877/Cliff.Walden@ch2m.com	UXO Quality Control Specialist (UXOQCS)/UXO Safety Officer (UXOSO)

TABLE 2-1
Key Project Team Member Contact Information
MEC RFI, Fort Rucker, Alabama

Name and Contact Information	Telephone/E-mail	Project Function
Mr. John Breznick	(434)978-3187 ext. 206/JBreznick@naevageophysics.com	NAEVA Geophysics, Inc. PM
Mr. Frank Cota	(623)266-9532, cell (623)680-0898/ frank.cota@errg.com	EERG, Inc. PM
Mr. Bill Barnes	(864) 288-1986, cell (864) 979-7291/ bbarnes@aedrilling.com	AE Drilling Inc. Vice President
Mr. James Newberry	(478) 474-5350, cell (478) 361-3384	Donaldson, Garrett and Associates, Inc. Project Manager
Sonya Gordon	(615) 345-1115 Ext. 238/sgordon@empirlabs.com	Empirical Laboratories, LLC PM
Rick Davis	(615) 345-1115 ext 245/rdavis@empirlabs.com	Empirical Laboratories, LLC Laboratory Director
Marcia McGinnity	(615) 345-1115 ext. 232/ mmcginnity@empirlabs.com	Empirical Laboratories, LLC Data Quality Manager

2.5.1 CH2M HILL

The following presents the CH2M HILL key team members' roles, responsibilities, and accountabilities. All team members are chartered at the initiation of each project. All team members sign the charter, which clearly provides their roles, responsibilities, and accountabilities. In addition to roles and responsibilities, CH2M HILL has identified the authorities for the key positions.

2.5.1.1 Mark Sherrill, Professional Geologist (PG), Project Manager (PM)

- Serves as the primary POC for all CH2M HILL communication with the Army
- Is ultimately responsible for the success of the project including quality, budget, and schedule
- Establishes team roles, responsibilities, and accountabilities
- Creates and tracks a resource- and activity-based schedule that is distributed to all team members; develops plan of the day and task assignments
- Develops communication links and establishes weekly communication protocols to ensure all team members (including subcontractors) are coordinated across all installation activities

- Oversees and is responsible for the safety of the team, subcontractors, and surrounding community

Authorities: makes technical and managerial decisions regarding specific project issues; negotiates with subcontractors; approves subcontractor deliverable performance; approves subcontractor invoices; approves and implements the Site Safety and Health Plan (SSHP) and QCP; issues stop work orders on MR field activities for contractual or technical reasons.

2.5.1.2 Kevin Lombardo, Senior Munitions Response Technical Consultant

- Technical lead for MR program conformance to approved processes and procedures; tracks performance against established resource- and activity-based schedule; develops plan of the day and task assignments for MMRP work
- Develops MEC technical information for Explosives Site Plan (ESP) requirements and prepares submissions, corrections, and amendments
- Assigns MEC resources, selects techniques, schedules personnel, manages risks, and coordinates with QC and safety personnel to achieve conformance and deliver safe and effective services

Authorities: determines acceptance or rejection of all MR fieldwork in process and completed work activities; issues stop work orders on MR field activities for quality-related reasons.

2.5.1.3 George DeMetropolis, MR Safety and QA Officer

- Reviews and approves the ESP submission
- Implements CH2M HILL standard munitions QC procedures and conducts monthly audits to confirm that QC protocols are being followed
- Develops safety plans that include detailed descriptions of the explosives safety quantity distance (ESQD) arcs, exclusion zones (EZs), and the explosives operations areas
- Prequalifies MEC subcontractors and verifies that selected subcontractors conform to, at a minimum, the CH2M HILL level of S&H requirements

Authorities: issues stop work orders for S&H-related reasons; approves the APP and SSHP (**Appendix D**) for munitions-related subjects; approves safety and quality documents for munitions-related subjects.

2.5.1.4 Mike Goldman, HSM

- Reviews and approves the project-specific APP/ SSHP as well as subcontractor activity hazard analyses (AHAs)
- Serves as the POC for the SUXOS/SM for any health- or safety-related issues, and may conduct project audits
- Investigates any accidents that occur during the project

Authorities: issues stop work orders for S&H-related reasons; approves APP and SSHP.

2.5.1.5 Tamir Klaff, Registered Geophysicist (RG), Munitions Response Geophysicist

- Develops DGM sampling approach
- Manages, designs, and oversees DGM operations, including subcontractor work
- Provides QC of all DGM operations and data deliverables

Authorities: approves deliverables in specialty area; approves geophysical staff assignments to the project.

2.5.1.6 Theresa Rojas, Corporate QA

- Establishes and distributes Quality Assurance/Quality Control (QA/QC) protocols and procedures for all field-and office-level work activities
- Conducts QC audits to confirm that QC checks are being conducted at the field- and office-level, and reports results to CH2M HILL PM
- Implements corrective action, as needed

Authorities: determines acceptance or rejection of all fieldwork in process and completed work activities; issues stop work orders on field activities for quality-related reasons.

2.5.1.7 Chris Rose, SUXOS/SM

- Reports directly to the CH2M HILL PM
- Implements approved Work Plan (including the APP/SSHP, provided as **Appendix D**)
- Plans, coordinates, and supervises all explosives operations; supervises all personnel inside the EZs
- Coordinates MEC avoidance
- Coordinates project staff and subcontractors, and onsite USACE, Fort Rucker, and regulatory agency representatives
- Certifies that MD and other debris are ready for final disposition
- Coordinates all aspects of QC and S&H with the UXO Quality Control Specialist (UXOQCS)/UXO Safety Officer (UXOSO)

Authorities: issues stop work orders on MR field activities; signs for receipt of explosives; signs explosives inventories; and signs DD-1348-1A.

2.5.1.8 Cliff Walden, UXOQCS/UXOSO

The UXOQCS/UXOSO will have a direct line of communication with the CH2M HILL PM, Senior MR Technical Consultant, Corporate MR Safety and QC Officer, and HSM. The UXOQCS/UXOSO's responsibilities include, but are not limited to, the following:

- Implements the MEC-related QC provisions of the project
- Conducts QC inspections of all MEC-related operations for compliance with established procedures

- Directs and approves all corrective actions to ensure that all MEC-related work complies with contractual requirements
- Implements the APP/SSHP, including MEC-related and general safety components
- Reports independently of project management to the CH2M HILL Corporate MR Safety and QC Officer and HSM
- Analyzes operational risks, hazards, and safety requirements
- Enforces personnel limits and safety EZs for MEC intrusive operations
- Conducts safety inspections to confirm compliance with safety requirements

Authorities: issues stop work orders on MR field activities where safety or QC issues exist; signs for receipt of explosives; signs explosives inventories; and signs DD-1348-1A.

2.5.2 Army Organization

USAEC is administering this contract through the USACE Mobile District. Members of the project team include the KO, USAEC ERM, COR, USACE PM, USACE TM, and other Army officials and subject matter experts (SMEs).

2.5.2.1 Contracting Officer

The KO is responsible for the day-to-day monitoring of CH2M HILL's performance in the areas of contract compliance and contract administration, reviewing the COR's assessment of CH2M HILL's performance, and resolving all differences between the COR's assessment and CH2M HILL's assessment of performance. The KO is ultimately responsible for the final determination of the adequacy of CH2M HILL's performance.

The KO for this contract is Alison W. Gannon at the Aberdeen Installation Contracting Division, CCRD-AI-MC.

2.5.2.2 Contracting Officer's Representative and USACE Technical Manager

The COR is responsible for technical administration of the project and ensuring proper Army surveillance of CH2M HILL's performance. The COR for this contract is William L. Woodall at the USACE, Mobile District. Dennis Mayton serves as the USACE Technical Manager (TM) in support of the COR and is responsible for monitoring, assessing, recording, and reporting on the technical performance of CH2M HILL on a day-to-day basis.

2.5.2.3 Other Army Officials and SMEs

The KO and COR may call upon other Army officials and SMEs as required to review technical documents and products generated by CH2M HILL. For this contract, the following Army officials and SMEs have been identified:

• USAEC	Ramon Cintron-Ocasio USAEC ERM
• USACE, Mobile District	Dennis Mayton USACE TM

• USACE, Mobile District	Richard Kinsella USACE Project Chemist
	Karl Blankinship USACE Project Manager (MEC)
• USACE, Huntsville District	Chris Cochrane USACE Program Manager (MEC)

- USACE Environmental and Munitions Center of Expertise
- U.S. Army Technical Center for Explosives Safety (USATCES)
- U.S. DoD Explosives Safety Board

If additional Army officials and SMEs are identified as work progresses, this TMP will be modified.

2.5.3 Fort Rucker

Ms. Susan Cowart, the Fort Rucker Acting IRP Manager, is the primary POC for Fort Rucker and will provide project oversight and direction, assist with coordination of project activities between CH2M HILL and installation operations personnel, provide technical review of deliverables, and serve as primary regulatory interface for the Army and the project team. Mr. Robert Saliewicz, Fort Rucker Installation Safety Officer, is the primary POC for safety issues.

2.5.4 ADEM

Mr. Mark Harrison is the RPM for ADEM. Mr. Bob Barnwell serves as reviewer for ADEM in support of Mr. Harrison. Additional ADEM officials and SMEs may also provide technical support to Mr. Harrison.

2.6 Project Communication and Reporting

During the MEC RFI, two types of data will be generated: field data and investigation results. This subsection presents documentation and processing procedures for both types of data.

2.6.1 Field Data

The field team will document all field activities, including any visits to the site by regulatory personnel or their contractors, in a bound field logbook. The logbook will also be used to document, explain, and justify all deviations from the approved Work Plan. All pages will be bound, water-resistant, and consecutively numbered. Waterproof ink, preferably black, will be used to record entries in the field logbook. Each page and correction will be dated and signed by the individual making the entry.

DGM data will be collected and recorded to field computers and will be downloaded or backed up at the end of each work day. Copies of field data will be kept on a computer or server in a different location from the field computers.

2.6.2 Investigation Results

Results of the RFI will be presented in tabular and graphical formats, as well as narrative discussion. The detailed DGM data and raw analytical data will be provided in appendices to the RFI report. Depending on the volume of such data, these appendices may be presented only in electronic format on CD.

The following data will be presented in tables:

- Surveying location coordinates
- Types and quantities of MEC identified by locations on maps

Graphs or figures will be used to depict the following:

- Layout and topography
- Surveying locations
- Locations of found MEC, material potentially presenting an explosive hazard (MPPEH, Material Documented as An Explosive Hazard and Material Documented As Safe (MDAS)
- Geophysical anomalies, maps and lists.

2.7 Project File Requirements

This project will require the administration of a central project file. The data and records management protocols set forth herein will provide adequate controls and retention of all materials related to the project. Records control will include receipt from external sources, transmittals, transfer to storage, and indication of records status. Records retention will include receipt at storage areas, indexing, filing, storage, maintenance, and retrieval.

2.7.1 Records Control

All incoming documents related to the project, including sketches, correspondence, authorizations, and logs, will be forwarded to the CH2M HILL PM or designee. These documents will be placed in the central project file. Project personnel will work from a copy of the documents as necessary. All records will be legible and easily identifiable.

Examples of the types of records that will be maintained in the project file are:

- Field documents
- Correspondence
- Photographs
- Laboratory data
- Reports
- Procurement agreements

Outgoing project correspondence and reports will be reviewed and signed by the CH2M HILL PM.

2.7.2 Records Status

To prevent the inadvertent use of obsolete or superseded project-related procedures, the CH2M HILL PM or his designee will notify project team members whenever procedures are updated.

Revisions to procedures will be subject to the same level of review and approval as the original procedures. The revised procedures will be distributed to all holders of the original procedures and discussed with project personnel.

2.7.3 Records Storage

All project-related information will be maintained by CH2M HILL for the duration specified by the contract. Designated personnel will ensure that incoming records are legible and in suitable condition for storage. Records storage will be performed in two stages: storage during and immediately following the project, and permanent storage of records directly related to the project.

CH2M HILL will use storage facilities that provide a suitable environment, minimize deterioration or damage, and prevent loss. Records will be secured in secure file cabinets labeled with the appropriate project identification. Data will be maintained on CD and backed up each time a file is modified. Upon presentation of data to the Army and ADEM, a backup of that version will be permanently stored in the central filing location.

At the completion of the project, the CH2M HILL PM or designee will be responsible for the project file inventory. All material from the project files, including drawings, project-related QC documents, and electronic project documentation and verification records will be maintained by CH2M HILL.

2.8 Project Deliverables

The following are the primary deliverables for this project:

MEC RFI Work Plan – Includes a summary of each MMRP site history and prior investigations, conceptual site models (CSMs), sampling strategies, analytical suites and data quality objectives (DQOs), fieldwork methods, and data evaluation for nature and extent of MEC and MC. The Work Plan will be submitted in three editions: a preliminary draft for client review, a draft final for regulatory review, and a final.

MEC RFI Report – Will include a summary of prior site investigations and a site history; a physical features description; updated CSMs; a discussion of sampling means and methods; a summary of completed field activities, including DGM and anomaly investigation results; an evaluation of site characterization data, including the MC sampling results with nature and extent of MEC and MC; risk characterization of MEC; risk assessment for MC; and revised Munitions Response Site Prioritization Protocol. The report will also include an identification and description of each corrective measure alternative, evaluation of each alternative, and presentation of the preferred alternative. The report will be submitted in three editions: a preliminary draft for client review, a draft final for regulatory review, and a final.

Statement of Basis (SB) – Will include general information about the selected corrective measure(s) and an explanation of the evaluation process and selection criteria. The SB will be submitted in three editions: a preliminary draft for client review, a draft final for regulatory review, and a final.

2.9 Project Schedule

The following milestones have been established for this project:

- December 7, 2011 – Submit final revision 1 MEC RFI Work Plan for regulatory review
- January 6, 2012 – Receive Army/ADEM approval of final MEC RFI Work Plan
- January 9, 2012 – Mobilize and begin field activities
- March 2, 2012 – Complete field activities
- July 11, 2012 – Submit draft final MEC RFI Report for regulatory review
- October 17, 2012 – Submit final MEC RFI Report
- December 3, 2012 – Receive Army/ADEM approval of Final MEC RFI Report
- February 14, 2013 – Submit draft final SB for regulatory review
- April 22, 2013 – Submit final SB
- June 6, 2013 – Receive Army/ADEM approval of final SB

The detailed project schedule for the MEC RFI is presented in **Figure 2-1**.

2.10 Periodic Reporting

Daily status reports will be submitted to the Army while field work is being conducted. When field work is not being conducted, project updates will be submitted to the Army on a monthly basis and at additional times as needed based on work progress or requests from the Army.

2.11 Subcontractor Management

2.11.1 General

CH2M HILL will subcontract the following services to support the field investigation:

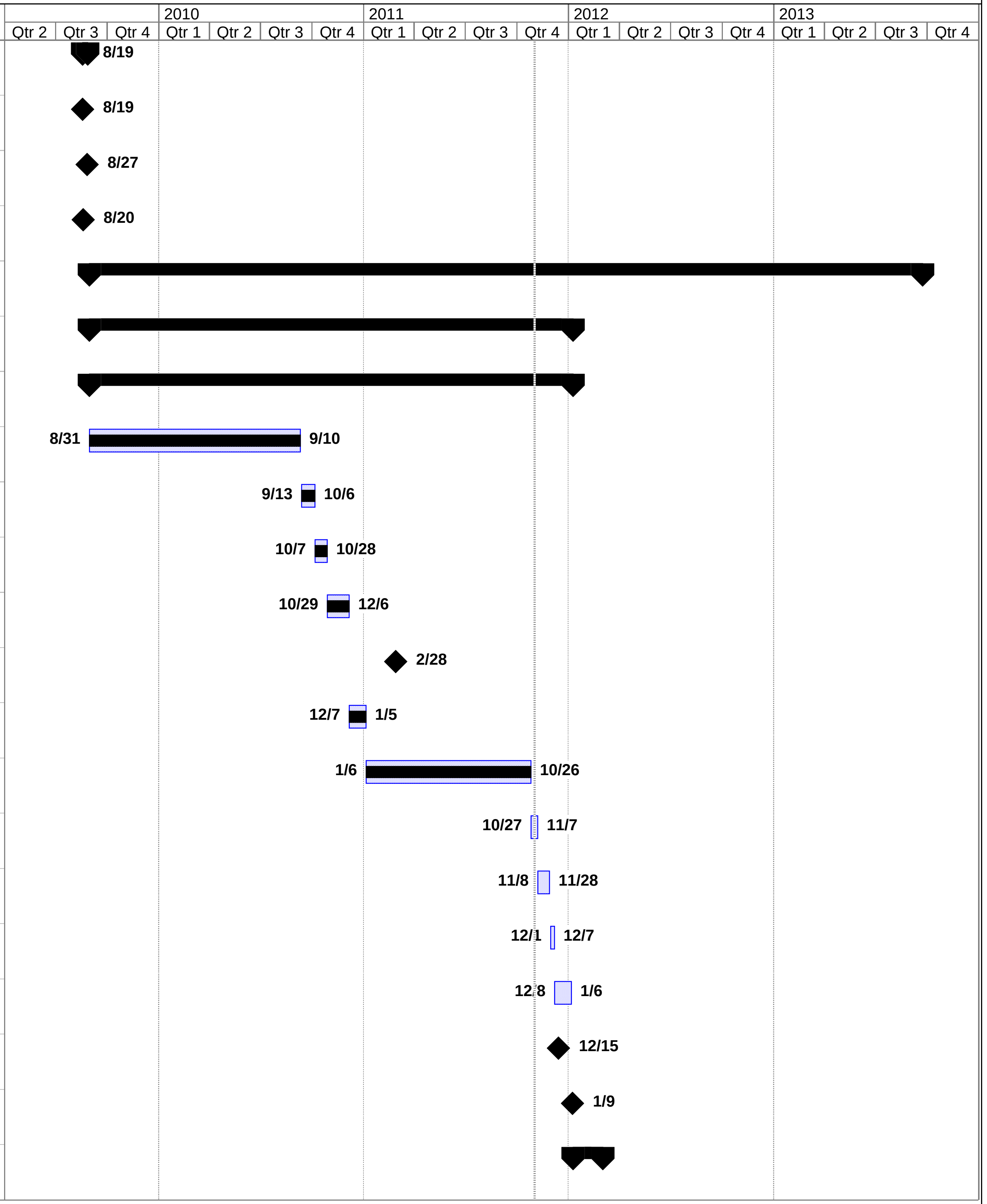
- MEC services (surface clearance, MEC avoidance, intrusive investigation of DGM anomalies, MPPEH disposition)
- DGM services
- Vegetation clearing
- Land surveying
- Analytical laboratory services

Subcontractor plans will be reviewed and approved by senior personnel in the CH2M HILL MR Program. All subcontractors will be approved by the CH2M HILL MR group prior to execution of purchase orders.

Subcontractor field personnel will operate under the direction of the CH2M HILL SUXOS/SM and will be required to comply with the requirements of the CH2M HILL APP/SSHP. Whenever non-MEC qualified personnel enter an area where MEC may be present, they are required to be escorted by at least one individual qualified as a UXO Technician Level II or higher.

FIGURE 2-1
MMRP RFI/CMS Project Schedule
Environmental Remediation Services
Fort Rucker, Alabama
Contract No. W91ZLK-05-D-0014

ID	ℹ	WBS	Task Name	Duration	Start	Finish
1	✓	1	**ENVIRONMENTAL REMEDIATION SERVICES AT FT. RUCKER**	**7 days**	**Wed 8/19/09**	**Thu 8/27/09**
2	✓	1.1	Award Date	1 day	Wed 8/19/09	Wed 8/19/09
3	✓	1.2	Site Recon Visit	1 day	Thu 8/27/09	Thu 8/27/09
4	✓	1.3	Project Kick-Off Meeting	1 day	Thu 8/20/09	Thu 8/20/09
5		**2**	**MMRP SITES**	**1061 days**	**Mon 8/31/09**	**Mon 9/23/13**
6		**2.1**	**RFI/CMS WORK PLAN**	**616 days**	**Mon 8/31/09**	**Mon 1/9/12**
7		**2.1.1**	**RFI/CMS Work Plan (includes all MMRP Sites)**	**616 days**	**Mon 8/31/09**	**Mon 1/9/12**
8	✓	2.1.1.1	Draft RFI/CMS Work Plan Preparation and Submittal	270 days	Mon 8/31/09	Fri 9/10/10
9	✓	2.1.1.2	Army Review/Comments	18 days	Mon 9/13/10	Wed 10/6/10
10	✓	2.1.1.3	Prepare Response to Army Comments and Response Submittal	16 days	Thu 10/7/10	Thu 10/28/10
11	✓	2.1.1.4	Army Review/Acceptance of Response to Comments	27 days	Fri 10/29/10	Mon 12/6/10
12	✓	2.1.1.5	Army Approval of Draft RFI/CMS Work Plan	1 day	Mon 2/28/11	Mon 2/28/11
13	✓	2.1.1.6	Final Rev 0 RFI/CMS Work Plan Preparation and Submittal	22 days	Tue 12/7/10	Wed 1/5/11
14	✓	2.1.1.7	ADEM/Army Review/Comments	210 days	Thu 1/6/11	Wed 10/26/11
15		2.1.1.8	Final Rev 1 RFI/CMS Work Plan Preparation and Submittal to Army	8 days	Thu 10/27/11	Mon 11/7/11
16		2.1.1.9	Army Review/acceptance of Final Rev 1 RFI/CMS Work Plan	15 days	Tue 11/8/11	Mon 11/28/11
17		2.1.1.10	Final Rev 1 RFI/CMS Work Plan Preparaton and Submittal to ADEM	5 days	Thu 12/1/11	Wed 12/7/11
18		2.1.1.11	ADEM Review/acceptance of Final Rev 1 RFI/CMS Work Plan	22 days	Thu 12/8/11	Fri 1/6/12
19		2.1.1.12	Pre-Construction Meeting	1 day	Thu 12/15/11	Thu 12/15/11
20		2.1.1.13	Mutual Understanding Meeting	1 day	Mon 1/9/12	Mon 1/9/12
21		**2.2**	**RCRA FACILITY INVESTIGATION**	**39 days**	**Tue 1/10/12**	**Fri 3/2/12**

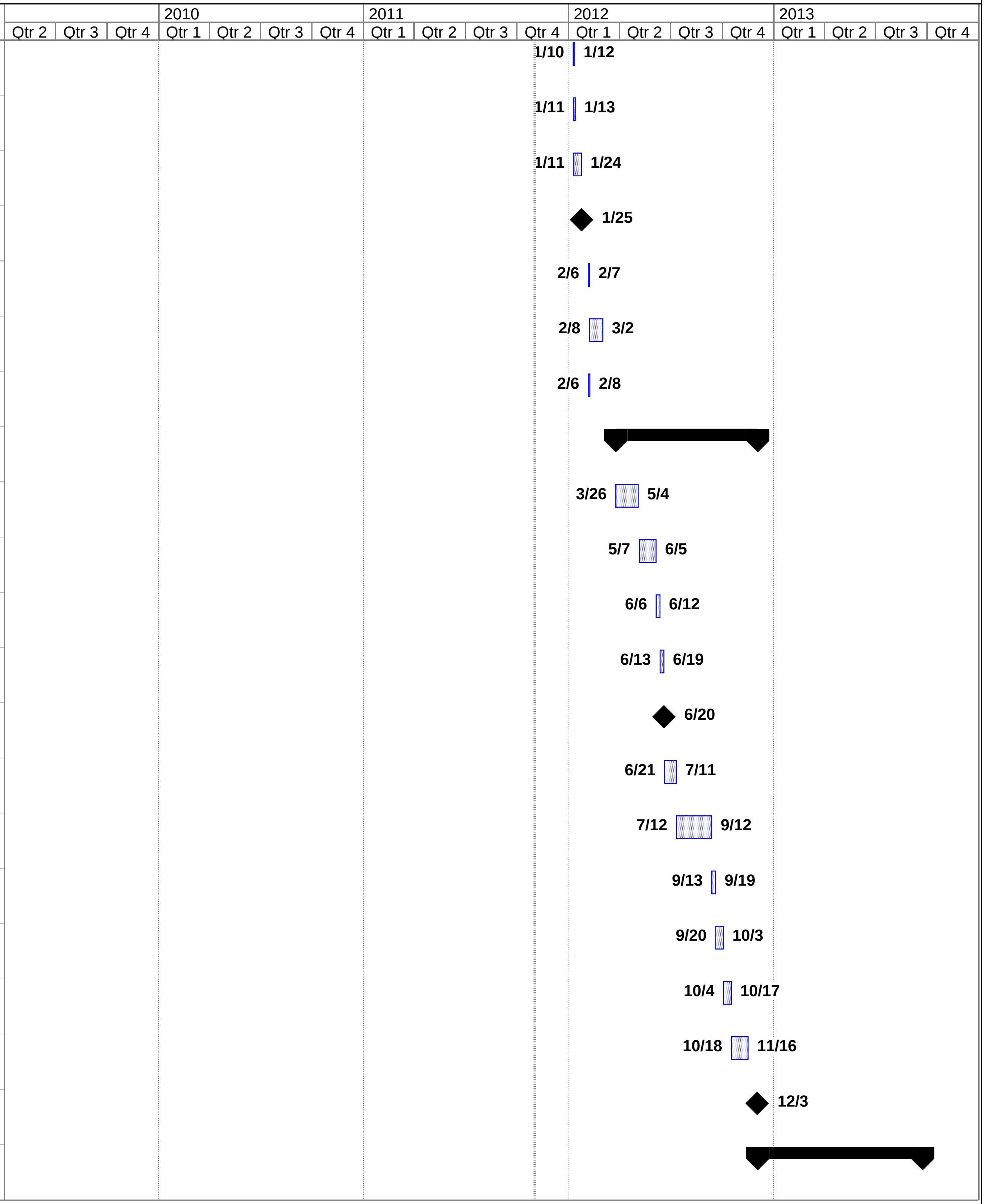


FORT RUCKER PROJECT SCHEDUI
11/01/2011

Task	▭	Milestone	◆	Rolled Up Task	▭	Rolled Up Progress	▬	External Tasks	▭	Group By Summary	▬
Progress	▬	Summary	▬	Rolled Up Milestone	◇	Split	┈	Project Summary	▬	Deadline	⇩

FIGURE 2-1
MMRP RFI/CMS Project Schedule
Environmental Remediation Services
Fort Rucker, Alabama
Contract No. W91ZLK-05-D-0014

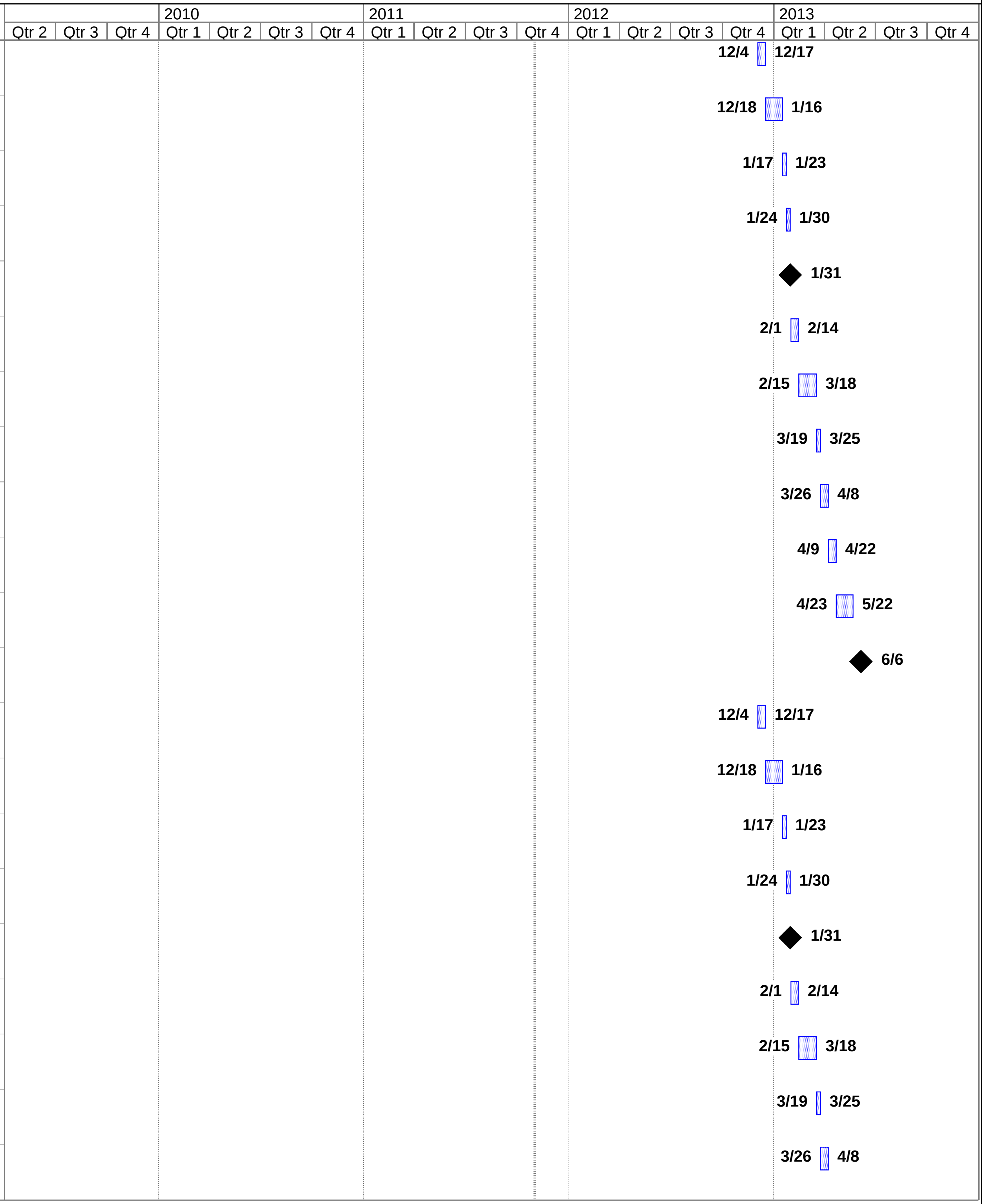
ID	ℹ	WBS	Task Name	Duration	Start	Finish
22		2.2.1	Establish Transects(Anti-Tank/Rocket Grenade Range&Infilitration/Grenade Range	3 days	Tue 1/10/12	Thu 1/12/12
23		2.2.2	Brush Clearing(Anti-Tank/Rocket Grenade Range&Infiltration/Grenade Range	3 days	Wed 1/11/12	Fri 1/13/12
24		2.2.3	DGM Survey(Anti-Tank/Rocket Grenade Range&Infiltration/Grenade Range	10 days	Wed 1/11/12	Tue 1/24/12
25		2.2.4	DGM Survey Evaluation and Instrusive Investigation Location List Preparation	8 days	Wed 1/25/12	Fri 2/3/12
26		2.2.5	Land Surveyor to Reacquire Dig List Targets	2 days	Mon 2/6/12	Tue 2/7/12
27		2.2.6	Instrusive Investigation(Anti-Tank/Rocket Grenade Range&Infiltration/Grenade Range	18 days	Wed 2/8/12	Fri 3/2/12
28		2.2.7	.22 Caliber Target Butt Instrument Assisted Walkabout/Surface Soil Sampling	3 days	Mon 2/6/12	Wed 2/8/12
29		**2.3**	**RCRA FACILITY INVESTIGATION REPORT / CMS**	**181 days**	**Mon 3/26/12**	**Mon 12/3/12**
30		2.3.1	Draft RFI/CMS Report (includes all MMRP Sites) Preparation and Submittal	30 days	Mon 3/26/12	Fri 5/4/12
31		2.3.2	Army Review/Comments	22 days	Mon 5/7/12	Tue 6/5/12
32		2.3.3	Prepare Response to Army Comments and Response Submittal	5 days	Wed 6/6/12	Tue 6/12/12
33		2.3.4	Army Review/Acceptance of Response to Comments	5 days	Wed 6/13/12	Tue 6/19/12
34		2.3.5	Army Approval of Draft Final RFI/CMS Report	1 day	Wed 6/20/12	Wed 6/20/12
35		2.3.6	Draft Final RFI/CMS Report Preparation and Submittal	15 days	Thu 6/21/12	Wed 7/11/12
36		2.3.7	ADEM/Army Review/Comment	45 days	Thu 7/12/12	Wed 9/12/12
37		2.3.8	Response to ADEM/Army Comments and Response Submittal	5 days	Thu 9/13/12	Wed 9/19/12
38		2.3.9	ADEM/Army Review/Acceptance of Response to Comments	10 days	Thu 9/20/12	Wed 10/3/12
39		2.3.10	Final RFI/CMS Report Preparation and Submittal	10 days	Thu 10/4/12	Wed 10/17/12
40		2.3.11	ADEM/Army Review of Final RFI/CMS Report	22 days	Thu 10/18/12	Fri 11/16/12
41		2.3.12	*Army/ADEM Approval of Final RFI/CMS Report*	1 day	Mon 12/3/12	Mon 12/3/12
42		**2.4**	**STATEMENT OF BASIS**	**210 days**	**Tue 12/4/12**	**Mon 9/23/13**



FORT RUCKER PROJECT SCHEDUI 11/01/2011	Task	▭	Milestone	◆	Rolled Up Task	▭	Rolled Up Progress	▬	External Tasks	▭	Group By Summary	▬
	Progress	▬	Summary	▬	Rolled Up Milestone	◇	Split	⋯	Project Summary	▬	Deadline	⇩

FIGURE 2-1
MMRP RFI/CMS Project Schedule
Environmental Remediation Services
Fort Rucker, Alabama
Contract No. W91ZLK-05-D-0014

ID	ℹ	WBS	Task Name	Duration	Start	Finish
43		2.4.1	Draft Statement of Basis - Anti-Tank/Rocket Grenade Range Prep and Submittal	10 days	Tue 12/4/12	Mon 12/17/12
44		2.4.2	Army Review/Comments	22 days	Tue 12/18/12	Wed 1/16/13
45		2.4.3	Prepare Response to Army Comments and Response Submitttal	5 days	Thu 1/17/13	Wed 1/23/13
46		2.4.4	Army Review/Acceptance of Response to Comments	5 days	Thu 1/24/13	Wed 1/30/13
47		*2.4.5*	Army Approval of Draft SB-Anti-Tank/Rocket Grenade Range	1 day	Thu 1/31/13	Thu 1/31/13
48		2.4.6	Draft Final Statement of Basis - Anti-Tank/Rocket Grenade Range Prep and Submittal	10 days	Fri 2/1/13	Thu 2/14/13
49		2.4.7	ADEM/Army Review/Comment	22 days	Fri 2/15/13	Mon 3/18/13
50		2.4.8	Response to ADEM/Army Comments and Response Submittal	5 days	Tue 3/19/13	Mon 3/25/13
51		2.4.9	ADEM/Army Review/Acceptance of Response to Comments	10 days	Tue 3/26/13	Mon 4/8/13
52		2.4.10	Final Statement of Basis - Anti-Tank/Rocket Grenade Range Prep and Submittal	10 days	Tue 4/9/13	Mon 4/22/13
53		2.4.11	ADEM/Army Review of Final Statement of Basis - Anti-Tank/Rocket Grenade Rg	22 days	Tue 4/23/13	Wed 5/22/13
54		2.4.12	*Army/ADEM Approval of Final SB-Anti-Tank/Rocket Grenade*	1 day	Thu 6/6/13	Thu 6/6/13
55		2.4.13	Draft Statement of Basis - Infiltration/Grenade Range Preparation and Submittal	10 days	Tue 12/4/12	Mon 12/17/12
56		2.4.14	Army Review/Comments	22 days	Tue 12/18/12	Wed 1/16/13
57		2.4.15	Prepare Response to Army Comments and Response Submittal	5 days	Thu 1/17/13	Wed 1/23/13
58		2.4.16	Army Review/Acceptance of Response to Comments	5 days	Thu 1/24/13	Wed 1/30/13
59		2.4.17	Army Approval of Draft SB-Infiltration/Grenade Range	1 day	Thu 1/31/13	Thu 1/31/13
60		2.4.18	Draft Final Statement of Basis - Infiltration/Grenade Range Prep and Submittal	10 days	Fri 2/1/13	Thu 2/14/13
61		2.4.19	ADEM/Army Review/Comments	22 days	Fri 2/15/13	Mon 3/18/13
62		2.4.20	Prepare Response to ADEM/Army Comments and Response Submittal	5 days	Tue 3/19/13	Mon 3/25/13
63		2.4.21	ADEM/Army Review/Acceptance of Response to Comments	10 days	Tue 3/26/13	Mon 4/8/13



Task	▭	Milestone	◆	Rolled Up Task	▭	Rolled Up Progress	▬	External Tasks	▭	Group By Summary	▬
Progress	▬	Summary	▬	Rolled Up Milestone	◇	Split	┈	Project Summary	▬	Deadline	⇩

FIGURE 2-1
MMRP RFI/CMS Project Schedule
Environmental Remediation Services
Fort Rucker, Alabama
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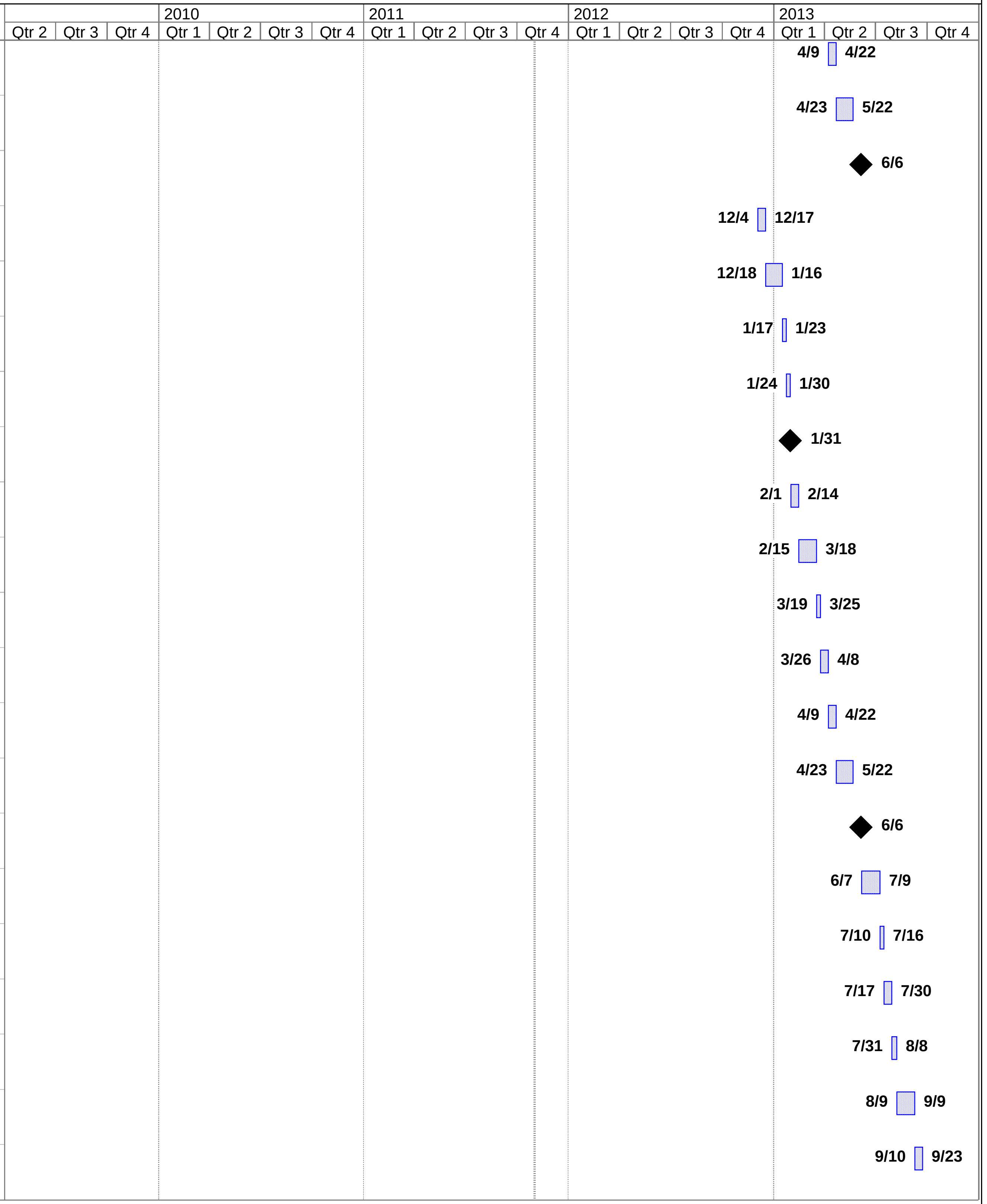
ID	ℹ	WBS	Task Name	Duration	Start	Finish
64		2.4.22	Final Statement of Basis - Infiltration/ Grenade Range Prep and Submittal	10 days	Tue 4/9/13	Mon 4/22/13
65		2.4.23	ADEM/Army Review of Final Statement of Basis - Infiltration/Grenade Range	22 days	Tue 4/23/13	Wed 5/22/13
66		2.4.24	*Army/ADEM Approval of Final SB-Infiltration/Grenade Range*	1 day	Thu 6/6/13	Thu 6/6/13
67		2.4.25	Draft Statement of Basis - .22-Caliber Target Butt Preparation and Submittal	10 days	Tue 12/4/12	Mon 12/17/12
68		2.4.26	Army Review/Comments	22 days	Tue 12/18/12	Wed 1/16/13
69		2.4.27	Prepare Response to Army Comments and Response Submittal	5 days	Thu 1/17/13	Wed 1/23/13
70		2.4.28	Army Review/Acceptance of Response to Comments	5 days	Thu 1/24/13	Wed 1/30/13
71		2.4.29	Army Approval of Draft SB-.22-Caliber Target Butt	1 day	Thu 1/31/13	Thu 1/31/13
72		2.4.30	Draft Final Statement of Basis - .22-Caliber Target Butt Prep and Submittal	10 days	Fri 2/1/13	Thu 2/14/13
73		2.4.31	ADEM/Army Review/Comment	22 days	Fri 2/15/13	Mon 3/18/13
74		2.4.32	Prepare Response to ADEM/Army Comments and Response Submittal	5 days	Tue 3/19/13	Mon 3/25/13
75		2.4.33	ADEM/Army Review/Acceptance of Response to Comments	10 days	Tue 3/26/13	Mon 4/8/13
76		2.4.34	Final Statement of Basis - .22-Caliber Target Butt Prep and Submittal	10 days	Tue 4/9/13	Mon 4/22/13
77		2.4.35	ADEM/Army Review of Final Statement of Basis - .22-Caliber Target Butt	22 days	Tue 4/23/13	Wed 5/22/13
78		2.4.36	*Army/ADEM Approval of Final SB-.22-Caliber Target Butt*	1 day	Thu 6/6/13	Thu 6/6/13
79		2.4.37	Public Comment Period (All MMRP Sites)	23 days	Fri 6/7/13	Tue 7/9/13
80		2.4.38	Prepare Response to Public Comments	5 days	Wed 7/10/13	Tue 7/16/13
81		2.4.39	Army/ADEM Review/Acceptance of Response to Public Comments	10 days	Wed 7/17/13	Tue 7/30/13
82		2.4.40	Revise Statement of Basis (If Needed Based on Public Comment)	7 days	Wed 7/31/13	Thu 8/8/13
83		2.4.41	ADEM/Army Review of Final Statement fo Basis	22 days	Fri 8/9/13	Mon 9/9/13
84		2.4.42	Final Statement of Basis - Acceptance of Ranges	10 days	Tue 9/10/13	Mon 9/23/13



FORT RUCKER PROJECT SCHEDUI
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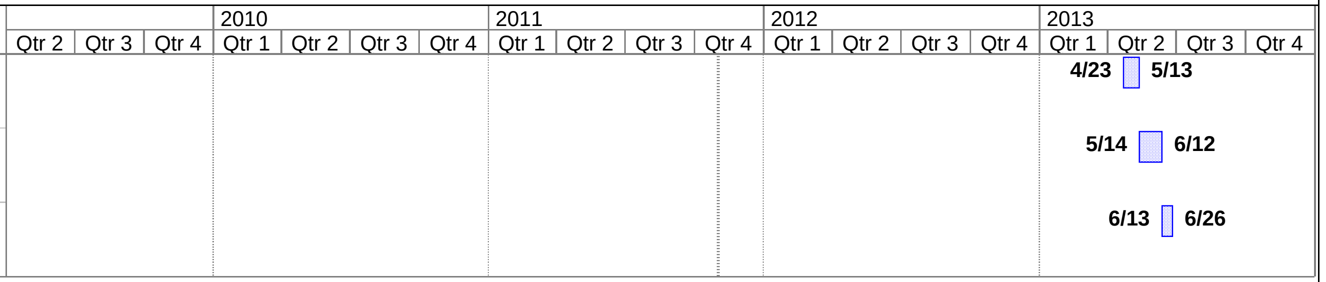
Task	▭	Milestone	◆	Rolled Up Task	▭	Rolled Up Progress	▬	External Tasks	▭
Progress	▬	Summary	▬	Rolled Up Milestone	◇	Split	┈	Project Summary	▬
								Group By Summary	▬
								Deadline	⇩

FIGURE 2-1
MMRP RFI/CMS Project Schedule
Environmental Remediation Services
Fort Rucker, Alabama
Contract No. W91ZLK-05-D-0014

ID	ℹ	WBS	Task Name	Duration	Start	Finish
85		2.4.43	Draft MMRP Scores Update and Submittal	15 days	Tue 4/23/13	Mon 5/13/13
86		2.4.44	Army Review/Comments	22 days	Tue 5/14/13	Wed 6/12/13
87		2.4.45	Final MMRP Scores Update and Submittal	10 days	Thu 6/13/13	Wed 6/26/13



FORT RUCKER PROJECT SCHEDUL
11/01/2011

Task	▭	Milestone	◆	Rolled Up Task	▭	Rolled Up Progress	■	External Tasks	▨	Group By Summary	■
Progress	■	Summary	■	Rolled Up Milestone	◇	Split	⋯	Project Summary	▨	Deadline	⇩

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2.11.2 MEC Services Subcontractor

ERRG, CH2M HILL's MEC services subcontractor, will provide MEC avoidance services, as required, and perform intrusive investigation at the selected DGM anomaly locations to evaluate the nature of the anomaly sources.

Specific project duties of the MEC services subcontractor will include the following:

- Train field personnel in appropriate MEC safety procedures before the field activities begin.
- Provide MEC avoidance escort to field personnel while conducting onsite activities in areas of potential MEC.
- Conduct surface metal clearance in the DGM transects.
- Intrusively investigate selected DGM anomalies.
- Provide MEC item identification and disposal (to include demolition for material documented as an explosive hazard [MDEH] and certification and demilitarization for material documented as safe [MDAS]).
- Conduct site restoration following munitions response activities.
- Provide necessary documentation of completed activities.

ERRG will provide all labor, equipment, and tools required for the work described above. ERRG personnel for MEC operations will meet the requirements of DDESB Technical Paper (TP) 18, *Minimum Qualifications for UXO Technicians and Personnel*. Personnel performing MR activities that present an explosive risk will be limited to a 50-hour work week, with no individual work day exceeding 10 hours, unless authorized by the COR.

ERRG will provide a federal permit for Purchase, Use and Transportation of Commercial Explosives, and identify the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF&E) certified responsible Person and Employee Possessors assigned to demolition teams. ERRG will secure Commercial Drivers License Services for the transportation of hazardous materials on Fort Rucker.

2.11.3 DGM Services Subcontractor

CH2M HILL's DGM services subcontractor, NAEVA, will provide MEC-project experienced personnel for the DGM investigation. Specific duties assigned to the DGM services subcontractor include performing DGM services according to the GIP (provided as **Attachment 3-1**), including the DGM survey, data processing and interpretation, and preparation of DGM anomaly maps.

NAEVA will provide all labor, equipment, and materials required for the DGM services.

2.11.4 Vegetation Clearing Subcontractor

While under escort for MEC avoidance, a vegetation clearing subcontractor will clear vegetation (as needed) from the transects where DGM will be performed. Vegetation clearing is discussed in more detail in **Section 3.8.4**. The vegetation clearing subcontractor will perform work in accordance with the Environmental Protection Plan, provided as **Section 6** of this Work Plan. The vegetation clearing subcontractor will provide all labor, equipment, and materials required for vegetation clearing tasks.

2.11.5 Land Surveying Subcontractor

While under escort for MEC avoidance, CH2M HILL's Professional Land Surveyor (PLS), Donaldson, Garrett, and Associates (licensed in the State of Alabama), will provide surveying services for the purpose of determining horizontal coordinates of stakes used in the DGM work. Additional surveying requirements are identified in **Section 3.8.3 and 3.8.6** and in the GIP (**Attachment 3-1**). The land surveying subcontractor will provide all labor, equipment, and materials required for the survey tasks.

2.11.6 Analytical Laboratory Subcontractor

The selected analytical laboratory, Empirical, a USACE-, and ADEM-approved laboratory, will perform sample analyses. Laboratory requirements are identified in the MC SAP (**Appendix E** of this Work Plan). Empirical will provide all labor, equipment, and materials required for the analytical laboratory tasks.

2.12 Management of Field Operations

All MEC-related field operations will be overseen by CH2M HILL's SUXOS/SM. The UXOQCS/UXOSO will provide oversight for quality and S&H issues.

Section 3. Field Investigation Plan

This MEC RFI is being conducted to investigate the potential presence of subsurface MEC and MC impact to soils at the three subject MMRP sites at Fort Rucker. The investigation will provide data for characterizing the nature and extent of MEC and MC impact to soils within each MMRP site, and provide information for decisions concerning appropriate future land management and use in the SB. Additional details relating to MC sampling and analysis are discussed in the SAP, included as Appendix E. Forms for documentation of field activities are provided as Appendix F. General

3.1 General

MR field activities will be conducted in accordance with the following guidance documents, regulations, and policies:

- DDESB TP 16, *Methodologies for Calculating Primary Fragment Characteristics*. TP 16 includes methodologies for calculating primary fragment mass and velocity, maximum fragment range, hazardous fragment distance, effects of detonating stacks of items, effects of detonating buried items, and penetration information.
- DDESB TP 18, *Minimum Qualifications for UXO Technicians and Personnel*. This document provides minimum qualification standards for personnel performing MEC-related operations in support of the DoD with the exception of DDESB personnel.
- DoD, 2008, 6055.09-M, *DoD Ammunition and Explosives Safety Standards*, administratively revised August 4, 2010. This is the primary DoD regulation that establishes uniform safety standards for ammunition and explosives, associated personnel and property, and unrelated personnel and property exposed to the potentially damaging effects of an accident involving ammunition or explosives. It applies to determining minimum safety distances, explosives storage requirements, facility construction and siting, such as work sites and magazines, and ESQD requirements.
- DoD, 1991, 4160.21-M, *Defense Materiel Disposition Manual*, and 4160.21-M-1, *Defense Demilitarization Manual*. DoD 4160.21-M implements the Federal Property Management Regulation and other laws and regulations applying to the disposition of excess, surplus, and foreign excess personal property. DoD 4160.21-M-1 contains specific guidance for property identified as Munitions List Items and Commerce Control List Items. The guidance is applicable to the demilitarization and disposal of MPPEH and MD.
- USACE, 2007, Engineering Pamphlet (EP) 1110-1-18, *Military Munitions Response Process*. This guidance provides the procedures and processes to be used to manage and execute all aspects of MEC-related projects.
- USACE, 2008, Engineering Manual (EM) 385-1-97, *Explosives Safety and Health Requirements Manual*. This guidance document establishes the safe operating procedures for dealing with MEC items on Formerly Used Defense Sites, Base Realignment and

Closure Act installations, and IRP projects. This guidance is applicable to all MEC-related projects.

- All USACE DIDs for MR activities applicable to the Work Plan, as specified by DID MMRP-09-0001.

3.2 Personnel Qualifications

All site personnel must have the training and meet the medical monitoring requirements outlined in **Appendix D**. These include the requirements of Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations under 29 CFR 1910.120/29 CFR 1926.65. All employees who perform work at hazardous waste sites or perform emergency response in accordance with 29 CFR 1910.120(a)(1)(i)-(v)/29 CFR 1926.65(a)(1)(i)-(v) will be subject to CH2M HILL's medical surveillance program requirements (CH2M HILL-Standard Operating Procedures [SOPs] HS-01, Medical Surveillance, and HS-02, Safety and Health Training).

All personnel conducting HAZWOPER-regulated tasks must meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated the Site Safety and Health Officer (SSHO)/Unexploded Ordnance (UXO) Safety Officer (UXOSO) must have completed CH2M HILL's safety coordinator course, and have documented requisite field experience. At least two employees currently certified by the American Red Cross, or equivalent, in first aid and cardiopulmonary resuscitation (CPR) must be available at each job site/operation.

All MEC operations personnel will be qualified and certified in accordance with terms outlined by U.S. Department of Labor Employment Standards Administration Wage Hour Division for UXO Personnel and DDESB TP 18, *Minimum Qualifications for UXO Technicians and Personnel*. Resumes and Contractor Personnel Qualifications Letters in accordance with DDESB TP 18 are included in **Appendix G**.

3.3 Overall Safety Precautions

General work practices outlined in EM 385-1-97, *Explosives Safety and Health Requirements Manual* (USACE, 2008) will be followed. Other basic precautions are as follows:

- The work periods for UXO Technicians are limited to maximums of 10 hours per day and 50 hours per week.
- The field team will consist of a UXO Technician III and six or fewer team members.
- The SUXOS/SM will oversee no more than 10 UXO teams.

Qualified UXO personnel will dispose of all MEC items using demolition procedures identified in **Section 3.8.11**.

3.4 Data Quality Objectives

Data Quality Objectives (DQOs) are both qualitative and quantitative statements that define the type, quality, and quantity of data necessary to support the decision-making process during project activities. The DQO process used for this project follows the EPA QA/G-4 guidance (USEPA, 2000) and uses the following seven-step DQO development process:

1. **State the problem.** Describe concisely the problem to be studied.
2. **Identify the decisions.** State the decisions to be made to solve the problem.
3. **Identify inputs to the decisions.** Identify information and supporting measurements needed to make the decisions and describe the source(s) of the information.
4. **Define the boundaries of the study.** Specify conditions (that is, time periods and spatial locations).
5. **Develop a decision rule.**
6. **Specify tolerable limits on decision errors.**
7. **Optimize the design for obtaining data.** Evaluate the results of the previous steps and develop the most resource-efficient design for data collection.

Table 3-1 describes the DQOs for the overall RFI project. **Tables 3-2** through **3-6** describe the DQOs for the DGM, intrusive anomaly investigations, instrument-assisted site walkabout and MC sampling. Individual items will be the targets of investigation; however, they will be evaluated in the context of the extent of MEC across any particular area (i.e. the search is for patterns or the density of individual items as opposed to trying to locate individual items for disposal). Requirements for sample collection, chemical analysis, and chemical parameter measurements are presented in the FSP **(Appendix E, Part I).**

TABLE 3-1
Data Quality Objectives–Overall RCRA Facility Investigation
MEC RFI, Fort Rucker, Alabama

Step	DQO
1. State the problem.	There is a potential for MEC and MC to be present at the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range MRSs and a potential for MC to be present at the .22-Caliber Target Butt MRS. Potential receptors include authorized installation personnel, authorized installation visitors, recreational users, trespassers, and biota. Potential exposure routes for surface and subsurface MEC include handle/tread underfoot and intrusive action; subsurface MEC may be exposed through intrusive action or erosion. Potential exposure routes for MC include dermal contact, inhalation, and ingestion. The objective of the RFI is to define the nature and extent of MEC and MC at the MRSs, as well as to evaluate the associated hazard/risk.
2. Identify the decisions.	Does the nature and extent of MEC and/or MC present a hazard/risk to human/ecological receptors?
3. Identify inputs to the decisions.	• MEC type and density – Individual items will be the targets of investigation; however, they will be evaluated in the context of the extent of MEC across any particular area (i.e., the search is for patterns or the density of individual items, such as identification of a target area, as opposed to trying to locate individual items for disposal). • MC concentrations from past investigations and RFI soil samples
4. Define the boundaries of the study.	The RFI will be conducted within the boundaries of the three MRSs. The RFI field efforts will be performed in a time frame such that an approved RFI/CMS report is finalized by 15 June 2012.
5. Develop a decision rule.	The RFI data will be used to evaluate the need for a munitions response action and evaluate remedial alternatives
6. Specify tolerable limits on decision errors.	The data collected during the RFI will be of sufficient quality and quantity as described in the work plan to achieve the project objective and support a CMS.
7. Optimize the design for obtaining data.	The TPP process will be used to develop a technical approach for achieving the RFI objective.

TABLE 3-2
Data Quality Objectives–Digital Geophysical Mapping
MEC RFI, Fort Rucker, Alabama

Step	DQO
1. State the problem.	There is a potential for MEC to be present in the subsurface within the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range MRSs.
2. Identify the decisions.	Are there geophysical anomalies present in selected areas within the MRSs that potentially represent subsurface MEC?
3. Identify inputs to the decisions.	Geophysical mapping data QC data
4. Define the boundaries of the study.	The boundaries are the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range MRSs. Transects in these MRS will be located 30 meters apart on centers, resulting in over 3.3% DGM coverage of each site. Target areas of at least 15m radius will be identified.
5. Develop a decision rule.	DGM will be considered complete when the following criteria have been met: 1) A sufficient portion of the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range MRSs has been surveyed to delineate the boundaries of potential MEC contamination, estimate anomaly densities, and characterize the nature of anomalies through intrusive investigation; if a target area is identified, the DGM must determine the extent of the target area. 2) Up to 272 randomly selected geophysical anomalies (a statistically significant portion, based on the Estimating a Proportion statistical method, described in Section 3.8.9.1) representing potential subsurface MEC each at the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range MRSs will be included on a target list for intrusive investigation ensure with a 90% confidence and +/- 5 sampling error the proportion of MEC to non-MEC DGM anomalies present. 3) The Estimating a Proportion statistical method has been applied over an area of homogenous anomaly density within each MRS. If densities of anomalies representing potential subsurface MEC are heterogeneous over an area within a MRS, transects will be divided by density contours and the Estimating a Proportion statistical method will be applied over a homogenous subarea (and more than 272 anomalies will be selected for investigation).
6. Specify tolerable limits on decision errors.	Decision errors will be minimized by ensuring that the appropriate instrumentation, positioning, processing, anomaly selection, geophysical system verification and procedures defined in this work plan are utilized. **Attachment 3-1** further defines the measurement quality objectives (MQOs) for DGM efforts. The maximum deviation between DGM transects will be 20% (or 6m) from the planned transect, when no obstacles such as impassable terrain, trees, or other hazards are encountered.
7. Optimize the design for obtaining data.	The design is optimized through the review of DGM results; if target areas are identified, more tightly spaced transects may be implemented to define the extent of target areas. The GSV and QC procedures described in this work plan will also be utilized to optimize the data collection design.

TABLE 3-3
Data Quality Objectives – Intrusive Anomaly Investigations
MEC RFI, Fort Rucker, Alabama

Step	DQO
1. State the problem.	There is a potential for MEC to be present in the subsurface within the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range MRSs.
2. Identify the decisions.	Are anomalies detected by geophysical instruments caused by subsurface MEC?
3. Identify inputs to the decisions.	DGM subsurface anomaly above background QC data
4. Define the boundaries of the study.	The boundaries of the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range MRSs; Up to 272 randomly selected geophysical anomalies (a statistically significant portion, based on the Estimating a Proportion statistical method) representing potential subsurface MEC each at the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range MRSs will be included on a target list for intrusive investigation to ensure with a 90% confidence and +/- 5 sampling error the proportion of MEC to non-MEC DGM anomalies present. Depth of investigation will be up to 2 feet below ground surface.
5. Develop a decision rule.	Intrusive Investigation will be considered complete when the following criteria have been met: 1) A sufficient portion of anomalies found within the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range MRSs have been intrusively investigated so that the nature of anomalies across each site can be characterized. 2) Subsurface anomalies selected from DGM data are intrusively investigated to determine the nature of the anomaly. 3) Any MEC/MPPEH found is disposed via detonation and MDAS is certified using DD Form 1348-1A and shipped offsite for disposal.
6. Specify tolerable limits on decision errors.	Decision errors will be minimized by utilizing qualified and experienced personnel, appropriate instrumentation and QC procedures (QC seeding and re-inspection) described in this work plan.
7. Optimize the design for obtaining data.	The design is optimized through the anomaly selection process (Estimating a Proportion statistical method). The intrusive investigation process is optimized by using qualified and experienced personnel to perform the investigation and implementing appropriate QC procedures.

TABLE 3-4
Data Quality Objectives – Instrument Assisted Site Walkabout
MEC RFI, Fort Rucker, Alabama

Step	DQO
1. State the problem.	There is a potential for small arms ammunition to be present that could contribute to MC contamination in the surface and subsurface soils within the .22 Caliber Target Butt MRS.
2. Identify the decisions.	Are small arms ammunition or target/berm areas present within the MRS?
3. Identify inputs to the decisions.	Visual observations and near-surface anomalies detected by handheld all-metals detectors QC data
4. Define the boundaries of the study.	The boundaries of the .22 Caliber Target Butt MRS; the instrument assisted site walkabout will consist of 1.5m-wide transects spaced a maximum of 15 meters apart on centers, covering at least 10% of the MRS.
5. Develop a decision rule.	The instrument-assisted site walkabout be considered complete when the following criteria have been met: 1. At least 10% of the MRS has been surveyed by transects spaced a maximum of 15 meters apart on centers using a handheld all metals detector 2. The presence or absence of small arms ammunition and/or target/berm areas has been confirmed.
6. Specify tolerable limits on decision errors.	Decision errors will be minimized by utilizing qualified and experienced personnel, appropriate instrumentation procedures described in this work plan. The maximum distance between walkabout transects will be 15m when no obstacles such as impassable terrain, trees, or other hazards are encountered.
7. Optimize the design for obtaining data.	The design is optimized through in field observations. The walkabout process is optimized by using qualified and experienced personnel to perform the investigation.

TABLE 3-5
Data Quality Objectives – MC Sampling at the Anti-Tank/Rocket Grenade Range (FTRU-001-R-01) and Infiltration/Grenade Range (FTRU-003-R-01)
MEC RFI, Fort Rucker, Alabama

Step	DQO
1. State the problem.	There is a potential for MC to be present in the near surface and subsurface soils at the Anti-Tank/Rocket Grenade Range Infiltration/Grenade Range MRSs.
2. Identify the decisions.	Are groupings of MEC/MPPEH or MD observed?
3. Identify inputs to the decisions.	Intrusive anomaly investigation data Geophysical mapping data QC data
4. Define the boundaries of the study.	The boundaries of the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range MRSs.
5. Develop a decision rule.	If MEC/MPPEH or MD items are found grouped together, surface soil samples will be collected using a grid sampling approach from the MRS. Samples will be collected and analyzed for explosives and select metals (arsenic, cadmium, chromium, lead, mercury, and selenium,)
6. Specify tolerable limits on decision errors.	Refer to **Appendix E, Part I**, MC Sampling and Analysis Plan (SAP)
7. Optimize the design for obtaining data.	Refer to **Appendix E, Part I**, MC Sampling and Analysis Plan (SAP)

TABLE 3-6

Data Quality Objectives – MC Sampling at the.22-Caliber Target Butt (FTRU-004-R-01) MRS

Step	DQO
1. State the problem.	There is a potential for MC to be present in the near surface and subsurface soils at the .22-Caliber Target Butt MRS.
2. Identify the decisions.	Do instrument-assisted site walkabout results indicate areas for soil sampling?
3. Identify inputs to the decisions.	Instrument-assisted site walkabout observations of small arms ammunition or other munitions,
4. Define the boundaries of the study.	The boundaries of the.22-Caliber Target Butt MRS.
5. Develop a decision rule.	If small arms ammunition or potential target/berm areas are observed during the instrument-assisted site walkabout, discrete soil samples will be collected in these areas. If no evidence of munitions use is observed, no samples will be collected. Collected soil samples will be submitted to the laboratory for analysis of select metals (antimony, copper, lead, and zinc).
6. Specify tolerable limits on decision errors.	Refer to **Appendix E, Part I**, MC Sampling and Analysis Plan (SAP)
7. Optimize the design for obtaining data.	Refer to **Appendix E, Part I**, MC Sampling and Analysis Plan (SAP)

3.5 Use of Time Critical Removal Actions during the Munitions Response Project

No time critical removal actions are anticipated during the duration of the project. If MEC is encountered during the RFI, it will be reported and disposed as discussed in **Section 3.8.10 and 3.8.11**.

3.6 Munition with the Greatest Fragmentation Distance (MGFD), EZs, and Minimum Separation Distances (MSDs)

Based on the types of MEC known or suspected to be present at each MMRP site, the munitions listed in **Table 3-7** have been selected for determination of ESQD arcs, which form the basis for hazardous fragment distances (HFDs), EZs, and MSDs. These distances are provided in the ESP **(Attachment 3-4).** The .22-Caliber Target Butt MMRP site is not listed, because no MEC is known or suspected to be present within this MMRP site.

TABLE 3-7
Munition with the Greatest Fragmentation Distance by MRS
MEC RFI, Fort Rucker, Alabama

MRS Location	MGFD
FTRU-001-R-01 Anti-Tank/Rocket Grenade Range	3.5-inch M28A2 HEAT Rocket
FTRU-003-R-01 Infiltration/Grenade Range	M31 Rifle Grenade

If any MEC items are identified other than those listed above, the fragmentation distances of those items will be evaluated. If MEC with a greater fragmentation distance than the selected MGFD is encountered, the minimum separation distance (MSD) will be adjusted in accordance with DDESB TP 16 (Revision 3), *Methodologies for Calculating Primary Fragment Characteristics* and the DDESB Fragmentation Database, operations will continue, and an amendment to the Explosives Site Plan and Work Plan will be submitted for approval.

Any occupied buildings or public roadways within the Hazardous Fragmentation Distance (HFD) will be evacuated and/or blocked to prevent non-essential personnel from entering during intrusive operations. Entry control points (ECPs) have been established, as illustrated on Figures 3 and 4 of the ESP. If a roadway cannot be blocked, spotters will be used to alert the SUXOS to cease intrusive operations when non-essential personnel approach/enter HFD areas. Work shall be suspended until non-essential personnel depart the HFD area. At the Anti-Tank/Rocket Grenade Range, horses stabled within the equestrian center will be removed from their stalls and withdrawn to beyond the HFD (157 ft).

In the event of an intentional detonation, all personnel and public will withdraw outside the maximum fragmentation distance (MFD). Horses stabled within the equestrian center on the Anti-Tank/Rocket Grenade Range will be removed from their stalls and withdrawn to beyond the maximum fragmentation distance - horizontal (MFD-H). Radio communications will be maintained among all concerned parties. Avenues of ingress will not be opened without the express permission of the Demolition Team Supervisor.

Sandbag mitigation is the preferred engineering control (if required) for intentional detonations. Sandbag mitigations shall be in accordance with HNC-ED-CS-S-98-7, *The Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions and Environmenta*l and Munitions Center of Expertise (EM CX) Safety Advisory: *Use of Jet Perforator During Intentional Detonation While Using Sandbag Mitigation for Engineering Controls*, dated 12 July 2010 (Note: a copy of these guidances will be available onsite). The implementation of sandbag mitigation during an intentional detonation will reduce the MFD-H to 200 feet. Figures 3 and 4 of the ESP illustrate this reduction in MFD-H at each MRS. If an additional reduction of the MFD is required; the Buried Explosion Module (see DDESB TP 16) will be used.

3.7 Sampling Rationale

The following subsections describe the investigation at each MMRP site, as summarized in **Table 3-8**. Historical background information for the three sites is provided in **Section 1**. MC sampling will be performed in accordance with the MC SAP (**Appendix E**).

TABLE 3-8
Summary of Investigations
MEC RFI, Fort Rucker, Alabama

MMRP Site	Investigation Activities
Anti-Tank/Rocket Grenade Range	Transect spacing of 30m to ensure that a 15m radius circle placed anywhere within the site will be crossed by at least one transect. Intrusive investigation of a statistically representative set of anomalies, (determined by DGM results). Biased MC sampling of soil where MEC was detonated (pre- and post-BIP samples).If MEC/MPPEH or MD items are found grouped together, soil samples will be collected using a grid sampling approach in the area where the items were found. Laboratory analysis for explosives and metals (arsenic, cadmium, chromium, lead, mercury, and selenium).
Infiltration/Grenade Range	Transect spacing of 30m to ensure that a 15m radius circle placed anywhere within the site will be crossed by at least one transect. Intrusive investigation of a statistically representative set of anomalies (determined by DGM results). Biased MC sampling of soil where MEC was detonated (pre- and post-BIP samples). If significant numbers of MEC/MPPEH or MD are found grouped together, soil samples will be collected using a grid sampling approach in the area where the items were found. Laboratory analysis for explosives and metals (arsenic, cadmium, chromium, lead, mercury, and selenium).
.22-Caliber Target Butt	10% instrument-assisted site walkabout coverage (one 1.5m wide transect every 15m) to ensure that a 15m radius circle placed anywhere within the site will be crossed by at least one transect. If small arms ammunition or other munitions are observed, discrete soil samples will be collected and submitted for laboratory analysis for metals (lead, antimony, copper, and zinc) .

3.7.1 Anti-Tank/Rocket Grenade Range (FTRU-001-R-01)

Based on historical site use, the ranges in this site should have a significant density of metal in the subsurface near any targets and the density should decline with radial distance. Assuming a minimum radial distance of 15m from each target having at least a moderate density of subsurface metal related to the target (fragmentation, UXO, practice munitions, etc.), a transect spacing of 30m will provide a 1m "footprint" (within which metallic items will be detected), resulting in a 3.3% coverage of the site. This coverage ensures that a 15m radius circle placed anywhere within the site will be crossed by at least one transect and thus any target of that dimension will likely be identified. This is a conservative approach given that the anticipated munition with the smallest MFD-H at the range, the MK2 grenade (121m), indicates that anticipated impact areas at the range will be larger than 121m. However, if a target is traversed and the resulting intrusive investigations reveal MEC or MD, additional, more tightly spaced transects may be placed to determine the extent of the target.

Soil samples collected from the MRS will include pre- and Post-BIP samples and) soil samples collected using a grid sampling approach in an area where MEC/, MPPEH, or MD items are found grouped together, as directed by the PM. Samples will be analyzed for explosives and select metals (arsenic, cadmium, chromium, lead, mercury, and selenium).

3.7.2 Infiltration/Grenade Range (FTRU-003-R-01)

Similar to the Anti-Tank/Rocket Grenade Range, if MEC exists at the artillery ranges associated with the Infiltration/Grenade Range, the strongest indication will likely be within target areas. A sampling approach similar to the one used at the Anti-Tank/Rocket Grenade Range, consisting of one transect every 30m and intrusive investigation of a statistically representative portion of discovered anomalies, will be used. . This is a conservative approach given that the anticipated munition with the smallest MFD-H at the range, the MK2 grenade (121m), indicates that anticipated impact areas at the range will be larger than 121m. However, if a target is traversed and the resulting intrusive investigations reveal MEC or MD, additional, more tightly spaced transects may be placed to determine the extent of the target.

Soil samples collected from this MRS will include discovered and (pre- and post-BIP samples) soil samples collected using a grid sampling approach in an area where MEC/MPPEH or MD items are found grouped together, as directed by the PM. Samples will be analyzed for explosives and select metals (arsenic, cadmium, chromium, lead, mercury, and selenium).

3.7.3 .22-Caliber Target Butt (FTRU-004-R-01)

MC sampling will include discrete soil sampling if small arms ammunition or other munitions are observed during the site walkabout. If there is no evidence of munitions use in the MRS, no samples will be collected. Collected soil samples will be sent to the laboratory for analysis of select metals (antimony, copper, lead, and zinc).

3.7.4 Soil Sampling Procedures

3.7.4.1 TR-02-1 Surface Soil Sampling

The TR-02-1 sampling method will be used to assess shallow soil conditions in areas constrained by development or dense vegetation. Each sampling location will be defined as an area 1m by 1m. MEC anomaly avoidance will be practiced as described in **Section 2.3** of the HSP (**Appendix A**). The coordinates of the sampling locations will then be recorded using GPS and will be based on the center of the sampling area. Soil samples will be collected by compositing a minimum of 30 sample increments from random locations within each 1m x 1m sampling location. The sample increments will be approximately equal in the amount of soil, which will be collected from depths of 0 to 6 inches. The sample increments at each location will be homogenized following the *Homogenization of Soil and Sediment Samples* SOP into a single sample before being transferred to the appropriate sample containers.

3.7.4.2 Incremental Surface Soil Sampling

Three composite incremental surface soil samples will be collected from each decision unit (DU). The size of each DU will be established based on the grouping of observed MEC/MPPEH or MD observed usage and current site layout (such as unvegetated areas). Decision units will have s boundaries that may range in size from 10m x 10m to 100m x 100m. MEC anomaly avoidance will be practiced as described in **Section 2.3** of the HSP (**Appendix A**). The incremental samples will be collected using the *Systematic Random Multi-Increment Sampling* SOP in Attachment C of the MRP Master Project Plans (CH2M HILL, 2008c). The sample increments will be approximately equal in the amount of soil, which will be collected from depths of 0 to 6 inches. Each composite sample will consist of a total of 30 soil increments with a minimum weight of 3 kilograms (6.6 pounds) of soil.

3.7.4.3 Pre-Blow-In-Place Soil Sampling

The use of explosives during controlled detonation/ blow-in-place (BIP) operations could potentially impact the surrounding soils. Soil samples will be collected at locations where MEC is discovered. One grab sample will be collected at the discovery depth of the MEC.

3.7.4.4 Post-Blow-In-Place Soil Sampling

Composite surface soil samples will be collected using the TR-02-1 sampling approach in the resulting crater, and the incremental sampling method will be utilized to collect a sample from outside of the crater. QA/QC samples will be collected in accordance with MC SAP (**Appendix E** of this Work Plan)**..**

Surface soil samples from the crater will be collected using the TR-02-1 approach described in the USACE Technical Report ERDC/CRREL TR-02-1, *Guide for Characterization of Sites Contaminated with Energetic Materials* (Thiboutot, et al., 2002). Each sampling location will be defined as an area measuring 1 meter (m) × 1 m. Coordinates of the sampling locations will be based on the center of the sampling area. Soil samples will be collected by compositing a minimum of 30 sample increments from random locations within each 1 m × 1 m sampling location. The sample increments will be approximately equal in the amount of soil, which will be collected from depths of 0 to 2 inches bgs. The sample increments at each location will be composited into a single sample following the *Homogenization of Soil and Sediment Samples* SOP in Appendix C of the MRP MPP (CH2M HILL, 2008a) prior to being transferred to the appropriate sample containers.

Additionally, the use of explosives during the MEC intrusive investigation could also impact the soils ejected from the crater. Surface soil samples will be collected outside the crater utilizing the incremental sampling method. The decision unit for the post-BIP sample collected outside the crater (outside the 1 m × 1 m TR-02-01 sampling area) will be roughly circular and centered upon the crater, with a radius of up to 15 m to encompass the visible ejecta pattern. The maximum radius of 15 m is based on work conducted by the US Army Engineer Research and Development Center entitled "Explosive Residues from Blow-in-Place Detonations of Artillery Munitions"(Pennington, et al., 2008). This paper concluded that the majority of the explosives residue mass falls within 15 m of the detonation center. The soil samples will be collected in accordance with the incremental sampling SOP in Appendix C MRP MPP (CH2M HILL, 2008a). At least 30 aliquots of soil will be collected from 0 to 2 inches bgs and homogenized in accordance with the SOP in Appendix C of the MRP MPP.

3.8 Munitions Response Field Activities

3.8.1 Mobilization and Site Preparation

Mobilization consists of transporting personnel and equipment to the work site and establishing temporary facilities and site controls, consisting of portable sanitary facilities, decontamination area, and site refuge area. Initial site activities include QC planning of blind DGM seed planting locations and setup of the Instrument Verification Strip (IVS) to be used as part of the GSV process (described in **Section 3.8.7** and **Attachment 3-2**). A metal detector Instrument Source Point (ISP) will be established. The ISP will be used to confirm the metal detection equipment is working correctly and the equipment operator is demonstrating proficiently equipment use.

3.8.2 MEC Avoidance/Escort

Within the Anti-Tank/Rocket Grenade Range MRS and the Infiltration/Grenade Range MRS, where MEC is known or suspected to occur and no clearance activities have been completed, UXO Technician support for MEC avoidance will be provided. MEC avoidance techniques are steps implemented by a UXO Escort to avoid any potential surface or subsurface MEC; subsurface avoidance will be performed during intrusive sampling operations.

Activities requiring MEC avoidance and/or escort activities include, but are not limited to, land surveying, environmental and natural resource assessments, vegetation removal, and sampling of environmental media. The MEC avoidance procedures established in MR Standard Operating Procedure (SOP) 001 (**Attachment 3-3**) will be followed.

3.8.3 Boundary Survey

Prior to the start of vegetation removal, CH2M HILL will use handheld GPS devices (accuracy of 1-3m) to mark the extent of each site that will be subjected to vegetation removal and transect surveys. Clear boundaries such as roadways will not be marked. The site boundaries will be prominently marked using highly visible flagging tape placed at maximum distances of 20m between points.

3.8.4 Vegetation Clearing

Areas of the Anti-Tank/Rocket Grenade Range MRS and the Infiltration/Grenade Range MRS that have brushy undergrowth or tree cover that might impede DGM operations will require vegetation clearing to establish the DGM transects. Vegetation clearing will consist of manually or mechanically removing brushy undergrowth and small trees (<4 inch diameter), where necessary. Personnel will use mechanical means where possible and manual means in the other areas.

Vegetation clearing will be conducted by a vegetation clearing subcontractor under the supervision of at least one UXO Technician II or higher for MEC avoidance, in accordance with CH2M HILL MR SOP 001, Anomaly Avoidance Procedures (**Attachment 3-3**). The subcontractor will use a handheld global positioning system (GPS) or compass bearings and tapes to locate approximately 30-meter separated transects through the wooded areas. Any MEC or MPPEH discovery will be documented and managed in accordance with **Section 3.8.10**.

3.8.5 Instrument-assisted Surface Clearance

Instrument-assisted surface clearance will be performed along wooded transects in the Anti-Tank/Rocket Grenade Range MRS and the Infiltration/Grenade Range MRS by UXO Technicians to ensure the safety of DGM crews and to remove metallic debris that would impede subsurface anomaly detection. Handheld all-metals detectors (White's XLT, or equivalent) will be used for this task. The handheld all-metals detectors will be checked twice daily (before and after use) over a small metallic item (i.e., a 1/2″ x 4″ section of pipe) at a test location to ensure function and operation. Any MEC/MPPEH discoveries will be documented and managed in accordance with **Section 3.8.10**. A minimum of one UXO Technician III and two UXO Technicians I or II will perform the surface clearance.

3.8.6 Transect Stakes Survey

An Alabama-licensed PLS will place stakes rising no higher than 1 ft above ground surface along the center of the established transects at approximately 75-ft intervals. These stakes will be used by the DGM teams to position DGM data and assist in anomaly reacquisition. The stakes are no greater than 1 ft above ground surface in order that the EM61 can pass over them without contacting them (and forcing them out of the ground.) Stakes will also be placed at any turning point along the transect (for example, at the endpoints of any segment of the transect established around trees or other obstructions). **Figures 3-1 and 3-2 (Appendix B)** show the site boundaries and idealized transects for the Anti-Tank/Rocket Grenade Range MRS and the Infiltration/Grenade Range MRS, respectively. Actual transect locations will be based on field conditions.

Site survey personnel will be accompanied by at least one UXO Technician II or higher, performing MEC avoidance procedures. If MEC or MPPEH is detected during surveying, operations will be temporarily stopped and the item will be documented and disposed of according to the procedures in **Section 3.8.10 and 3.8.11**.

3.8.7 Digital Geophysical Mapping (DGM)

3.8.7.1 Overview

At the Anti-Tank/Rocket Grenade Range MRS and the Infiltration/Grenade Range MRS, instrument-assisted surface clearances will be followed by DGM surveys of the transects to non-intrusively identify subsurface anomalies possibly representing MEC. Prior to and during the DGM, the GSV process, including an IVS and QC seeding, will be performed (see **Section 3.8.7.2**).

DGM will be completed using EM61-MK2 time-domain electromagnetic metal detectors to map the investigation area and select DGM anomalies that could potentially represent subsurface MEC. The DGM team will include a field geophysicist experienced in MEC projects, and a geophysical technician. All geophysical and positioning data will be digitally recorded and downloaded at the end of each day.

Following data processing and interpretation, a statistically significant sample of DGM anomalies potentially representing MEC will be selected for intrusive investigation.

3.8.7.2 GSV

The GSV is a physics-based presumptively selected technology process in which signal strength and sensor performance are compared to known response curves of industry standard objects (ISOs)[1] to verify DGM systems prior to and during site surveys. The GSV process is designed to perform initial verification of the proposed DGM system using an IVS

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[1] Nelson, H.H., T. Bell, J. Kingdon, N. Khadr, and D. Steinhurst. 2009. *EM61-MK2 Response of Three Munitions Surrogates. NRL/MR/6110-09-9183*. March

followed by a "blind" seeding program for continued verification throughout the field operations.

During the vegetation removal or survey of the transect stakes, QC ISOs (Nelson et al., 2009) will be placed along transects, directly between survey stakes so the data collection crews will pass over them, and an Alabama-licensed PLS will record these locations. For open areas in which transects are not bounded by cut vegetation and stakes, the QC seed will be placed along the section between two flags but the location will be obscured such that the team does not know where it is placed. The "blind" QC seeds will be used for ongoing QC on the detection, selection, and intrusive investigation process. The locations of QC seeds will be known by QC personnel, but not shared with data collection/operational personnel until the operation being checked has been completed. The GSV Plan, provided as **Attachment 3-2,** provides details of the equipment, approach, methods, and operational procedures to be used in performing the IVS and QC seeding.

3.8.7.3 Geophysical Investigation Plan (GIP)

The GIP, provided as **Attachment 3-1**, provides details of the equipment, approach, methods, operational procedures, and QC to be used in performing the DGM investigations.

3.8.8 Instrument-Assisted Site Walkabout

An instrument-assisted site walkabout over at least 10 percent of the .22-Caliber Target Butt MMRP site will be performed by UXO Technicians for the purpose of identifying any areas where small arms or ammunition may be present or if evidence of a berm exists. Handheld all-metals detectors (White's XLT, or equivalent) will be used for this task. **Figure 3-3 (Appendix B)** shows the site boundaries and the idealized path for the site walkabout within the .22-Caliber Target Butt MMRP site MRS.

If observations of a berm, small arms ammunition or other munitions items are made, the observations will be used to bias the locations of soil sample collection. If no observations of a berm, small arms ammunitions or other munitions are made, no soil samples will be collected.

3.8.9 Intrusive Investigation

The following subsections detail the statistical approach for selection of anomalies to be investigated and processes for reacquisition, excavation, removal verification, and QC of the intrusive investigation locations.

Because Fort Rucker conducts aviation operations, the Directorate of Plans, Training, Mobilization, and Security Airspace will be contacted prior to intrusive operations to allow a Notice to Airman to be posted. The Directorate of Family and Morale, Welfare and Recreation; the Fort Rucker Golf Course; and the Fort Rucker Equestrian Center, as applicable, will also be notified. Efforts will be made to perform intrusive operations during low-use periods.

3.8.9.1 Statistical Anomaly Selection Approach

A statistically representative set of anomalies will be intrusively investigated to identify the nature and extent of the anomaly sources. The tool to be used for statistical sampling within the MMRP sites is the Estimating a Proportion method. Using the following statistical sample size formulas for categorical data, it is possible to determine the necessary sample size of DGM anomalies to be intrusively investigated and classified within a population of anomalies (e.g., within a transect, group of transects, or site) when that population can be assumed to be homogeneous (or having an equal chance of encountering a MEC item at any location). If the population of anomalies as a whole appears heterogeneous, the transects will be divided by density contours and the approach applied to sub-populations consisting only of the anomalies within areas of relative homogeneity. One can extrapolate the sample population investigation results to estimate the proportion of MEC to non-MEC across the population within an acceptable confidence limit and margin of error. When a population size is large or unknown:

$$n_0 = \frac{Z_\alpha^2 pq}{e^2}$$

When a population size is finite or known (finite population correction):

$$n_1 = \frac{n_0}{1 + \left(\frac{n_0}{N}\right)}$$

Z_α = desired confidence level
p = proportion of MEC classified as DGM anomalies
q = proportion of non-MEC classified as DGM anomalies ($q = 1-p$)
e = acceptable margin of error for proportion being estimated
n_0 = statistical sample size for a large population
n_1 = adjusted statistical sample size for a finite population
N = size of the population (number of DGM anomalies along a transect segment)

When estimating the variance of proportional variables (i.e., MEC or non-MEC), it is most conservative to estimate a population proportion of 50% ($p=0.5$); the result is that variance (pq) is maximized and thus, the required sample size is also maximized.

Using a z-statistic for a 90% confidence level (i.e., $Z_\alpha=1.645$) and a margin of error of 5% (i.e., $e=0.05$), the solution for n_0:

$$n_0 = \frac{Z_\alpha^2 pq}{e^2} = \frac{1.65_\alpha^2 (0.5)(0.5)}{0.05^2} = 272$$

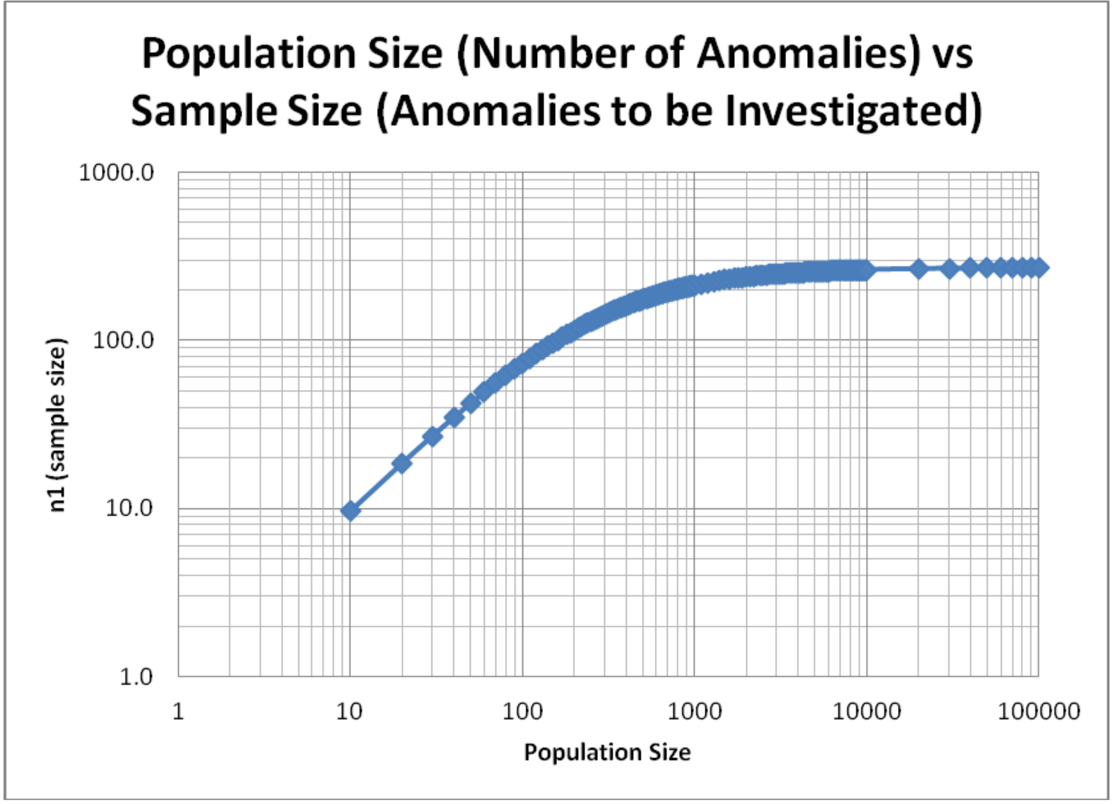
This formula calculates that a maximum of 272 randomly selected DGM anomalies need to be classified to determine with 90% confidence and ± 5% sampling error the proportion of MEC to non-MEC DGM anomalies in a large or unknown population.

Once the number of DGM anomaly contacts has been determined in a population, one can use the total number of contacts as the total population (N). If n_0 is greater than 5% of N ($N*0.05 > n_0$), one can further reduce the required sample size. Thus, within a population, once N is known, one can reduce the required sample size by solving for n_1:

$$n_1 = \frac{n_0}{1 + \left(\frac{n_0}{N}\right)} = \frac{272}{1 + \frac{272}{N}}$$

This formula allows scaling of sample size to the appropriate quantity based on (1) the number of contacts discovered within a population and (2) the pre-determined confidence level and acceptable margin of error. **Figure 3-4** shows results of this calculation for various population sizes.

FIGURE 3-4
Estimating a Proportion



3.8.9.2 Reacquisition

Anomalies selected for intrusive investigation will be reacquired using either real-time kinematic (RTK) GPS (in open areas) or straight-line distances between survey stakes (in wooded areas). The location of each selected anomaly will be flagged 1 ft north of the actual field location. The flagging will consist of a polyvinyl chloride (PVC) flag with the unique identifier number recorded in indelible ink.

3.8.9.3 Anomaly Excavations

Handheld metal detectors (Whites XLT and Schonstedt GA-52Cx, or comparable) will be used to predict proximity to the anomaly. Based on the types of munitions items potentially present at the site, the total depth of excavation will not exceed 2 ft below ground surface (bgs). Since majority of munitions items are typically found within the first 2 feet below ground surface; it is not anticipated that items will be found beyond 2 feet bgs. Hand grenades do not typically penetrate the ground surface. Rifle grenades are found in the shallow subsurface because they are fired at low velocity, at a low angle. Anomalies located at depths greater than 2 ft bgs will be documented, but left in place. The MEC teams performing this work will be composed of at least one UXO Technician II and up to four UXO Technicians II or I supervised by a Technician III. Details associated with this operation are included as **Attachment 3-3** (SOPs). The handheld all-metals detectors will be checked twice daily (before and after use) over a small metallic item at a test location to ensure function and operation.

Small hand tools, such as shovels, spades, trowels, and pry bars, will be used to access the anomaly. Hand tools will be used for the majority of the items, which generally are expected to be found near the surface. The following basic technique will be used for anomaly excavation:

- The UXO Technician will investigate within a 1-meter radius, or to the limits of detection, of the flagged anomaly with an appropriate geophysical instrument.
- Until identified otherwise, the anomaly is assumed to be MEC. Excavation will be initiated adjacent to the subsurface anomaly. The excavation will continue until the excavated area has reached a depth below the top of the anomaly as determined by frequent inspection with an appropriate geophysical instrument.
- Using progressively smaller and more delicate tools to remove the soil carefully, the excavation team will expand the sidewall to expose the metallic item for inspection and identification without moving or disturbing the item.
- Once the item is exposed for inspection, the excavation team will determine if it is MEC.
- If MEC is discovered, the SUXOS will notify the CH2M HILL PM, who will contact the USAEC ERM, USACE PM, and Fort Rucker IRP Manager. The USAEC ERM will be responsible for notifying the ADEM RPM. MEC will be managed as discussed in **Section 3.8.10**.
- If the item is not MEC, it will be removed and the area will be rechecked to ensure that a MEC item was not hidden beneath the removed item. The excavation team will then annotate the results of the excavation on the dig sheet and move on to the next marked DGM anomaly.
- Anomaly locations inspected, along with results of the inspection, will be documented by ERRG and provided to the CH2M HILL Project Geophysicist.

Buffer layers of soil that exceed 12 inches in distance from an anomaly may be removed with mechanical equipment (e.g., backhoe or track-hoe). Mechanical excavation will not occur within 12 inches of an anomaly and will commence to the side of the anomaly. Within 12 inches of an anomaly, the excavation team will resume manual excavation with hand tools to move in horizontally to the anomaly.

MEC teams will intrusively investigate the selected and reacquired anomalies and record results of the investigation on digital dig sheets in handheld Munitions Response Site Information Management System (MRSIMS) (described in **Section 3.11.1**) field devices.

3.8.9.4 Removal Verification

Refer to **Section 4.3.2.4** for anomaly removal verification processes.

3.8.9.5 QC Inspection during Intrusive Investigations

QC inspection requirements during intrusive investigations are provided in Section **4.3.2.5.**

3.8.10 MEC/MPPEH/MD Inspection and Processing for Disposition

A systematic approach will be used for collecting, inspecting, and segregating site debris. The approach is designed so that materials undergo a continual evaluation/inspection process from the time they are acquired until the time they are removed from the site. Segregation procedures begin at the time the item is discovered by the UXO Technician. At this point, the UXO Technician makes a preliminary determination as to the classification of the item into one of four categories and the UXO Technician III confirms the item to be MEC, MPPEH, MD, or other debris (non-munitions related items).

MPPEH and MD will be inspected, certified, verified and disposed of in accordance with DOD Instruction (DODI) 4140.62, *Management and Disposition of Material Potentially Presenting an Explosive Hazard*, and EM 1110-1-4009, *Military Munitions Response Actions* and Errata Sheet No. 2. MPPEH inspection shall occur within the MRS, at the location where the item is encountered.

3.8.10.1 MEC/MDEH

When an initial inspection by a qualified and authorized person determines that the MPPEH item is hazardous, the item will be classified as MEC/MDEH. The SUXOS and UXOSO will then make an acceptable-to-move determination for MEC. The SUXOS and UXOSO must determine that the risk associated with movement is acceptable and that the movement is necessary for the efficiency of the activities being conducted or the protection of people, property or critical assets. In such cases, the responsible SUXOS and UXOSO must agree with the risk determination and document this decision in writing prior to movement of the MEC or suspect munitions item. UXO qualified personnel may determine that MPPEH is safe for on-site movement. Written documentation and concurrence of the SUXOS and UXOSO is not required for MPPEH.

All recovered MEC/MDEH determined unacceptable-to-move will be blown-in-place by controlled detonation with engineering controls (i.e., sandbag mitigation or the Buried Explosion Module). MEC/MDEH determined acceptable-to-move by the SUXOS and UXO Safety Officer (UXOSO) may be moved within the MRS for the purpose of conducting disposal operations away from any inhabited buildings, structures, or roadways. Onsite demilitarization procedures are presented in **Section 3.8.11**.

3.8.10.2 MDAS

MPPEH items require a 100 percent visual inspection of all surfaces to result in a classification as MDAS. If this cannot be achieved, the items will be handled as MDEH. Explosive venting of such items will allow for subsequent visual inspection of all surfaces of the items and classification as MDAS.

The SUXOS and UXOSO will provide 100 percent visual inspection, verification, and certification of MDAS. MDAS will be documented as such by signature from the two inspectors on the DD Form 1348-1A. The following statement will be included on the DD Form 1348-1A:

> *"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, is inert and/or free of explosives."*

Quality control procedures are presented in **Section 4.3.2.5.** Disposition procedures are presented in **Section 3.8.13.**

3.8.10.3 Other Debris

The UXOQCS will perform random checks to confirm that segregated non-range related items classified as "other debris" (such as targets, scrap metal, etc,)are free from explosive hazards, engine fluids, illumination dials, and other visible liquid HTRW materials. Disposition procedures for other debris are presented in **Section 3.8.14**.

3.8.10.4 Quality Control of MEC/MPPEH/MD Inspection and Processing

The UXOQCS will perform daily audits of the procedures used by UXO Technicians for processing MPPEH and MD as required by EM 1110-1-4009 Chapter 14. Additionally, the UXOQCS will perform and document random sampling (by pieces, volume, or area) of all MPPEH/MD collected from the various teams to ensure that no items with explosive hazards, engine fluids, illuminating dials, and other visible liquid HTRW materials are identified as MD or other debris.. The UXOQCS will perform daily audits to ensure that the specific procedures and responsibilities for processing MDEH/MDAS for chain-of-custody, segregation, and accountability specified in this Work Plan are being followed and that all processing of MDEH/MDAS is being performed safely, consistent with applicable regulations.

3.8.11 Onsite MEC and MPPEH Demilitarization

3.8.11.1 General

Explosives operations will comply with procedures outlined in Technical Manual (TM) 60A-1-1-31, *EOD Disposal Procedures*, and EM 385-1-97, *Explosives Safety and Health Requirements Manual*. Onsite demilitarization will be by controlled denotation applying commercial explosives. The commercial explosives will be transported to the site using just-in-time delivery, and in accordance with Alabama statutes, DoD, ATF&E, USACE, and Fort Rucker requirements, and the Explosives Management Plan (EMP) in **Section 5**.

Demolition operations will be performed daily or the items will be properly secured and guarded until operations can be conducted. Consolidated detonations and collection points will not be used during this project.

3.8.11.2 Demolition Team

The Demolition Team will be composed of a minimum of three UXO qualified individuals. The Demolition Team Supervisor will coordinate with the UXOSO, who is not a member of the Demolition Team. The Demolition Team Supervisor will inspect each post-detonation location after a minimum of 5 minutes have passed to confirm a complete detonation, assess fire hazards, assess the response, and recover potential remaining explosives that were not consumed in the explosion.

3.8.11.3 Demilitarization Operations

Prior to demilitarization operations, the SUXOS will notify and coordinate with local emergency services to reduce public exposure, maintain safety, and keep the public informed. The emergency contacts and phone numbers are provided in the APP/SSHP, located in **Appendix D**.

In addition, all non-essential personnel to the operations will be evacuated to a distance greater than the established MSD for the MEC being detonated. Prior to priming of demolition charges, all avenues of entry will be physically blocked and positive control will be maintained. Entry control points shall be established in accordance with the ESP. Radio communications shall be maintained among all concerned parties. Avenues of ingress will not be opened without the express permission of the Demolition Team Supervisor.

While preparing MEC for detonation, the Demolition Team Supervisor will ensure that the number of personnel onsite is kept to the minimum required to safely accomplish the disposal mission. The MEC disposal process will be performed in accordance with demolition practices outlined in TM 60A-1-1-31 and manufacturer's guidelines. **Attachment 3-3** provides additional activity checklists and procedures.

During demolition operations, the Demolition Team Supervisor will control and be responsible for explosive disposal operations to ensure the following:

- The area is clear and remains clear of unauthorized personnel.
- The MSD is the maximum fragmentation distance or applicable Maximum Credible Event (MCE) K328 distance for the item being destroyed or demilitarized.
- Disposal detonations are configured in a manner that precludes fragments from entering inhabited areas and limits blast wave damage to facilities and property.
- The UXOSO shall have sole custody of and maintain the firing device, and shall not delegate or authorize connection to the firing device or initiation of the pyrotechnic chain until the MFD is secured for horizontal and vertical fragmentation distances are evacuated of personnel and aircraft. Only the UXOSO may give permission to the Demolition Team Supervisor to prime a detonation and ignite or fire a detonation.
- The Demolition Team Supervisor shall confirm by verbal communication and document the time of communication approval from the UXOSO to authorize an explosion.

Preparatory activities for demolition:

- Review of the DDESB-approved ESP for conformance to plan criteria
- Review and conform to EMP guidance and requirements
- Identify MDEH or MPPEH item and applicable technical publication or ORDATA II Database (http://ordatamines.maic.jmu.edu), for functioning, hazards, safeties, warnings, and/or notes.

- Document (demo/safety log books) Demolition Team Supervisor and UXOSO review of commercial explosives manufacturer's: safety notes, warnings instructions, and MSDS for explosives and as applicable initiation or firing device or systems manufacture's guidelines.
- Establish FAA Notice to Airmen (NOTAM) as applicable
- Review points of contacts list, emergency upwind rally points and evacuation points, location and directions to hospital and ensure that detonation and safety support vehicles have directions and map to the hospital with communications and ensure demolition vehicle has two (2) - 20lb BC rated fire extinguishers.
- Ensure emergency response equipment identified within APP is on hand
- Ensure two means of communications are available
- Designate essential personnel to be involved in the operation
- Acquire protective work materials and implement approved engineering controls
- Provide warning signal briefing to operational personnel and visitors:
    - One 30-second horn blast prior to explosives preparation and handling;
    - Three 30-second horn blasts separated by five seconds of quiet per horn blast, one minute prior to detonation event; three oral shouts "Fire in the Hole!" 15-seconds prior to initiation of detonation, shouted toward the detonation location, and then 90 degrees right and left of detonation location;
    - Two 30-second horn blasts separated by 5 seconds of quiet as the "All Clear" signal.
    - Use warning flag "Bravo Red Flag" at Entry Control Point (ECP) when explosives have been delivered and during use.
- Ensure proper movement of explosive material and vehicle operations in accordance with EMP and DOT regulations.
- Complete detonator tests for all electric detonators at least 25 feet from and downwind of MEC/MPPEH or other donor explosives.
- Detonation (det) cord will be placed at least 50 feet from detonation materials until ready for use. Cap and det cord mating for sensitized det cord will be performed 50 feet away and downwind from all donor explosives and MEC/MPPEH items.
- As applicable to explosive operation, prior to each daily use of time fuse, verify the burn rate for the time/safety fuse; to ensure enough time fuse is requisitioned/delivered to achieve a minimum burn personnel separation time of 10 minutes. This event shall be confirmed by UXOSO and documented in applicable log books. Do this burn test using an 18-inch section of time fuse

downwind and 50 feet from explosive material/MEC/MPPEH. Time recording shall commence after visible indication of sustained ignition and conclude with zero indications of sustained burning.

Preparing the Explosive Charge:

- All personnel not required to prime charges will depart and proceed to the firing point or safe area.
- Ensure shunt is in place for both opposing ends of blasting wire at the firing point, and end of wire for walking to the detonation site.
- Extend firing wire from upwind location to detonation location, lay wire on ground, and avoid pulling, snatching, or dragging wire over ground surface. Ensure 25 feet of wire is located at detonation point,
- Perform "Continuity Check" of firing wire removing and closing shuts, if acceptable continuity; close all shunts, if not acceptable, reject wire and repeat process.
- Acquire detonator(s) and secure under sand bags 25 feet downwind from MDEH and MPPEH ,
- Secure detonator under barricade, electric cap(s) hold lead wires, perform continuity check of un-shunt lead wires, connect legs of lead wires together to form shunt. -

STOP - await UXOSO authorization to proceed with priming.

- Place donor explosives and det cord on or next to MDEH and MPPEH as required by technical publication.
- Secure detonators under barricade, (electric caps) hold lead wires, un-shunt lead wires, individually connect legs of lead wires to blasting circuit wire.
- Isolate each leg of lead wires to ensure bare wire contact is not possible between lead wires, insulate each lead wire at all connections with UL rated electrician tape. Leave detonator(s) under sand bag and 25 feet from MDEH/MPPEH
- Ensure there is continuity between the det cord and detonator booster and the main charge (or det cord and jet-perforator). When ready to use, (cast boosters) place the det cord through the priming slot on main charge, or set the det cord detonator booster in the main charge (follow manufactures MSDS and user instructions for product procured) or (as applicable) secure jet perforator in place for attack on the target and then place det cord through slot on the perforator. Ensure the det cord fits securely to the perforator and tape as required. Extend det cord from target, and secure IAW ESP protective guidance and procedure.
- Request permission from UXOSO to prime charge (If multiple charges are to be primed, only one request to prime is needed).
- Remove electric detonator from barricade and place on det cord connecting explosive charge. Attach the blasting cap(s) to a det cord loop (taped section of det cord with six-inch det cord extending beyond last side by side det cord taped

point) Secure blasting caps to double det cord loop section with electrician tape. Depart area, and notify UXOSO and Demolition Supervisor – that priming is complete.

Initiating the charge:

Note:

For use of Non-el © initiation of main charges, follow manufactures instructions and apply applicable electric firing safety procedures. Remote control electric firing devices are not authorized.

- Electrical Firing:

– - Depart to the firing point and or safe area.

– - Check in with the UXOSO; to obtain accurate personnel head count and request permission to fire.

– - Once permission to fire is received from the UXOSO, three loud "fire in the holes" will be verbally shouted for a 360 degree coverage and one "fire in the hole" will be transmitted over the radio.

– - Use a blasting machine or device initiate the detonation

- Non Electrical Initiation:
  - The UXOSO shall calculate and track the detonation safe separation time for a person to ignite a time fuse set-up and transit to a safe area. For multiple shots, the UXOSO shall ensure that ten minutes of time fuse burning time on number one shot remains after arrival of the person to the safe area. Note: Personnel transit time shall be calculated at a conservative walking pace of two miles per hour from detonation location to safe area.
- All personnel not directly involved with the initiation process will depart to the safe area.
- Ensure all personnel are accounted for and request permission from the UXOSO to prime and fire. (Note: for time fuse priming, follow manufactures instructions – product specific). MDEH and MPPEH will initiate by "Det Cord Loop" connected to main charge, place main charge on or near MDEH/MPPEH as applicable o Technical Manual guidance, and apply engineering controls as specified within ESP.
- Once permission to prime/fire is received from the UXOSO, three loud "fire in the holes" will be verbally shouted for a 360 degree coverage followed by one "fire in the hole" transmitted over the radio.
- The farthest team member will initiate the detonation and transmit over the radio "smoking hole on one, and then two, three as applicable". The UXOSO will document the time for initiation of each burn.
- During multiple detonation operations, the time between detonations will be determined by the UXOSO. The UXOSO will calculate and ensure there is sufficient time (for all detonations) for all team members to safely transit to the designated safe area.

  - Once smoke is observed the Non electric initiation person will proceed to the safe area utilizing the briefed route.
  - Once all detonations have been initiated the UXOSO will be the last team member to depart the detonation area for the safe area ensuring all personnel are accounted for and within a safe area.
- **Post-Detonation**
  - The EZ will be maintained until a misfire or low order detonation is cleared
  - After final detonation initiation a 5-minute wait time will be observed.
  - The UXOSO will conduct a visible survey of the area before giving an "all clear" to proceed back down range.
  - The SUXOS and UXOSO will proceed down range to conduct a detonation verification inspection.

Once the Demolition Supervisor and UXO Technician III have inspected the detonation site and determined that the area is safe to re-enter, the team members will be authorized to proceed back down range.

Following the completion of demolition activities, CH2M HILL will notify the USACE ERM, USACE PM, and Fort Rucker IRP Manager to provide a summary of the demolition activities and outcome.

3.8.12 MEC Data Reporting

The collection of accurate and detailed data is essential to documenting MEC-related discoveries and resulting disposition of MEC for future reference. Digital MEC, MDEH, MDAS tracking forms (in the MRSIMS devices) will be used to list data for each MEC item encountered. The MEC tracking form will be filled out with the following information:

- Unique identity number –Also to be incorporated in photographs of the item (by using a dry erase board, for example)
- Northing and easting coordinates
- Depth to Item —If the item is partially buried, depth to the center of the mass of the item (recorded in inches)
- Orientation — Geographical direction (N, S, E, W) the item is pointing, unless vertical
- Type and Nomenclature— Type of ordnance and nomenclature, as specifically as possible; to also be incorporated in photographs of the item (by using a dry erase board, for example)
- Filler — Type of filler, such as none, inert, high explosive (HE), WP, illumination, incendiary, chemical, or smoke
- Fuze — Type of fuze, such as none, inert, point detonating, powder train, or base detonating

- Date and Time Found — Date when the MEC item was found and approximate time it was found
- Team or Individual —Team number or individual's name that found the MEC item
- Disposal — Disposal status
- Date Disposed — Date when the MEC item was disposed of
- Photo identification (ID) – Photo number(s) from camera or ID number if included in photo
- Comments — Any noteworthy comments.

3.8.13 Certification/Disposal of Scrap Metal

Fort Rucker (the generating activity) will ensure that the quantities of demilitarized property turned in to the Defense Reutilization and Marketing Office (DRMO) are accurate and that these quantities are readily verifiable by the DRMO. The DRMO will not accept any property unless the DD Form 1348-1A contains the demilitarization code or clear text statement of the demilitarization required.

The generating activity, the Fort Rucker IRP, is responsible for issuing a letter specifying who is authorized to sign the DD Form 1348-1A. This letter will be retained in the project files, at the local DRMO, and with the Fort Rucker IRP Manager (as the representative for the generating facility). It will be updated as needed.

All material generated from the firing and/or demilitarization of munitions will be rendered free from explosives before being referred to the DRMO for sale. All scrap metal generated at the site will be disposed of through the local DRMO or, when appropriate and approved, to a local scrap metal dealer, and will be transferred using DD Form 1348-1A. Prior to release of the material, the SUXOS and UXOSO will inspect the material in the containers to ensure that they are free of dangerous items. Final disposition of scrap metal will be determined by the CH2M HILL PM at the conclusion of the project. DD Form 1348-1A will be used as 100 percent inspection/100 percent re-inspection documentation. All DD Form 1348-1A documentation will clearly show the following information in typed or printed letters:

- Name of SUXOS and the government representative (or designee)
- Organization
- Two signatures not in the same chain of command (i.e., SUXOS and the UXOSO, SUXOS and a government representative)
- Contractor's office
- Field office phone number(s) of the persons certifying and verifying the MDAS
- Basic material content (type of metal [e.g., steel, mixed])
- Estimated weight
- Unique identification of each sealed container

- Location where MDAS was obtained
- Seal identification, if different from the unique identification of the sealed container

The certification will be verified (countersigned) by a technically qualified U.S. Government representative (U.S. citizen) performing the 100% reinspection of the material as designated by the responsible commander/generating activity (the Fort Rucker IRP Manager). CH2M HILL will coordinate with the Fort Rucker IRP Manager, USAEC, and USACE to maintain the chain of custody and final disposition of the certified and verified materials. The certified and verified materials will be released only to an organization that will comply with EM 1110-1-4009, Chapter 14-3(a) (1 and 2). If the chain of custody is broken, the affected MPPEH will undergo a second 100 percent inspection, a second 100 percent re-inspection, and be documented to verify its explosive safety status (identified as either MD or other debris).

Scrap will be segregated into like metals (mainly steel, aluminum, and mixed metal) and placed into palletized wooden shipping boxes. Each item placed into the box will be inspected. The boxes will be filled, the covers will be nailed on, and a lead seal will be affixed. The signed DD Form 1348-1A will accompany each box.

3.8.14 Containerization, Characterization, and Transportation and Disposal of Contaminated Material

Recovered visible residual materials and/or affected soil and any generated decontamination wastes will be containerized in 55-gallon drums and sampled and characterized in accordance with the FSP (**Appendix E, Part I).** The material will be documented as MEC/MPPEH and/or MDAS, and will be managed, transported, and disposed of in accordance with the ESP and the Waste Management Plan under chain-of-custody control **(Appendix E, Part I).**

3.8.15 Unintentional Detonation

These emergency procedures provide a plan in the event of an explosive emergency and provide procedures to be followed to limit the extent of injury and damage until qualified professionals can arrive to provide assistance. After an explosion occurs, additional explosions may occur. Therefore, the response to unintentional detonations should involve a minimal number of personnel. Emergency steps are as follows:

- Contact emergency services
- Minimal number of personnel (one person if possible) provides first aid
- Additional personnel withdraw to safe rally point
- One MEC-qualified person meets first responders and escorts them to the explosion site

3.9 MC Delineation

Although the results of the 2005 SI indicated that there were no preliminary remediation goal exceedances for MC in sampled soils, this RFI conservatively includes soil sampling. At the Anti-Tank/Rocket Grenade Range MRS and the Infiltration/Grenade Range MRS, soil sampling will consist of: 1) (pre- and post-BIP samples),and if MEC/, MPPEH, or MD items are found grouped together. These samples will be analyzed for explosives using U.S.

Environmental Protection Agency (USEPA) Method SW8330A and for select metals (arsenic, cadmium, chromium, lead, mercury, and selenium) using USEPA Method SW6010B/7000.

At the .22-Caliber Target Butt MMRP site, the instrument-assisted site walkabout will be used as the basis for soil sampling. If observations of small arms ammunition or other munitions items are made, discrete soil samples will be collected at those locations. If no observations of small arms ammunitions or other munitions are made, no soil samples will be collected. Collected soil samples will be sent to the laboratory for analysis of select metals (lead, antimony, copper, and zinc) using USEPA Method 6010B.

The nature and extent of MC contamination at the MMRP sites will be based on exceedance of laboratory reporting limits for explosives and selected metals. As described in the QAPP **(Appendix E, Part II),** screening values were not available in the ADEM Risk-Based Corrective Action Guidance Manual (ADEM, 2008) or USEPA's Regional Screening Levels**.** If exceedances are reported, the results will be presented to the project team and the extent of additional sampling (the number of samples, and the step out horizontally and vertically) will be determined.

3.10 Site Restoration and Demobilization

3.10.1 Site Restoration

Damage caused by equipment or other site activities (e.g., deep ruts) will be repaired and revegetated as necessary to prevent erosion.

3.10.2 Demobilization

Full demobilization will occur when the project is completed and appropriate QA/QC checks have been performed. The following activities will occur before demobilization takes place:

- Confirmation that DGM is complete
- Review of chain-of-custody records to ensure that all field and QC samples were collected as planned and were submitted for appropriate analyses
- Verification of adequate site restoration
- Inspection, packaging, and shipment of all field equipment to the appropriate location

3.11 Data Management

Before mobilization to the site, the CH2M HILL PM and QC Geophysicist will verify that appropriate measures are in place to manage and control project data. Project data include MEC/MD data, surveying data, DGM mapping data, and analytical data. All data will be cross-referenced in the GIS database and the CSM.

The data warehouse is a Microsoft SQL Server 2005 relational database. This database has a data structure designed to achieve compliance with the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE). SDSFIE provides effective, comprehensive standards for environmental data management.

Field and laboratory data are merged into a format that is amenable to the data warehouse. The data warehouse will contain valid coordinate information for each data point. The project will utilize ESRI's suite of GIS software for the majority of GIS-related tasks. The GIS data model will consist of one or more geodatabases. All data points will be pulled directly from the data warehouse and stored in the geodatabase as a data table. This way all data from the data warehouse is cross-referenced in the geodatabase.

3.11.1 MRSIMS

The entire MR project process, documentation, and QC will be strictly controlled through the use of MRSIMS. MRSIMS is a "cradle-to-grave" data management system designed to track and query all data for MR projects. MRSIMS digitally captures, tracks, and creates automated reports on:

- Project information, such as personnel, teams, instrument serial numbers, and transect IDs and locations
- Field management notes, such as safety meetings, logbooks, and field requests to management
- DGM and MEC Team notes, such as transects, files, personnel, methods, instruments, GPS coordinates, and descriptions of items found
- DGM data processing notes and delivery data, such as file names, processing performed, QC of data, and delivery dates
- Transect status, such as activities performed by transect and by area, and percents and quantities complete or remaining
- Demolition tracking
- QC, such as QC on notes, processing, data, and comparison of DGM results to intrusive results and field activities

Field operations data will be captured using handheld devices running mobile forms-based software. The data will be transferred daily to a centralized relational database, where they will then be validated (QC checks). Data elements will not be allowed to progress to the next stage of the process until appropriate QC is performed, digitally "signed," and dated as checked. A hard copy is provided to ERRG and CH2M HILL's UXOQCS for review and signatory approval after download from the handheld devices. The hard copy is retained in the project files. The data delivery report cannot be created in the system until the QC Geophysicist has approved the data and the associated documentation.

3.11.2 EM61-MK2 Data

EM61-MK2 data will be temporarily stored in an instrument data logger and then downloaded into a laptop computer for further onsite processing. Initial data processing will be performed by the field team and will include reviewing data for integrity and repeatability. Data will then be uploaded to a project file transfer protocol site for download and processing and interpretation by MEC-experienced data processing geophysicists. EM61-MK2 data must be reviewed and approved by the QC Geophysicist, or designee. All data will be archived on DVD-ROM or hard drives and provided for the Administrative Record as part of the RFI Report.

3.11.3 Project Repository and Administrative Record

The project repository will be maintained and updated monthly (both hard copy and electronic) for the length of the project. Final electronic files will be in text-searchable Adobe® portable document format (PDF) format and will be accompanied by the metadata for upload into the Repository of Environmental Army Documents. If required, the COR will be provided the data and documentation necessary for each MMRP site in the Army Environmental Database-Restoration Module. In addition, analytical data generated will be uploaded into the Environmental Restoration Information System on a quarterly basis.

3.12 Geospatial Information and Electronic Submittals

This subsection describes the methods, equipment, and accuracy requirements for conducting location surveys and mapping and the subsequent development of GIS databases to support the mapping and document production process. All geospatial data will conform to the Computer-Aided Drafting and GIS Technology Center SDSFIE and will be provided in metric units.

3.12.1 Survey Accuracy

Horizontal and vertical control of Class I, Third Order or better will be established for the network of monuments. Horizontal control will be based on the metric system and referenced to the North American Datum of 1983 (NAD83) and the Universal Transverse Mercator (UTM) grid system.

All newly established control points will be permanent, to allow for future recoverability. All control points will be established using iron or steel pins, concrete monuments, or other permanent construction method.

A PLS licensed in the State of Alabama will certify all survey data. The PLS will use either RTK GPS or conventional geodetic survey instruments to collect or emplace points. Upon completion of the field work, the easting and northing (*x,y*) for all control points, grid corners, transect points, boundaries, and sampling locations will be presented in a certified letter or drawing, along with an electronic submittal of the same.

Handheld GPS devices with accuracies of 1 to 3 meters may also be used to determine horizontal coordinates for points, such as sampling locations or site boundaries.

3.12.2 Geographic Information System Incorporation

Spatial data created for the project will be provided in Environmental Systems Research Institute, Inc. (ESRI)–compliant formats (shapefiles, coverages, or geodatabases). Supporting tabular data will be provided in Microsoft Excel format, Microsoft Access format, or both, as needed.

3.12.3 Plotting

All of the control points recovered and/or established at the site will be plotted at the appropriate coordinate points on reproducible electronic media for production of planimetric or topographic maps at scales appropriate for the parcel size being described.

3.12.4 Mapping

The location, identification, coordinates, and elevations of all control points that are recovered and/or established at the site will be plotted on one or more site maps. Each control point will be identified on the map by its name and number and the final adjusted coordinates.

Each map will include a legend showing the standard symbols used for the mapping, a north arrow, and a title block.

3.12.5 Digital Data

Location information will be collected as part of the DGM survey and will be sufficient to accurately relocate the position of DGM anomalies in the field and accurately plot the position of each anomaly in the GIS.

3.12.6 Computer Files and Digital Data Sets

All final document files, including reports, figures, tables, and appendices will be submitted in electronic format. These files will be compatible with Microsoft Office 97 or later formats or will be submitted in PDF format; all files will be submitted on CD or DVD.

All final GIS data generated will be submitted in nonproprietary Spatial Data Transfer Standard (SDTS) format at the completion of the project, as well as in ESRI–compliant format. All data will conform to the Spatial Data Standards for Facilities, Infrastructure, and Environment and will be provided on CD or DVD.

3.13 Investigation Derived Waste (IDW) Plan

Although the waste generated during the field activities is assumed to be nonhazardous, all containerized waste will be handled as hazardous waste until analytical results of characterization sampling indicate that the waste is nonhazardous. Exceptions to this practice include containers identified and labeled as "non-regulated waste", such as MDAS, cultural debris, and uncontaminated trash. The IDW expected to be generated during the field activities includes the following:

- Used personal protective equipment (PPE) and disposable sampling equipment
- Decontamination fluids
- General trash (uncontaminated)
- Empty containers

Details regarding IDW handling and management, and IDW characterization, are presented in the FSP **(Appendix E, Part I).**

3.14 Risk Characterization and Analysis

The RFI will provide data necessary to identify the need for and scope of appropriate MEC removal actions and to complete a MEC risk analysis for the sites. Detected concentrations of MC will be compared against soil background values for metals (if available) and human health and ecological risk screening levels to assess if there is a potential for impact to human health or ecological receptors at each MRS. If a site has detected levels above screening levels, additional human health and ecological risk assessments will be conducted. The risk assessment methodology is detailed in **Attachment 3-5** (Risk Assessment Protocol).

3.15 Analysis of Land Use Controls

The RFI will provide data necessary to identify the need for and scope of appropriate land use controls for the sites. The analysis of land use controls will be conducted as part of the CMS phase of the RFI.

3.16 Preparation of the Five-Year Review Plan

Fort Rucker is currently conducting installation-wide remedy reviews every 5 years, with the next scheduled review in 2014. By 2014, each of the MMRP sites discussed in this Work Plan will be managed on a consolidated schedule with the other sites managed at the installation. The 5-year remedy review in 2014 will evaluate the implementation and performance of the remedies to determine the extent to which the remedies are or will be protective of human health and the environment. Evaluation of the remedies and the determination of protectiveness, determined through a risk assessment or through the Alabama Risk-Based Corrective Action Guidance, will be based on and sufficiently supported by data and observations.

Section 4. Quality Control Plan

4.1 Introduction

This QCP describes the QC approach and procedures to be used for this project. The requirements and systems established in this QCP are relevant and applicable to project work performed by CH2M HILL and its subcontractors. Refer to the GIP, presented in **Attachment 3-1**, for DGM systems QC. The QAPP is included as Part II of the MC SAP **(Appendix E).**

4.2 Project Organization and Responsibilities

This section identifies key project team members, lists the QA/QC responsibilities associated with each position, and describes communication procedures that will be followed throughout the project.

4.2.1 Project Team Members

The organizational structure and responsibilities of the project team are designed to provide QA/QC for the project. The major positions are described in the following paragraphs.

4.2.1.1 Project Manager (PM)

The CH2M HILL PM for this project is Mark Sherrill. He is responsible for overall project activities, including cost control, schedule control, and technical quality. In addition, the CH2M HILL PM develops the Work Plan and monitors task order activities to ensure compliance with project objectives and scope.

The CH2M HILL PM has ultimate responsibility within the project team for producing deliverables that are technically adequate, satisfactory to the client, and cost-effective. To accomplish this, the CH2M HILL PM develops an internal project review schedule, provides written instructions and frequent guidance to the project team, and monitors budgets and schedules. The CH2M HILL PM will work with the project team to complete the selection of an internal QA/QC review team, to coordinate review efforts, to address review comments, and to adjudicate technical issues.

4.2.1.2 Senior MR Technical Consultant

The Senior MR Technical Consultant for this project is Kevin Lombardo. This position is a company-wide resource with significant experience in the various technical aspects involved in a complex project. The Senior MR Technical Consultant is responsible for the following:

- Evaluating the technical merit of the work planning documents before field activities begin, and reviewing all deliverables before submittal
- Assisting the CH2M HILL PM in coordinating review efforts, addressing review comments, and resolving technical issues

4.2.1.3 Corporate MR Safety and QC Officer

The Corporate MR Safety and QC Officer for this project is George DeMetropolis. The Corporate MR Safety and QC Officer's responsibilities include, but are not limited to, the following:

- Reviewing and approving the qualifications of the proposed MEC operations staff and MEC services subcontractors
- Ensuring that the required MEC safety records are generated and retained as prescribed in this QCP
- Performing MEC QC audits and surveillance as needed
- Ensuring that the responsibilities specific to MR operations are performed by the UXO Technicians

The Corporate MR Safety and QC Officer will coordinate with the CH2M HILL PM and the SUXOS\SM and has authority to enforce the MEC procedures defined in this QCP. The Corporate MR Safety and QC Officer, along with all onsite UXO Technicians, has the authority to stop work to ensure that project activities comply with MEC-related specifications of this QCP, the contract, and the project. This authority applies equally to all project activities, whether performed by CH2M HILL or its subcontractors.

4.2.1.4 SUXOS/SM

The SUXOS/SM for this project is Chris Rose. The SUXOS/SM responsibilities include, but are not limited to, the following:

- Overseeing the execution of all onsite activities. The SUXOS/SM will be responsible for overseeing scheduling of UXO personnel and ensuring that surface clearance activities are performed in accordance with the specified plans.
- Coordinating all aspects of S&H related to MEC and coordinating with the UXOSO to promote the health and safety of site personnel

4.2.1.5 UXOQCS/UXOSO

The UXOQCS/UXOSO for this project is Cliff Walden. The UXOQCS/UXOSO responsibilities include, but are not limited to, the following:

- Implementing the MEC-related provisions of this QCP
- Conducting QC inspections of all MEC-related operations for compliance with established procedures
- Directing and approving all corrective actions to ensure that all MEC-related work complies with contractual requirements. The UXOQCS will have a direct line of communication with the CH2M HILL PM, Senior MR Technical Consultant, and Corporate MR Safety and QC Officer.
- Implementing the APP/SSHP, including the MEC-related and general safety components

The UXOQCS/UXOSO will verify compliance with applicable S&H requirements and will report independently of project management to the CH2M HILL Corporate MR Safety and QC Officer. The UXOQCS/UXOSO will implement the approved safety programs in compliance with all applicable requirements, whether DoD, other federal, state, or local; analyze operational risks, hazards, and safety requirements; enforce personnel limits and safety EZs for MEC intrusive operations; and conduct safety inspections to ensure compliance with safety codes.

4.2.1.6 Health and Safety Manager (HSM)

The HSM for this project is Mike Goldman. The HSM is responsible for:

- Reviewing and approving the APP/SSHP as well as subcontractor AHAs.
- Acting as the POC for the UXOSO for any health- or safety-related issues
- Conducting project audits
- Investigating any accidents that occur during the project

4.2.2 Project Communication

During the field investigation, the field teams will meet daily to review the status of the project and to discuss technical and safety issues. When necessary, other meetings will be scheduled, or the SUXOS\SM will meet individually with field personnel or the subcontractors to resolve problems. During the field effort, the SM will prepare a weekly report detailing project progress.

During the field effort, the SUXOS/SM will be in regular telephone or face-to-face contact with the project team. When significant problems or issues requiring additional authority occur, the SUXOS/SM can immediately contact the CH2M HILL PM for assistance.

4.3 Definable Features of Work (DFOW) and Three-Phase Control Process

MEC-related QC will be monitored through the DFOW using a three-phase control process.

4.3.1 Definable Features of Work

The MEC-related DFOWs for this project are as follows:

- Planning/Premobilization Activities
- Mobilization/site preparation
- Transect survey
- Vegetation clearing
- Surface clearance
- DGM
- Instrument-assisted walkabout
- Intrusive Investigation

- Management of MPPEH/MDEH/MDAS, including inspection, demilitarization, certification, verification, and disposition
- Demobilization
- Report Preparation and Approval

4.3.2 Three Phases of Control

4.3.2.1 Overview

The UXOQCS/UXOSO is responsible for ensuring that the three-phase control process, consisting of the Preparatory Phase, the Initial Phase, and the Follow-up Phase, is implemented for the MEC-related DFOW listed in this QCP, regardless of whether it is performed by CH2M HILL or its subcontractors. Each control phase is important for obtaining a quality product and meeting the project objectives; however, the Preparatory and Initial Phases are particularly valuable in preventing problems. Production work is not to be performed on DFOW until successful Preparatory and Initial Phases have been completed.

4.3.2.1.1 Preparatory Phase

The Preparatory Phase begins with the planning and design process and leads to actual field activities. Successful completion of the Preparatory Phase verifies that the project delivery, QC, and safety plans have been completed. The following actions will be performed as applicable for each DFOW:

- Confirm that the appropriate technical procedures are incorporated into the project Work Plan and review procedures.
- Confirm that adequate testing is called for to ensure quality delivery.
- Confirm definition of preliminary work required at the work site and examine the work area to confirm that required preliminary work has been properly completed.
- Confirm availability of required materials and equipment.
- Examine materials and equipment to confirm compliance with approved submittals and procedures.
- Ensure that equipment testing procedures are in place, with control limits and frequency, for each piece of equipment.
- Confirm the qualifications/training of personnel and verify that roles/responsibilities are well-defined and communicated.
- Confirm with the UXOSO that the site APP/SSHP adequately addresses the work operations and that applicable safety requirements have been incorporated into the APP/SSHP.
- Discuss methods to be used during the field activities.
- Confirm that any required permits and other regulatory requirements are met.

- Verify that lessons learned during previous similar work have been incorporated as appropriate into the project procedures to prevent recurrence of past problems.

Project personnel must correct or resolve discrepancies between existing conditions and the approved plans/procedures identified by the CH2M HILL PM, SUXOS/SM, and other team members during the Preparatory Phase. The CH2M HILL PM or designee must verify that unsatisfactory and nonconforming conditions have been corrected before authorizing work to begin. Results of these activities will be documented in a DFOW-specific Preparatory Phase Inspection Checklist and summarized in the daily QC report.

4.3.2.2 Initial Phase

The Initial Phase occurs at the startup of field activities associated with a specific DFOW. The Initial Phase confirms that this QCP, other applicable Work Plan sections, and procedures are being effectively implemented and the desired results are being achieved.

During the Initial Phase, the first segment of the DFOW is observed and inspected to ensure that the work complies with contract and Work Plan requirements. The Initial Phase will be repeated if acceptable levels of specified quality are not achieved. The following actions will be performed for each DFOW:

- Establish the quality of work required to properly deliver the project in accordance with contractual requirements. The SUXOS/SM will ensure that the field teams are aware of expectations associated with the field methods established during the Preparatory Phase by observing the initial work activities and interacting with the CH2M HILL PM, SUXOS/SM, and responsible subcontractors' supervisors.
- Resolve conflicts. The UXOQCS will provide guidance to the CH2M HILL PM and responsible supervisor(s) in resolving conflicts. Should conflicts arise in establishing the baseline quality for the DFOW, the responsibility to resolve the conflict rests with the CH2M HILL PM. Should the conflict not be resolved in a manner that satisfies the project requirements, the UXOQCS, and/or the Corporate MR Safety/QC Manager must elevate the conflict to the corporate level and issue a nonconformance report. The UXOQCS may issue a stop work order when a nonconformance to a DFOW is observed. The UXOQCS will determine whether retraining of personnel, adjustments of equipment and/or plans and procedures, etc., are necessary.
- Verify APP/SSHP development. The UXOSO will verify that the site APP/SSHP was developed to ensure that the AHAs adequately address field conditions and potential hazards. The UXOQCS will confirm that applicable safety requirements are being implemented during field activities.

Upon completion of Initial Phase activities, the results will be documented in the Initial Phase Inspection Checklist **(Appendix F)** and the QC logbook and summarized in the daily QC report. Should results be unsatisfactory, the Initial Phase will be rescheduled and performed again.

4.3.2.3 Follow-up Phase

Completion of the Initial Phase of QC activity leads directly into the Follow-up Phase, which addresses the routine day-to-day activities at the site. Specific concerns associated with the Follow-up Phase include:

- Inspection of the work to ensure that it complies with the contract and Work Plan requirements
- Evaluation of the work and confirmation that quality is being maintained at least at the level established during the Initial Phase
- Evaluation and confirmation that required testing is being performed in accordance with procedures established during the Preparatory Phase and confirmed during the Initial Phase
- Confirmation that nonconforming work is being corrected promptly and in accordance with the direction provided by the UXOQCS. Nonconformance to project requirements will result in reperformance to meet project requirements.

To conduct and document these inspections, the UXOQCS will generate the Follow-up Phase Inspection Checklist **(Appendix F).** The Follow-up Phase inspections will be performed daily or as otherwise identified in this QCP until the completion of each DFOW.

The UXOQCS is responsible for onsite monitoring of the practices and operations taking place and verifying continued compliance with the specifications and requirements of the contract and approved project plans and procedures. The UXOQCS is also responsible for verifying that a daily S&H inspection is performed and documented as prescribed in the APP/SSHP **(Appendix D).** Discrepancies between site practices and approved plans and procedures will be resolved and corrective actions for unsatisfactory and nonconforming conditions or practices will be verified by the UXOQCS or a designee prior to authorizing work to continue. Follow-up Phase inspection results will be documented in the QC logbook and summarized in the daily QC report.

4.3.2.4 Anomaly Removal Verification

Once the source of an anomaly is removed, the hole will be checked by the MEC team with an EM61-MK2 for additional masked anomalies from the primary contact. The depth of the excavation will be decided based no further detection of an anomaly. If 15 percent of the anomaly investigations yield no contact with a metallic item, a root cause analysis will be performed by the CH2M HILL Project Geophysicist to determine if this is acceptable. (Often, when selecting anomalies with amplitudes just above background noise there can be a high “false positive” rate, which can be acceptable when using a conservative anomaly selection approach.)

Should large amounts of non-munitions related debris be encountered in a single anomaly location without any evidence of munitions, anomaly investigation at the location may be terminated. In this instance, the approval of the UXOQCS and the QC Geophysicist will be required to verify that the items discovered were appropriate for the initial anomaly amplitude. The results of the investigation will be documented.

4.3.2.5 QC Inspection during Intrusive Investigations

The following procedure will be followed for QC inspections during the intrusive investigations:

- After the dig team intrusively investigates an anomaly location, the hole will be left open to the depth investigated and a PVC flag will be placed in the hole and bent after the investigation is completed.
- The UXOQCS will inspect at least 10 percent of the intrusively investigated anomaly locations using an EM61-MK2 to determine whether all detectable metallic items within a 1-meter radius of the hole have been removed. The inspection will be at random but spatially distributed locations.
- All holes related to intrusive investigations will be filled back to original grade after QC/QA is complete. Open holes will covered before the team departs the project site each day.
- Blind seed locations will be compared against selected targets to ensure 100% selection of blind seed locations; failure to achieve 100% selection of blind seed locations will result in root cause analysis and re-inspection of geophysical raw data**.**
- Additional QC analysis of intrusive investigation results versus original amplitude of DGM anomalies will be performed by the CH2M HILL Project Geophysicist. This will include a qualitative review of the intrusive results against the original amplitude to determine, using professional judgment, whether a significant mismatch exists (i.e. the discovered source could not have created an anomaly of the amplitude recorded.) Anomaly locations where reinvestigation is found to be required through this process will be tracked in MRSIMS (see **Section 3.11.1**) and reinspected.

If the UXOQCS determines that inspection results require a change in intrusive team procedures or reperformance of any work, EERG will provide documentation of corrective actions to the CH2M HILL Project Geophysicist; likewise if the CH2M HILL Project Geophysicist requires reinvestigation, EERG will provide documentation of corrective actions to the CH2M HILL Project Geophysicist.

4.3.2.6 Additional Audits

Additional audits performed on the same DFOW may be required at the discretion of the UXOQCS. Additional preparatory and initial audits are generally warranted under any of the following conditions: unsatisfactory work, changes in key personnel, resumption of work after a substantial period of inactivity (for example, 2 weeks or more), or changes to the project scope of work/specifications.

4.3.2.7 Final Acceptance Audit

Upon conclusion of the DFOW and before closeout, the Final Acceptance Inspection will be performed to verify that project requirements have been met. Outstanding and nonconforming items will be documented on the Final Inspection Checklist **(Appendix F).**

Resolution of each item will be noted on the checklist. Contractor acceptance and closeout of each DFOW is a prerequisite to project closeout.

4.4 Audit Procedures

The UXOQCS is responsible for verifying compliance with this QCP through audits and surveillance. The UXOQCS will inspect/audit the quality of work being performed for each DFOW. The UXOQCS will verify that procedures conform to applicable specifications in this Work Plan or other applicable guidance. MRSIMS will be used for documenting QC processes related to DGM and intrusive investigation, as described in Section 3.11.1. Identified deficiencies will be communicated to the responsible individual and documented in the QC logbook and daily QC report. Corrective actions will be verified by the UXOQCS and recorded in the daily QC report.

Corporate safety and QC audits will be scheduled for 2 weeks after the project starts and then for every 30 days the project continues in the field.

The Inspection Schedule and Tracking Form **(Appendix F)** will be used by the UXOQCS for planning, scheduling, and tracking the progress of audits for this project. The information on the form will be kept up to date and reviewed by the UXOQCS for planning purposes. Audit activities and corrective actions will be documented by the UXOQCS in accordance with this QCP. Audit records will be maintained as part of the project QC file. The UXOQCS will document other QC activities in the QC logbook, daily QC report, and MRSIMS.

Detailed QC procedures for DGM activities are outlined in the GIP (**Attachment 3-1)**. The QC performed for the DGM activities will be tracked in MRSIMS and will be audited by the QC Geophysicist or designee.

DFOW responsibilities and procedures are listed in **Table 4-1**.

TABLE 4-1
Definable Features of Work Auditing Procedures and Responsibilities
MEC RFI, Fort Rucker, Alabama

Definable Feature of Work with Auditable Function	Responsible Person(s)[1]	Audit Procedure	WP Reference	QC Phase[2]	Freq. of Audit[3]	Pass/Fail Criteria	Action if Failure Occurs
Planning							
Planning/Premobilization Activities-GIS Setup	Project GIS Manager	Verify GIS system has been set up and is ready for site data	3.12	PP	O	GIS system has been set up and is ready for site data	Do not proceed with field activities until criterion is passed
Planning/Premobilization Activities-Document management and control	CH2M HILL PM	Verify appropriate measures are in place to manage and control project documents	4.6.1	PP	O	Appropriate measures are in place to manage and control project documents	Do not proceed with field activities until criterion is passed
Planning/Premobilization Activities-Data Management	CH2M HILL PM, QC Geophysicist	Verify appropriate measures are in place to manage and control project data	3.10	PP	O	Appropriate measures are in place to manage and control project data	Do not proceed with field activities until criterion is passed
Planning/Premobilization Activities-Subcontracting	CH2M HILL PM, UXOQCS	Verify subcontractor qualifications, training, and licenses	4.7.1	PP/IP	O	Subcontractor qualifications, training, and licenses are up to date and acceptable	Ensure subcontractor provides the qualifications, training, and licenses or change subcontractor
Planning/Premobilization Activities-Technical and Operational approaches	CH2M HILL PM	Verify technical and operational approaches have been agreed on by the project team		PP/IP	O	Technical and operational approaches have been agreed on by project team and incorporated into the Work Plan	Do not proceed with field activities until criterion is passed
Planning/Premobilization Activities-GSV Plan preparation and approval	CH2M HILL PM	Verify GSV Plan has been prepared and approved		PP/IP	O	GSV Plan has been approved	Do not proceed with field activities until criterion is passed
Planning/Premobilization Activities-Work Plan	CH2M HILL PM	Verify Work Plan has been prepared and approved		PP/IP	O	Work Plan has been approved	Do not proceed with field activities (excluding site mobilization) until criterion is passed
Planning/Premobilization Activities-Staffing	CH2M HILL PM	Verify personnel qualifications	3.2, Appendix D	PP/IP	O	Personnel qualifications and training are up to date and acceptable	Do not mobilize field personnel until qualifications and training requirements are established
Field Operations							
Mobilization/Site Preparation	UXOQCS	Verify local agencies are coordinated	Appendix D	PP/IP	O	Local agencies are coordinated	Do not proceed with field activities until criterion is passed
Mobilization/Site Preparation	UXOQCS	Verify equipment has been inspected and tested	3.8.9.3	PP/IP	E	Equipment passes inspection and testing	Proceed only with activities for which equipment has passed inspection and testing
Mobilization/Site Preparation	UXOQCS	Verify communications and other logistical support are coordinated	Appendix D	PP/IP	O	Communications and other logistical support are coordinated	Do not proceed with field activities until criterion is passed
Mobilization/Site Preparation	UXOQCS	Verify emergency services have been coordinated	Appendix D	PP/IP	O	Emergency services are coordinated	Do not proceed with field activities until criterion is passed
Mobilization/Site Preparation	UXOQCS	Verify site-specific training is performed and acknowledged	Appendix D	PP/IP	O	Site-specific training is performed and acknowledged	Do not proceed with field activities until criterion is passed
Mobilization/Site Preparation	UXOQCS	Verify QC seed locations have been planned and IVS installed according to Attachment 3-2,	3.81	PP/IP	O	QC Seed location planned, IVS properly installed	Do not proceed with field activities until criterion is passed
Mobilization/Site Preparation	UXOQCS	Verify the extent of areas of vegetation removal and transect surveys have been marked by CH2M HILL using GPS at each MRS	3.8.3	PP/IP	O	Boundaries of vegetation removal and transect surveys have been clearly marked with flagging at least every 20m unless clear boundaries such as roadways exist	Do not proceed with vegetation clearance until criterion is passed
Vegetation Clearing	SM	Verify environmental controls are correct and functional	6.8	IP/FP	O	Environmental controls are correct and functional	Ensure that appropriate environmental controls are in place prior to proceeding with vegetation removal
Vegetation Clearing	SM, UXOQCS	Verify vegetation removal is conducted in accordance with (IAW) Work Plan	3.8.4	FP	D	Vegetation removal is conducted IAW Work Plan	Stop vegetation removal activities until full compliance can be assured and any activities not performed in compliance are re-evaluated and re-performed if necessary
Transect Survey	SM	Verify benchmarks for survey have been established and documented	3.8.6	PP/IP	O	Benchmarks for survey have been established and documented	Ensure benchmarks for survey are established and documented prior to performing survey
Transect Survey	SM	Verify site boundaries and transects have been established	3.8.6, 3.11	PP/IP	O	Site boundaries and transects have been established	Do not proceed with dependent field activities until criterion is passed
Transect Survey	SM	Verify surveyor notes are legible, accurate, and complete	3.8.6, 3.11	IP	O	Surveyor notes are legible, accurate, and complete	Ensure surveyor replaces deficient notes with legible, accurate, and complete notes
Vegetation Clearing	SM	Verify personnel qualifications and training	Appendix D	PP/IP	O	Personnel qualifications and training are appropriate	Ensure subcontractor provides appropriately trained and qualified personnel or replace with properly trained and qualified personnel
Surface Clearance	UXOQCS	Verify equipment tested IAW QCP	3.8.5	IP/FP	D	Equipment testing performed and tests passed	Repair or replace equipment
Surface Clearance	UXOQCS	Verify team separation distance is as established in Work Plan	Attachment 3-4	IP/FP	D	Team separation distance is appropriate for work being performed	Stop activities until appropriate separation distance is established

TABLE 4-1
Definable Features of Work Auditing Procedures and Responsibilities
MEC RFI, Fort Rucker, Alabama

Definable Feature of Work with Auditable Function	Responsible Person(s)[1]	Audit Procedure	WP Reference	QC Phase[2]	Freq. of Audit[3]	Pass/Fail Criteria	Action if Failure Occurs
DGM	QC Geophysicist	Verify DQOs established in GSV Plan have been achieved	Attachment 3-2	PP/IP	O	DQOs identified in GSV Plan have been achieved using the IVS	Continue with IVS until DQOs are achieved
DGM	QC Geophysicist	Verify DGM survey conducted IAW GIP and GSV Plan	Attachment 3-1 and 3-2	IP/FP	O/D	DGM survey conducted IAW GIP and GSV Plan	Stop activity until full compliance can be assured and any activities not performed in compliance are re-evaluated and reperformed if necessary
DGM	QC Geophysicist	Check results of QC tests performed as specified in GIP	Attachment 3-1	FP	E	QC tests must pass IAW standards determined during the GSV and referenced SOPs.	A root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action
DGM	QC Geophysicist	Confirm that DGM survey DQOs are being met	Table 3-2	FP	E	DGM survey DQOs are being met	A root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action
DGM	QC Geophysicist	Verify data checks specified in GIP and GSV Plan are used in data processing	Attachment 3-1 and 3-2	FP	E	Data checks must pass in accordance with standards determined during the IVS and referenced SOPs	A root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action
Instrument-assisted Walkabout	UXOQCS	Verify equipment is tested IAW the Work Plan	3.8.8	IP/FP	D	Equipment testing performed and tests passed	Repair or replace instrument
Instrument-assisted Walkabout	UXOQCS	Verify survey conducted IAW the Work Plan	3.8.8	IP/FP	D	Equipment testing performed and tests passed; evidence of a berm, small arms ammunition, or other munitions is used to choose sample locations.	Stop activity until full compliance can be assured and any activities not performed in compliance are re-evaluated and re-performed if necessary
Instrument-assisted Walkabout	SM	If small arms ammunition or other munitions are observed, verify that biased soil and QA/QC samples were collected in accordance with the MC SAP	Appendix E	IP/FP	E	Soil and associated QA/QC samples are collected and submitted for laboratory analysis where small arms ammunition or other munitions are observed.	Complete sampling, as required.
Intrusive Investigation	UXOQCS	Verify Ft. Rucker Directorate of Plans, Training, Mobilization, and Security Airspace has been contacted; also the Directorate of Family and Morale, Welfare and Recreation, the Fort Rucker Golf Course, and the Fort Rucker Equestrian Center, as applicable	3.8.9	PP	O	Notice to Airmen must be posted prior to intrusive operations, Other site users must also be contacted.	Stop activity until full compliance can be assured
Intrusive Investigation	UXOQCS	Verify equipment is tested IAW the Work Plan	3.8.9.3	IP/FP	D	Equipment testing performed and tests passed	Repair or replace instrument
Intrusive Investigation	UXOQCS	Verify team separation distance is as established in the Work Plan	Attachment 3-4	IP/FP	D	Team separation distance is appropriate for work being performed	Stop activities until appropriate separation distance is established
Intrusive Investigation	Project Geophysicist	Verify the Estimating a Proportion statistical method has been used to select a statistically significant portion of anomalies for investigation over a area of homogenous anomaly density	3.4, 3.8.9.1	IP/FP	E	Areas of homogenous anomaly density are established using DGM data and the estimating a proportion statistical method has been applied to each area for anomaly selection	If densities of anomalies representing potential subsurface MEC are heterogeneous over an area within a MRS, transects will be divided by density contours and the estimating a proportion statistical method must be applied over a homogenous subarea before intrusive investigation in that area can proceed.
Intrusive Investigation	UXOQCS	During reacquisition, confirm that anomalies are located within a 1-m radius of the flagged location as selected by DGM	4.3.2.5	IP/FP	E	Anomaly located within 1-m radius of flag	If anomalies are being located beyond a 1-m radius of flag or are not being located within a 1-m radius of flag, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action
Intrusive Investigation	UXOQCS	Confirm that all detectable metallic objects within a 1-m radius of intrusively investigations have been removed for at least 10% of the intrusively investigated anomaly locations	4.3.2.5	IP/FP	D	All detectable metallic items have been removed for 10% of the intrusively investigated anomaly locations	If detectable metallic items remain, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action
Intrusive Investigation	Project Geophysicist	Verify that any source of an anomaly recovered during intrusive excavations is appropriate to the amplitude of the initial anomaly detected during the DGM	4.3.2.5	IP/FP	D	Recovered anomaly is appropriate to the amplitude of the initial anomaly detected during the DGM	Return to the location of the anomaly excavation to determine if additional anomalies are present. If anomalies being recovered continue to be inappropriate for the amplitude as detected during the DGM, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action
Intrusive Investigation	QC Geophysicist	Verify all QC seed items are recovered	4.3.2.5, Attachment 3-1	IP/FP	E	All QC items in area of operation recovered.	A root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action
Intrusive Investigation	UXOQCS	Verify operations are conducted IAW the Work Plan, MEC removal SOPs, and the Site Safety and Health Plan. - Survey Sweeps - MEC Surface Sweeps - DGM Anomaly Investigation - Explosives Storage and Accountability - Disposal/Demolition Operations - Scrap Inspection Operations	3.8.10	IP/FP	D	Work performed IAW Work Plan, referenced MEC SOPs, and the SSHP	Stop activity until full compliance can be assured and any activities not performed in compliance are re-evaluated and re-performed if necessary
Intrusive Investigation	SM	If areas of grouped MEC/MPPEH are identified, verify that soil samples are collected in accordance with the MC SAP	3.7, Appendix E	IP/FP	E	Soil and associated QA/QC samples are collected and submitted for laboratory analysis where areas of grouped MEC/MPPEH/MD are identified	Complete sampling, as required.

TABLE 4-1
Definable Features of Work Auditing Procedures and Responsibilities
MEC RFI, Fort Rucker, Alabama

Definable Feature of Work with Auditable Function	Responsible Person(s)[1]	Audit Procedure	WP Reference	QC Phase[2]	Freq. of Audit[3]	Pass/Fail Criteria	Action if Failure Occurs
Management of MPPEH/MDEH/MDAS	UXOQCS	Verify inspections conducted IAW the Work Plan	3.8.13	IP/FP	DD/E	Inspections being conducted IAW the Work Plan	Stop activity until full compliance can be assured and any activities not performed in compliance are re-evaluated and re-performed if necessary
Management of MPPEH/ MDEH/MDAS	UXOQCS	Verify certification conducted IAW the Work Plan	3.8.10.2, 3.8.13-	IP/FP	D/E	Certification is conducted IAW the Work Plan	Stop activity until full compliance can be assured and any activities not performed in compliance are re-evaluated and re-performed if necessary
Management of MPPEH/ MDEH/MDAS	UXOQCS	Verify disposal is conducted IAW the Work Plan	3.8.11	IP/FP	D/E	Disposal is conducted IAW the Work Plan	Stop activity until full compliance can be assured and any activities not performed in compliance are re-evaluated and re-performed if necessary
Management of MPPEH/ MDEH/MDAS	SM	If demolition is performed, verify pre-BIP and post-BIP and QA/QC samples are collected in accordance with the MC SAP	3.7.4, Appendix E				
Demobilization	Field Supervisor	Verify area is returned to original condition	3.10	FP	O	Facilities-support infrastructures are dismantled and shipped to appropriate location and site is returned to original condition	Ensure that all support facilities are removed and that the site is returned to original condition
Final Project Reports and Closeout							
Report preparation and approval	CH2M HILL PM	Verify that tabulations of all items identified during the field actions are accurate and complete	3.11/3.12	IP	O	Tabulations of all items identified during the field actions are accurate and complete	Ensure tabulation of all MEC, MD, and other material recovered during the field actions is accurate and complete
Report preparation and approval	CH2M HILL PM	Verify that all data is added to the GIS geodatabase and is represented in the updated CSM.	3.11	IP	O	All data is added to the GIS geodatabase and is represented in the updated CSM.	Ensure data is added to the GIS geodatabase and is represented in the updated CSM.

Notes:
IAW = in accordance with

[1] The responsible person (if other than the UXOQCS) is the individual with whom the UXOQCS will coordinate to ensure compliance with requirements and to verify that any necessary follow-up actions are taken.

[2] QC Phase
PP = Preparatory Phase
IP = Initial Phase
FP = Follow-up Phase

[3] Frequency
O = Once
D = Daily
W = Weekly
E = Each occurrence

4.5 Corrective/Preventive Action Procedures

The corrective and preventive action procedures are designed to prevent quality problems and to facilitate process improvements, as well as identify, document, and track deficiencies until corrective action has been verified.

4.5.1 Preventive Measures

While the entire QC program is directed toward problem prevention, certain elements of the program have greater potential to be proactive. The primary tools for problem prevention on this project are discussed in Three Phases of Control and Personnel Qualifications and Training sections of this QCP. Should these preventive measures fail, tracking and communicating procedures provide a mechanism for preventing the recurrence of the problems.

4.5.2 Continual Improvement

Project personnel at all levels are encouraged to provide recommendations for improvements in established work processes and techniques. The intent is to identify activities that are compliant but can be performed more efficiently or cost-effectively. Typical quality improvement recommendations include identifying an existing practice that should be improved and/or recommending an alternate practice that provides a benefit without compromising prescribed standards of quality. Project staff members are encouraged to bring recommendations to the attention of project management or the UXOQCS through either verbal or written means. However, deviations from established protocols are not to be implemented without prior written approval from the CH2M HILL PM and concurrence from the UXOQCS. Where a staff-initiated recommendation results in a tangible benefit to the project, public acknowledgment will be given by the CH2M HILL PM.

4.5.3 Deficiency Identification and Resolution

While deficiency identification and resolution occurs primarily at the operational level, QC audits provide a backup mechanism to address problems that either are not identified or cannot be resolved at the operational level. Through implementation of the audit procedures prescribed in this QCP, the QC staff is responsible for verifying that deficiencies are identified, documented as prescribed herein, and corrected in a timely manner. Deficiencies identified by the QC staff will be corrected by the CH2M HILL PM or designee and SUXOS/SM and documented by the UXOQCS.

4.5.4 Corrective Action Request

A Corrective Action Request (CAR) **(Appendix F)** can be issued by any member of the project staff, including CH2M HILL and subcontractor employees. If the individual issuing the CAR is also responsible for correcting the problem, then that individual should do so and document the results on the CAR. Otherwise, the CAR should be forwarded to the CH2M HILL PM, who is then responsible for evaluating the validity of the request, formulating a resolution and prevention strategy, assigning personnel and resources, and specifying and enforcing a schedule for the corrective action. Once a corrective action has been completed, the CAR and supporting information will be forwarded to the UXOQCS for closure. Sufficient information will be provided to allow the QC reviewer to verify the effectiveness of the corrective action.

In addition to observing actual work operations, CARs will be reviewed during follow-up QC audits. The purposes of this review are as follows: to ensure that established protocols are implemented properly; to verify that corrective action commitments are met; to ensure that corrective actions are effective in resolving problems; to identify trends within and among similar work units; and to facilitate system root cause analysis of larger problems. Particular attention will be given by the UXOQCS to work units that generate either an unusually large or unusually small number of CARs.

The UXOQCS will determine whether a written Corrective Action Plan (CAP) **(Appendix F)** is necessary, based on whether or not any of the following criteria are met: the CAR priority is high; the deficiency requires a rigorous corrective action planning process to identify a similar work product or activities affected by the deficiency; or the deficiency requires extensive resources and planning to correct the deficiency and to prevent recurrence. The CAP may be developed by the CH2M HILL PM designee and approved by the CH2M HILL PM. The CAP will indicate whether it is submitted for informational purposes or for review and approval. In either event, the CH2M HILL PM and SUXOS/SM are encouraged to discuss the corrective action strategy with the UXOQCS throughout the process.

4.5.5 Deficiency and Corrective Action Tracking

Each CAR will be given a unique identification number and tracked until corrective actions have been taken and documented and the CAR is submitted to the UXOQCS for verification and closure.

4.5.6 Lessons Learned and Other Documentation

The lessons learned through the deficiency management process are documented on CARs and CAPs. To share the lessons learned, these documents can be submitted to USAEC and USACE in the daily QC report summarizing the week's QC activities and including a group of the daily QC reports **(Appendix F)** and all other pertinent reports created during the week.

CARs should be cited in the daily QC report. Minor deficiencies identified during a QC audit that are readily correctable and can be verified in the field will be documented in the QC logbook and daily QC report without initiating a CAR. Deficiencies that cannot be readily corrected will be documented by the QC staff on a CAR and in the daily QC report. Copies of CARs will be referenced in and attached to the daily QC report. CAPs will also be attached to daily QC reports to document the final outcome of the deficiency. Similar or related deficiencies may be addressed on a single CAP.

4.6 Records Generated

4.6.1 Onsite Project File

The SUXOS/SM will establish and maintain an onsite project file in accordance with the CH2M HILL corporate quality manual for document control. The onsite files will be maintained in the project field office or designated field vehicle. The purpose of these files is to maintain a complete set of all documents, reports, certifications, and other records that provide information on project plans, contractual agreements, and project activities.

The MRSIMS, which consists of a mobile field data collection device used to collect form-based information about DGM operations and a centralized desktop interface and database, will be the repository for most of the information collected by the field team (for example, daily reports). This database will contain information that can be easily presented and delivered through automated report production, which reduces the amount of actual paper in the files. The database will be backed up daily and stored in an offsite location as well as in the project trailer. The files (in either paper or digital format) will include copies of the following:

- Qualifications and training records of all site personnel
- Submittals
- Schedule and progress reports
- Survey records
- Telephone conversation logs
- Meeting minutes and agenda
- Audit logs and schedules
- Photo documentation
- Site maps
- Equipment check records
- Nonconformance and corrective action reports

Daily work activity summary reports, which may include:

- Daily QC report
- Daily S&H report
- Daily report (including activity log)
- Daily MEC team logs
- Daily DGM team logs
- Reports on any emergency response actions
- Equipment check records
- Chain-of-custody records
- Incident reports
- Truck load tickets and shipping papers (if applicable)

As the project activities progress, the SUXOS/SM will monitor the usefulness of the project filing system for information retrieval. If additional file sections are needed, the SUXOS/SM will expand the initial filing structure to include additional sections.

4.6.2 Daily QC Report

The UXOQCS is responsible for preparing and submitting the daily QC report to the SUXOS/SM, who will incorporate it into a weekly progress report to the CH2M HILL PM. The daily QC report will provide an overview of QC activities performed each day, including those performed by subcontractors. The QC reports must present an accurate and complete picture of QC activities by reporting both conforming and deficient conditions, and the reports must be precise, factual, legible, and objective. Copies of supporting documentation, such as checklists and surveillance reports, will be attached.

A field QC log will be maintained by the UXOQCS to document details of field activities during QC monitoring activities. At the end of each day, copies of the log entries will be attached to the daily QC report. The information in the field QC log provides backup information and is intended to serve as a phone log and memory aid in the preparation of the daily QC report and for addressing follow-up questions.

QC and S&H staff input for the daily QC report will be provided in writing to the SUXOS/SM at a previously agreed-upon time and place, generally no later than 1 hour before normal close of business. For simplicity and completeness, the format for QC staff input should follow the same format as the daily QC report, with only the relevant sections completed.

Copies of daily QC reports with attachments and field QC logs no longer in use will be maintained in the project QC file. Upon project closeout, all QC logs will be included in the project QC file.

4.7 Personnel Qualifications and Training

All project staff members will be qualified to perform their assigned jobs in accordance with the terms outlined in the contract and by the project plans. Specific qualifications and training required for MEC-qualified personnel are specified in the following subsections. Qualifications for DGM operations-related personnel are covered in the **GIP (Attachment 3-1)**.

4.7.1 Documentation of Qualifications and Training for MEC-qualified Personnel

The UXOQCS will maintain records documenting the required qualifications, training, and certifications for each site worker. The UXOQCS will monitor expiration dates to provide advance warning to the CH2M HILL PM of when employees will require refresher training or other renewals. The UXOQCS will maintain records of site-specific and routine training for personnel and visitors, as required by this QCP. These records will be maintained onsite for audit purposes.

4.7.2 All UXO Personnel

UXO personnel assigned to the following positions will be qualified and certified in accordance with Department of the Army Pamphlet 385-64, *Ammunition and Explosives Safety Standards*; terms outlined by U.S. Department of Labor Employment Standards Administration Wage Hour Division for UXO Personnel; and DDESB TP 18, *Minimum Qualifications for UXO Technicians and Personnel*: UXO Technician I, UXO Technician II, UXO Technician III, UXOSO, UXOQCS, and SUXOS.

4.7.3 UXO Technician I

UXO Technician I personnel may, with direction and supervision from MEC-qualified personnel, perform the following tasks:

- Conduct visual and/or instrument-assisted MEC field search activities.

- Locate subsurface MEC by operating geophysical detection instruments and related equipment.
- Perform field maintenance and tests on geophysical detection instruments and related equipment.
- Remove nonhazardous MD and other debris, but only after such items have been inspected by a UXO Technician or MEC-qualified personnel and determined to be safe for handling.
- Perform site and area security functions.
- Reconnoiter and classify MEC.
- Identify all types of military munitions, including possible fuzes and their condition, armed or unarmed; such as:
  - Bombs
  - Guided missiles
  - Projectiles
  - Rockets
  - Land mines and associated components
  - Pyrotechnic items
  - Military explosives and demolition materials
  - Grenades
  - Sub munitions
- Excavate subsurface MEC.
- Transport demolition materials and/or MEC that have been determined safe for transport over public traffic routes, when required.
- Move MEC that has been determined acceptable for movement within the boundaries of a Munitions Response Area, but not over public traffic routes.
- Prepare firing systems, both electric and nonelectric, for demilitarization operations.
- Inspect MPPEH for the presence of explosive hazards.
- Construct MEC-related protective works.

4.7.4 UXO Technician II

In addition to being able to perform all functions of the UXO Technician I listed in this subsection, for this project, UXO Technician II personnel may:

- Determine precise locations in a field environment using a variety of techniques such as GPS equipment or basic land navigation using a topographical map and compass.
- Perform field collection procedures to identify contaminated soil.
- Operate modes of transportation for acceptable to move MEC within the MRS, when appropriate.

- Escort personnel, such as those performing environmental monitoring, who are not directly involved in MEC-related operations, but who have activities to perform within EZs.
- Inspect MPPEH for the presence of explosive safety hazards.

4.7.5 UXO Technician III

In addition to being able to perform all functions of the UXO Technicians I and II listed in this subsection, UXO Technician III personnel may:

- Supervise and perform the onsite demolition of MEC and handle demolition materials.
- Prepare required MR actions administrative reports.
- Prepare SOPs for onsite MR activities.
- Conduct daily site safety briefings.
- Supervise the conduct of all onsite MEC-related operations.
- Inspect and certify and/or verify MPPEH as safe or as to the explosive hazard it may present for transfer within DoD or release from DoD control per current policies and standards.

4.7.6 UXOQCS/UXOSO

In addition to being able to perform all functions of the UXO Technicians I, II, and III listed in this subsection, a UXOQCS/UXOSO may:

- Develop and implement the MEC-specific sections of this QCP for all explosives-related operations.
- Conduct daily audits of the procedures used by MEC teams and individuals for processing MPPEH.
- Perform and document random sampling (by pieces, volume, or area) of all MPPEH collected from the various teams to ensure that no items with explosive hazards, engine fluids, illuminating dials, or other visible liquid hazardous or toxic waste materials are identified as MD or other debris as required for completion of the Requisition and Turn-in Document, DD Form 1348-1A.
- Conduct QC audits of all explosives operations for compliance with established procedures.
- Identify and verify completion of all corrective actions to ensure that all explosives operations comply with requirements.
- Develop and implement an approved explosives and MEC S&H program in compliance with applicable requirements, whether federal, state, or local.
- Analyze operational risks, explosive hazards, and safety requirements.

- Establish and ensure compliance with all site-specific explosives operations safety requirements.
- Enforce personnel limits and safety EZs for explosives-related operations.
- Conduct, document, and report the results of safety inspections to ensure compliance with all applicable explosives safety policies, standards, regulations, and codes.
- Ensure that all protective works and equipment used within the EZ are operated in compliance with applicable DoD policy, DDESB approvals, and other federal, state, and local S&H statutes, regulations, and codes

4.7.7 SUXOS/SM

In addition to being able to perform all functions of the UXO Technicians I, II, and III listed in this section, the SUXOS/SM will:

- Plan, coordinate, and supervise all field operations.
- Assist in the development of MR plans.
- Supervise multiple teams.

4.7.8 UXO Team Composition and Roles

For all MEC-related operations, each MEC team will consist of one UXO Technician III and two to six team members. Teams will have a minimum of two MEC-qualified personnel, one of whom will be the UXO Technician III. A UXO Technician III will supervise all MEC operations and all teams operating within the EZ.

4.7.9 S&H Training

S&H training requirements for onsite project personnel have been established in accordance with Occupational Safety and Health Act/Occupational Safety and Health Administration requirements for hazardous site workers (29 Code of Federal Regulations [CFR] 1910.120) and are specified in the APP/SSHP (**Appendix D)**. These training requirements will be met before project personnel begin site work.

4.8 Testing and Maintenance

Testing and maintenance of equipment such as geophysical instruments, radios, cell phones, vehicles, and machinery will be performed per the manufacturer's specifications, this QCP, and all applicable SOPs. Geophysical detection equipment will be tested daily, as specified in the GIP.

Test results will be documented by the individual performing the test. In addition, testing and maintenance records associated with the measuring and testing of equipment will be generated by the individual performing the activity. Documentation for testing and maintenance of equipment will be made available to USAEC and USACE upon request.

The UXOQCS is responsible for ensuring that the tests are performed and that the results are summarized and provided with the daily QC report. To track each failing test for future retesting, the failing test will be noted on the deficiency log. Resolution of the failing test is complete when retesting is performed and the corrective action is verified on the deficiency log.

Section 5. Explosives Management Plan

5.1 General

CH2M HILL recognizes the regulatory, safety, and security requirements for controlling, using, storing, and transporting explosives required to perform demolition actions. This EMP details the procedures that will be used to manage the just-in-time delivery of explosives for this project in accordance with the following policies and federal, state, and local laws and regulations:

- Task Order Scope of Work **(Appendix A)**
- Policy - CH2M HILL Corporate HSE SOP- 610, Explosives Usage and Munitions Response (MR), dated August 2009
- The DoD Ammunition and Explosives Safety Standards, DoD 6055.09-STD, which establishes uniform safety standards that apply to ammunition and explosives, to associated personnel and property, and to unrelated personnel and property exposed to the potentially damaging effects of an accident involving ammunition and explosives during their development, manufacturing, testing, transportation, handling, storage, maintenance, demilitarization, and disposal; Title 18 U. S. Code (USC), 842, Safe Explosives Act
- 27 CFR Part 555.1, Explosives
- 29 CFR 1910.109, Explosives and Blasting Agents
- National Fire Protection Association, 495 Explosive Materials Code
- 49 CFR Parts 100 –199, Hazardous Materials Transportation

5.2 Management of Explosive Material

In accordance with the Safe Explosives Act of 2002, CH2M HILL implements stringent requirements for management of explosives that must be followed. Management of explosives is a process that, if in compliance with federal, state, and local jurisdictions, will reduce, control, or eliminate civil and criminal penalties, disciplinary actions, and potential risk to personnel, the public, and the environment. Therefore, CH2M HILL will retain a copy of the following authorization documents onsite:

- ATF&E User of HEs Type 33 License; number: 3-CA-013-33-0J-01233 **(Attachment 5-1)**
- A letter signed by the ERRG Licensee and authorized official of ERRG designating onsite personnel who are responsible persons, and employee possessors, authorized to purchase, receive, access, and use explosives **(Attachment 5-1)**
- Alabama Blaster, Mr. James Molina, Permit Number: B-07748 expiration date February 13, 2011) and the ERRG Competent Person for Explosive Operations

These documents will be made available, upon request, to any authorized federal, state, or local authority.

5.2.1 "Responsible Person" / "Possessor of Explosives"

Under the Safe Explosives Act of 2002, a "Responsible Person" or a "Possessor of Explosives" is defined as follows:

- **Responsible Person:** An individual who has the power to direct the management and policies of the applicant pertaining to explosive materials. Generally, the term includes partners, sole proprietors, project managers, site managers, corporate officers and directors, and majority shareholders.
- **Possessor of Explosives:** An individual who has actual physical possession or constructive possession, meaning the person has dominion or control over explosives. For example, persons who are physically handling explosive materials would be considered to be possessors of explosives. This would include employees who handle explosive materials in order to ship, transport, or sell them; and employees, such as "blasters," who actually use explosive materials. Other examples of possessors include a supervisor at a construction site who keeps keys for magazines in which explosives are stored, or who directs the use of explosive materials by other employees; and an employee of a licensee or permittee transporting explosive materials from a licensed distributor to a purchaser.

5.3 Right-of-Entry and Examination by ATF&E

As stated in 27 CFR Part 55.141(a)(6), with the exception of DoD property, any ATF&E officer may enter, during business hours, ERRG premises (including places of storage) to inspect or examine any records, documents, and inventory of explosive materials. As stated in 27 CFR Part 55.141 (a) (6), with the exception of DoD property, any ATF&E officer may inspect the site of any accident or fire when there is reason to believe that explosive materials are involved. Any ATF&E officer may enter areas where explosive materials have been used, are suspected of being used, or have been found in an unauthorized location.

5.4 Prohibited Shipment, Transportation, or Receipt of Explosive Materials

Only authorized ERRG employees (see **Section 5.2**) will transport, ship, and cause to be transported, or receive in interstate or foreign commerce any explosive materials. ERRG personnel will not distribute explosive materials to any person not licensed or holding a permit under 27 CFR Part 55.

No ERRG employee who is in one of the following four categories may ship, transport, or receive any explosive materials in interstate or foreign commerce:

- Is under indictment or information for, or who has been convicted in any court of, a crime punishable by imprisonment for a term exceeding 1 year
- Is a fugitive from justice

- Is an unlawful user of or addicted to marijuana, or any depressant or stimulant drug, or narcotic drug (as these terms are defined in the Controlled Substances Act; 21 U.S.C. 802)
- Has been adjudicated as a mental defective or has been committed to a mental institution

5.5 Prohibited Distribution of Explosive Materials

ERRG employees will not distribute any explosive materials to any person:

- Who the employee knows is less than 21 years of age
- Who is in a state where the purchase, possession, or use of explosive materials would be in violation of any state law or any published ordinance applicable at the place of distribution
- Who the employee has reason to believe intends to transport the explosive materials into a state where the purchase, possession, or use of explosive materials is prohibited or which does not permit its residents to transport, ship, or receive explosive materials in the state
- Who the employee has reasonable cause to believe intends to use the explosive materials for other than lawful purposes

5.6 Use of Explosives – Process and Procedures

1. The term “Blaster” refers to the Demolition Team Supervisor and the possessor of explosives and these terms may be used interchangeably, as they mean the same individual.
2. Explosives will not be ordered without the review and approval of the ATF&E License Holder. (See Explosive Purchase Procurement Request Form, **Attachment 5-2).** This completed and signed form will be maintained by the CH2M HILL PM in the project ATF&E file.
3. The ATF&E License Holder must review and approve this EMP and the ESP to ensure compliance with ATF&E regulations. The ATF&E License Holder will affix his or her signature and date authorizing the EMP and ESP for use.
4. Following compliance with the above, the ATF&E License Holder will provide the CH2M HILL PM and Purchasing with names of authorized responsible person(s) and possessor(s) of explosives and an endorsed copy of the ATF&E license **(see Attachment 5-1).** A copy of this letter will be maintained by the CH2M HILL PM in the project ATF&E file.
5. The CH2M HILL PM will forward a copy of the ATF&E endorsed license and the names of responsible persons and possessors of explosives to the designated “Blaster.”
6. Written authorization designating the “responsible persons” and “possessors of explosives” who can order, receive, store, and use explosives will be provided by

Purchasing to the explosives vendor/supplier **(Attachment 5-1).** This letter will include a statement that "These persons have been submitted to the Department of Justice Bureau of Alcohol, Firearms, and Explosives National Licensing Center for a letter of clearance, in accordance with the Safe Explosives Act of 2002. These personnel are considered acceptable to perform the duties of responsible persons, and/or employee possessors pending a Department of Justice, ATF&E Licensing Center written determination of noneligible."

7. The ATF&E License Holder will copy the EMP and provide copies through the ATF&E local office for submission to the Regional ATF&E office responsible for Fort Rucker, Alabama. A copy of the transmittal letter will be send to the CH2M HILL PM for retention in the project ATF&E file.

8. The ERRG PM will secure a certificate of insurance naming the client/property owner as the third-party insured and present a final copy to the CH2M HILL Contracting Officer. The ERRG licensed Blaster is Mr. James Molina. A copy of his license will be maintained onsite and a copy forwarded to the CH2M HILL PM for retention in the project ATF&E file.

9. The ERRG licensed Blaster will post a copy of the ERRG ATF&E Type 33 User of HEs license on the wall of the command trailer at the project site. The ERRG PM will notify the ATF&E License Holder that the site is ready to receive explosives and request that the License Holder provide authorization to the ERRG purchasing agent to implement the purchase order with the vendor/supplier to ship explosives.

10. The ATF&E License Holder will coordinate with the ERRG purchasing agent and provide the following "original" certified documents:

    a. ATF&E Type 33 License 9-CA-013-33-0J-01233 with: Name and address of the project site where explosive materials are to be used, and the project number associated with site. This document will be signed in with a copy of an ATF&E extension letter if applicable.

    b. A letter identifying the responsible persons and employee possessors authorized to purchase, receive, use, store, and transport HEs certified by the License Holder as an original signature.

11. The ERRG purchasing agent will send the following documents to the vendor/supplier in original form and will copy these documents to the CH2M HILL PM for retention in the ATF&E file.

    a. Purchasing will obtain notification from the vendor/supplier agent of acceptance of the purchase order and receipt of the ERRG ATF&E Type 33 endorsed license and the letter identifying the responsible/possessor information. The vendor/supplier will sign the purchase order and provide the purchasing agent with a copy of the vendor/supplier ATF&E explosive license/permit. A copy of the supplier ATF&E license will be forwarded to the CH2M HILL PM for retention in the ATF&E file.

    b. Purchasing will obtain from the vendor/supplier the transportation firm and schedule, and will determine the anticipated arrival date. Purchasing will communicate this information to the ERRG PM, who will notify the ERRG Alabama-Licensed Blaster.

c. The ERRG PM will notify the designated ERRG possessor of explosives of the vendor/supplier anticipated arrival date, time, location, and shipper name, and send a copy of the purchase order for the explosives to the site location. This written notification will be retained in the site ATF&E file.

12. The ERRG Alabama-Licensed Blaster will confirm his identity to the delivery driver and present legal identification to receive the explosives shipment, review manifests, and review the purchase order to confirm amounts, types, and condition. The Blaster will then conduct a physical inventory of the explosives shipment and record in the field log the date shift codes/lot numbers and or manufacturer's marks as applicable to the items. He or she will secure all paperwork (bill of lading, manifests, material safety data sheets [MSDSs], etc. for the project record and the ATF&E Licensee files. A copy of the manifests and receiving documents will be forwarded to the CH2M HILL PM for retention in the project ATF&E files.
13. The ERRG Alabama-Licensed Blaster will proceed from the delivery location to Fort Rucker through the predesignated gate. Once cleared through gate security, the ERRG driver will be led by the SUXOS/SM to the MRS site(s) where demolition operations are to occur. Once explosives have been issued to the demolition operations team, the driver will stand by at the designated area until operations are complete.
14. The ERRG Alabama-Licensed Blaster will conduct a physical inventory of *just-in time* delivered explosive stocks, keeping track of explosives issued that day until the total explosives on hand equate to zero, he will also record the date shift codes/lot numbers as applicable for each delivered quantity in a bound project logbook for explosives management. No pages will be removed from this logbook; mistakes will be annotated with a single strike-through, and initialed by the author. The logbook will be used to record the date, person by full name, time of action, purpose of action, and description of action, manufacturer of explosives, type of explosive materials involved in action, applicable date shift codes/lot numbers, and quantities. The logbook will track cradle-to-grave the starting, running, end inventory by each just in time delivery, and track with deliver manifests, consumption to shot logs by date and time. The logbook will be used to document shot logs by date, time, person, type of explosive, quantity of explosive materials, applicable date shift code, lot number/munitions destroyed by date and quantity.

5.7 Fire Prevention and Safety

The ERRG Alabama-Licensed Blaster will locate the local fire department with response authority for and liaison with the local commander. The ERRG Alabama-Licensed Blaster will provide the commander with a copy of the ESP and provide a project briefing. This is in addition to the previously discussed distribution of ESP copies. MSDSs for commercial explosives that may be used during this project are included in **Attachment 5-5**.

5.8 Blasting Procedures

Blasting procedures will be in accordance with ERRG SOP MEC Disposal Operations #UXO008 (**Attachment 5-3)**.

5.9 Training

ERRG employees who work on this project must complete the following training:

- A one-time, 40-hour comprehensive hazardous waste course with training in hazard recognition and basic S&E issues, as required by the occupational safety and health regulations in 29 CFR §1910.120(e)
- An annual 8-hour hazardous waste refresher course
- Drug Free Workplace Training
- Hazardous waste supervisory training (required for managers and supervisors only) as specified in 29 CFR §1910.120(e)

All UXO Technicians will be graduates of one of the following:

- U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD
- U.S. Naval EOD School, Indian Head, MD
- U.S. Naval EOD School, Eglin Air Force Base (AFB), FL
- EOD Assistant Course, Redstone Arsenal, AL
- EOD Assistant Course, Eglin AFB
- An equivalent course as identified in DDESB TP 18

The ERRG qualified Blaster will have an Alabama Blaster License and be able to understand and give written and oral orders. He will also be in good physical condition and not be addicted to narcotics, intoxicants, or similar types of drugs. He will be qualified by reason of training, knowledge, or experience, in the field of transporting, storing, handling, and using explosives, and have a working knowledge of State and local laws and regulations which pertain to explosives. The Blaster will be required to furnish satisfactory evidence of competency in handling explosives and performing in a safe manner the type of blasting that will be required. He will also be knowledgeable and competent in the use of each type of blasting method used.

ERRG employees who work on MR sites must participate in a medical surveillance program consisting of a baseline health assessment, including a medical and occupational history review, blood and urine tests for contaminants of interest, drug testing, electrocardiogram, pulmonary function tests, chest x-ray, respiratory fitness test, and a psychological examination and a general physical examination that includes hearing and vision.

5.10 Explosives Storage Area and Security

Explosives purchased by ERRG for use on this project will not be stored. All explosives purchased will be delivered using just-in-time delivery and all explosive materials will be expended during the day’s scheduled demolition operations.

5.11 Donor Explosives Acquisition

Jet Research, located in the state of Texas, is the vendor/supplier of commercial explosives for this project. Jet Research is required to be fully licensed to sell and transport explosives, and must fully comply with the provisions of this plan.

5.12 Description and Estimated Quantity of Donor Explosives

Explosive Items	Unit of Issue	Quantity
Nonelectric Shock Tube & Detonator Assembly	100	1
Cast Booster	1	10

5.13 Initial Explosives Receipt

The Demolition Team Supervisor is the Alabama-licensed Blaster and is responsible for the receipt, inspection, issue, security, use, and transport of all commercial explosives purchased for this project. The Demolition Team Supervisor will be fully certified and licensed to perform blasting operations within the State of Alabama. The Demolition Team Supervisor will inventory, initiate, and maintain all documentation concerning the explosive materials upon receipt, and by signing the receipt documents, will assume accountability for the material.

5.14 Procedures for Reconciling Discrepancies upon Receipt

The Demolition Team Supervisor will conduct a 100 percent inventory of the incoming explosives. The quantities annotated on the shipping manifest must match the quantities reflected in the purchase order. If these quantities do not match, the Demolition Team Supervisor will contact the CH2M HILL PM or designee and the ATF&E License Holder.

ERRG personnel will only sign for the actual quantity of explosive materials received. Actual quantities will be properly annotated on the shipping documentation prior to ERRG accepting delivery. These procedures will be conducted for each receipt of explosives materials. The Demolition Team Supervisor will record the “DATE SHIFT CODE” and/or lot number for each type and quantity of explosive item received, to include detonators, time fuzes, igniters, primer cords, explosive actuated items, and other items U.S. Department of Transportation (DOT) manifested as a Class of explosives, to include the manufacturer name, model number, make, and series for the item.

At a minimum, the following will be recorded or the item will not be accepted:

- Item type
- Item class
- Item issue
- Item quantity
- Item date shift code/date shift code
- Item manufacturer name or marks

5.15 Storage

ERRG will not establish an explosives storage facility for this project. All explosives acquired will be ordered and delivered using just-in-time delivery in an amount to be used prior to the end of the day’s scheduled demolition operations.

5.16 Physical Security

The ERRG Demolition Team Supervisor will receive explosives on an as-needed basis. He will maintain security control of the explosives until they are expended. Inspections in accordance with ATF&E requirements will be conducted and documented as applicable.

5.17 Transportation Procedures

Transportation of explosives to the site and local movement of explosives to the MRSs will be conducted by an ERRG driver who has met all DOT requirements for explosives transport and all DoD requirements for transportation on a DoD base.

Commercial explosives will be moved to the demolition locations in an ATF&E Type 3, day storage boxes. Detonators and main charge explosives will not be transported in the same day box.

During transportation of explosive material, safety is the primary concern. The most obvious requirements are to protect personnel, the general public, and the environment from fire, blast, noise, fragmentation, and toxic releases from receipt location to onsite disposal locations

Prior to movement, the driver will visually inspect the explosives-laden vehicle to ensure the load is properly secured and determined acceptable to move to the site. The Demolition Team Supervisor will provide oversight during loading. The cargo will be checked to ensure that containers are loaded, blocked, braced, tied down, or otherwise secured.

The Demolition Team Supervisor will ensure that the following general safety precautions are observed during transport operations:

- Detonators and HEs will remain separated at all times.
- Explosives will remain covered with a flame-resistant tarpaulin or in a waterproof or sparkproof container at all times, except when loading or unloading.
- Explosives will not be transported in the passenger compartment of a vehicle.
- The cargo compartment will be lined with a nonmetallic material in any portion that comes in contact with the load.
- Vehicles will be equipped with a fire extinguisher having an Underwriters’ Laboratories rating of 10 BC or more.
- The explosives-laden vehicle will not be left unattended.
- No person is permitted to ride on, or in, the cargo area.

- Smoking in or within 50 ft of vehicles transporting explosives is prohibited.
- Refueling of vehicle will be accomplished without the explosive cargo.
- Vehicle will not exceed the posted speed limit, and if a prudent speed is less than the posted speed limit, the operator may not exceed a safe and reasonable speed.
- Operator will be CDL licensed with hazmat endorsement to operate the vehicle, and a copy of this license will be maintained with the operator.

5.18 Requirements for Transporting Explosives

Explosives transportation vehicles will be inspected for suitability and properly equipped for movement of explosives. Inspections and findings will be recorded in the Demolition Team Supervisor daily logbook.

ERRG will properly placard the day boxes (ATF&E Type 3) that the vehicle will move to warn personnel and furnish specific guidance to fire fighters and other personnel who may be responding to an emergency involving the vehicle. Transportation on public roads/explosive transportation routes is authorized.

5.19 Receipt Procedures

The ERRG designated Blaster will receive the shipments and follow the procedures outline in **Section 6.** Careful attention to inventory, documentation, and records retention will be given the highest priority.

5.20 Authorized Individuals

The ERRG ATF&E license holder will sign a letter designating those personnel who are designated as responsible persons or possessors of explosives; a copy of this letter will be maintained onsite and at the CH2M HILL PM's ATF&E project file.

5.21 Certification of Use of Explosives

The End User Certificate **(Attachment 5-4)** will be completed by the Demolition Team Supervisor on the final day of explosives use. This Certificate will be forwarded immediately to the CH2M HILL PM for retention in the project ATF&E file.

5.22 Lost, Stolen, or Unauthorized Use of Explosives

Upon discovering that explosives have been lost, stolen, or used without authorization, the Demolition Team Supervisor will immediately report the circumstances to the ERRG PM. The Demolition Team Supervisor will also notify the:

- ERRG Alabama-Licensed Blaster (if a different individual)
- ERRG ATF&E License Holder
- ERRG Operations Manager - (925)969-0750

The ERRG ATF&E License Holder and/or the ERRG PM will immediately notify the appropriate ATF&E officials by calling the AFT&E toll free number (800-461-8841). The

Demolition Team Supervisor will immediately contact the Fort Rucker Installation Safety Office and the CH2M HILL PM. The Demolition Team Supervisor will prepare and submit a memorandum to the ERRG PM detailing all the necessary information concerning the lost, stolen, or unauthorized use of explosives. This memorandum will be submitted within 12 hours of incident identification. The ERRG PM will then prepare the ATF&E Form 5400.5. The form will be reviewed by the ERRG ATF&E Licensee prior to submittal to the ATF&E. The form will be submitted to the appropriate ATF&E official within 24 hours of incident identification.

5.23 Return to Storage of Unexpended Explosives

Since ERRG will expend all explosives on the day the materials are delivered, there will be no unexpended explosives to store.

5.24 Disposition of Remaining Explosives at the End of Site Activities

No explosives will remain at the end of site activities, as all explosives materials will be expended on the day the materials are delivered, as documented in the logbook.

5.25 Records

ERRG will retain a permanent file (in accordance with this EMP) of all applicable demolition records, shipping papers, forms associated with this plan, logbooks, invoices, correspondences, including permits, training records, inspector reports, and any applicable manifests. It is the responsibility of the Demolition Team Supervisor and the CH2M HILL PM to ensure all ATF&E related materials are forwarded to the License Holder within 7 days of project completion.

5.26 Explosives Storage Area Closeout

Not Applicable. Explosives will not be stored onsite.

Section 6. Environmental Protection Plan

6.1 Ecological Summary

Fort Rucker is located in the East Gulf Coastal Plain physiographic section in southeast Alabama, approximately 20 miles northwest of the town of Dothan. It is bounded by the towns of Enterprise on the west, Daleville on the south, and Ozark on the east. Fort Rucker encompasses 62,430 acres, primarily in Dale and Coffee Counties.

Fort Rucker is in the Southern Red Hills district of the East Gulf Coastal Plain physiographic section, an area generally described as a southward sloping upland of moderate relief (Sapp and Emplaincourt, 1985). Fort Rucker, however, lies in a slightly more rugged area at the southern edge of this physiographic district, in the extreme eastward Buhrstone Hills that developed on indurated resistant siliceous claystone and sandstone (Sapp and Emplaincourt, 1985; Osborne et al., 1989).

Habitats within Fort Rucker include upland forested areas, pine plantations, agricultural lands (including fallow fields and old fields), maintained grassed areas, lowland areas, wetlands, streams, ponds, man-made lakes, and badly eroded sites that include waste areas and quarries, bridges, and overpasses (Fort Rucker, 2001).

The slightly more rugged, sometimes deeply dissected, topography of Fort Rucker apparently favors Sargent's (1884) longleaf pine-shortleaf pine-hardwoods transition community. Ware et al. (1993) also describe the potential natural vegetation (in the absence of fire) of the area containing Fort Rucker as southern mixed hardwood forest.

6.2 Species of Special Concern within the Project Site

Animal species of special concern potentially occurring on the three MMRP project sites were identified by searching online databases and information available through the U.S. Fish and Wildlife Service (USFWS, 2010) and the Alabama Department of Conservation and Natural Resources, Natural Heritage Section (ADCNR, 2010). The State of Alabama does not have an official list of threatened or endangered plant species. A search of threatened or endangered species within Dale County, Alabama indicated the presence of 1 bird, 11 mussel, 2 fish, 2 small mammal, 4 reptile/amphibian, and 2 flowering plant species **(Table 6-1).** No known endangered species have been identified at Fort Rucker.

The wood stork feeds on small fish in wetland areas and favors tall cypress trees near water for nesting sites. There are no known wood stork nesting sites within Alabama (Auburn University, 2010). Since there is only a small pond on the golf course within the Anti-Tank/Rocket Grenade Range MRS, and no nearby possible nesting sites, it is concluded that this species would not be found on the MMRP project sites.

TABLE 6-1
State and Federal Species of Concern Potentially Occurring in Dale County, Alabama[a]
MEC RFI, Fort Rucker, Alabama

Common Name	Scientific Name	State Status	Federal Status[1]
Wood Stork	*Mycteria americana*		Endangered
Stirrupshell Mussel	*Quadrula stapes*		Endangered
Upland Combshell Mussel	*Epioblasma metastriata*		Endangered
Yellow Blossom Mussel	*Epioblasma florentina florentina*		Endangered
Flat Pigtoe Mussel	*Pleurobema marshalli*		Endangered
Fuzzy Pigtoe Mussel	*Pleurobema strodeanum*		Candidate species
Narrow Pigtoe Mussel	*Fusconaia escambia*		Candidate species
Tapered Pigtoe Mussel	*Quincuncina burkei*		Candidate species
Round Ebonyshell Mussel	*Fusconaia rotulata*		Candidate species
Choctaw Bean Mussel	*Villosa choctawensis*	Protected	Candidate species
Southern Sandshell Mussel	*Lampsilis australis*	Protected	Candidate species
Southern Kidneyshell Mussel	*Ptychobranchus jonesi*		Candidate species
Alabama Shad	*Alosa alabamae*	Protected	
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*		Threatened
Barbour's Map Turtle	*Graptemys barbouri*	Protected	
Gopher Tortoise	*Gopherus polyphemus*	Protected	
Long-tailed Weasel	*Mustela frenata*	Protected	
Southeastern Pocket Gopher	*Geomys pinetis*	Protected	
Southern Hognose Snake	*Heterodon simus*	Protected	
Black Pine Snake	*Pituophis melanoleucus lodingi*		Candidate species
Georgia Rockcress	*Arabis Georgiana*		Candidate species
[Unnamed] Gladecress	*Leavenworthia crassa*		Candidate species

[a]USFWS Threatened and Endangered Species Database, http://ecos.fws.gov/tess_public/ accessed February 10, 2010

The 11 mussel species (stirrupshell, upland combshell, yellow blossom, flat pigtoe, fuzzy pigtoe, narrow pigtoe, tapered pigtoe, round ebonyshell, choctaw bean, southern sandshell, and southern kidneyshell), 2 fish species (Alabama shad and Gulf sturgeon), and Barbour's map turtle inhabit creeks and rivers. The 11 freshwater mussel species (Family *Unionidae*) prefer well-oxygenated riffle habitats (USACE, 2009), and the Alabama shad and Gulf sturgeon are anadromous fish that migrate from saltwater into large coastal rivers to spawn and spend the warm months. The Barbour's map turtle occurs almost exclusively in rivers and their associated shoreline habitats (ADCNR, 2008a).

With the exception of the small pond on the golf course within the Anti-Tank/Rocket Grenade Range MRS, there are no water bodies within the MMRP project site boundaries. None of the aquatic species discussed above would inhabit a pond habitat, and it is concluded that none of these aquatic species of special concern would occur on the MMRP project sites.

The long-tailed weasel occurs in a variety of habitats, including forest edge, fencerows, brush lands, open lands, and farmlands (ADCNR, 2008b). The southeastern pocket gopher and southern hog-nosed snake are generally found in dry upland habitats, and the gopher tortoise typically occurs in areas with deep sandy soils where the overhead canopy is open, and/or along forest edges (ADCNR, 2008c). The black pine snake can be found in hardwood forests, or other closed-canopy areas not regularly used (ADCNR, 2008d). Based on the developed nature of most of the Anti-Tank/Rocket Grenade Range MRS and the Infiltration/Grenade Range MRS, it is considered highly unlikely that these species would be present. These terrestrial species could occur along the undeveloped fringes of these two areas and/or within the .22-Caliber Target Butt MMRP site.MRS However, the munitions survey and removal activities to be conducted within these areas will result in minimal disturbance to the vegetation and soils and will have no significant impact on these species even if they are present.

Georgia rockcress and [unnamed] gladecress are both flowering plants that bloom from March to May **(**shown in **Figures 6-1 and 6-2).** Georgia rockcress is found in lightly shaded woods, rocky bluffs, gently sloping outcrops, and along rivers (NatureServe, 2009). [Unnamed] gladecress is found in limestone (cedar) glades, disturbed roadsides, pastures, cultivated fields, and old fields (NatureServe, 2009). These flowering plant species of concern could occur within the MMRP project sites; care will be taken to avoid these species if encountered. The planned site activities will result in minimal disturbance to the vegetation and soils and will have no significant impact on these species even if they are present.

FIGURE 6-1
Georgia Rockcress
(Source: http://jimbotany.com/)

FIGURE 6-2
[Unnamed] Gladecress
(Source http://www.biosurvey.ou.eedu/okwild/gladecress.html)

6.3 Cultural and Archaeological Resources within the Project Site

Fort Rucker has a Historic Preservation Plan (Harvey et al., 1996) that will be used to guide the protection of historic and cultural resources on the installation during implementation of this EPP. Based on the analysis in this document, the MMRP project sites do not contain any cultural or archaeological resources.

6.4 Water Resources within the Project Site

Fort Rucker is located in the Choctawhatchee River basin. The Choctawhatchee River originates in the northern section of the Coastal Plain physiographic section and flows south-southwest, passing along the southeastern perimeter of Fort Rucker (Fort Rucker, 2001). Farther southwest, at the Geneva County line, the Choctawhatchee River merges with Claybank Creek, the tributary that receives most of the surface water drainage from Fort Rucker. The Pea River, the largest tributary of the Choctawhatchee, flows in a southwestern direction along the northwestern perimeter of Fort Rucker, eventually flowing east to its confluence with the Choctawhatchee (Rust Environment and Infrastructure, 1999).

With the exception of the small pond on the golf course within the Anti-Tank/Rocket Grenade Range MRS, there are no water bodies within the MMRP site boundaries.

6.5 Trees and Shrubs to be Removed within the Project Site

Site vegetation will be removed from approximately 3 acres of the combined 101 acres of the Anti-Tank/Rocket Grenade Range and the Infiltration/Grenade Range sites in order to facilitate DGM. This calculation is based on conducting DGM over 3 percent of the area of the sites. Only the minimum amount of vegetation necessary will be removed to prepare the transects for DGM surveys.

The vegetation will be mulched and left in place. Trees larger than 4 inches in diameter will not be removed unless necessary to allow the passage of vegetation clearing or DGM equipment.

6.6 Existing Waste Disposal Sites within the Project Site

At Fort Rucker, clean rock, concrete, and asphalt are disposed of in old borrow pits on the installation. All other solid waste (except hazardous waste) is hauled to a local landfill that complies with the requirements of RCRA Subtitle D (Fort Rucker, 2001).

Fort Rucker currently maintains one closed sanitary landfill (Fort Rucker, 2001). The landfill is not within the MMRP project site boundaries.

6.7 Compliance with Applicable or Relevant and Appropriate Requirements

CH2M HILL will follow all applicable or relevant and appropriate requirements (ARARs) concerning environmental protection, pollution control, and abatement for the proposed project work. No environmental permits are believed to be required for the work, based on the initial evaluation of the sites. The Fort Rucker Environmental Management office will be consulted to confirm whether any sensitive ecological and/or archaeological resources are present within the MRSs. The munitions survey/removal activities to be conducted within these areas will result in minimal disturbance to the habitats and/or soils and are not expected to cause any impacts relevant to the ARARs presented in **Table 6-2**.

TABLE 6-2
Federal ARARs for Environmental Protection
MEC RFI, Fort Rucker, Alabama

Reference	Title
33USC 1251, et seq.	Clean Water Act
33 USC 403	Rivers and Harbors Act of 1899
16 USC 1531 et seq., per 50 CFR 402	Endangered Species Act
16 USC 603, et seq.	Migratory Bird Treaty Act
16 USC 460	National Historic Preservation Act of 1966
16 USC 469, et seq., and 36 CFR 65	National Archaeological and Historic Preservation Act

6.8 Detailed Procedures and Methods to Protect and/or Mitigate the Resources/Sites Identified

Fort Rucker Environmental Management personnel, in conjunction with the CH2M HILL PM, will provide instructions to field personnel regarding the protection of onsite environmental resources. Such protective measures will include, but are not limited to, the following:

- Avoidance of contact with any federally protected animal species or the nest or burrow of a protected species that is found within the project area. Flag specimens within the project area for relocation and verification. Record latitude and longitude of the occurrence if possible.

- Avoidance of blocking any gopher tortoise burrows or any access routes for gopher tortoise burrows with cut or mulched vegetation.
- If any cultural or archaeological material or resource would be disturbed within the project area, a qualified archaeologist will be notified to provide guidance on performing further work in the area.
- The CH2M HILL PM will seek the guidance of a Fort Rucker ecologist to develop appropriate mitigation measures in the event that the work activities adversely affect any environmental resource.

Section 7. Property Management Plan

Not Applicable.

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Section 8. Interim Holding Facility Siting Plan for RCWM Projects

Not Applicable.

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Section 9. Physical Security Plan for RCWM Project Sites

Not Applicable.

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Attachment 3-1
Geophysical Investigation Plan

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Munitions and Explosives of Concern Geophysical Investigation Plan

MEC RCRA Facility Investigation

Anti-Tank/Rocket Grenade Range - FTRU-001-R-01
Infiltration/Grenade Range - FTRU-003-R-01
.22-Caliber Target Butt - FTRU-004-R-01

Fort Rucker, Alabama

FINAL REVISION 1

Contract W91ZLK-05-D-0014
Task Order No. 0001

Prepared for:

U.S. Army Environmental Command

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Contents

Tables

Figures

Acronyms and Abbreviations

cm	centimeter
DGM	digital geophysical mapping
DQO	data quality objective
EM	electromagnetic
GIP	Geophysical Investigation Plan
GPS	global positioning system
GSV	geophysical system verification
MEC	munitions and explosives of concern
MPPEH	material potentially presenting an explosive hazard
MR-SIMS	Munitions Response Site Information Management System
m	meter
OSHA	Occupational Safety and Health Administration
PDF	portable document format
QA	quality assurance
QC	quality control
RTK	real-time kinematic
SUXOS	Senior UXO Supervisor
UXO	unexploded ordnance

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1.0 Geophysical Operations Overview

This Geophysical Investigation Plan (GIP) provides details of the equipment, approach, methods, operational procedures, and quality control (QC) methods to be used in performing the geophysical investigation at the Anti-Tank/Rocket Grenade Range, the Infiltration/Grenade Range, and the .22-Cal Target Butt sites at Fort Rucker, Alabama. Fort Rucker is located in southeast Alabama, approximately 2 to 3 miles southwest of Ozark, Alabama and 0.5 mile north of Daleville, Alabama. The installation encompasses nearly 98 square miles of land and includes airfields, stagefield and tactical sites, and leased land for rotary-wing pads and fixed-wing airstrips. The installation is bordered to the north and west by agricultural land, to the south by the towns of Daleville and Enterprise, and to the east by the town of Ozark. Background information on each of the sites can be found in Section 1 of the Work Plan, of which this document is Attachment 3-1.

The following topics are covered in the remaining subsections of this GIP: safety issues; geophysical measurement quality objectives (MQOs); description of the site; anticipated munitions and explosives of concern (MEC) types, quantities, compositions, and depths; site physical conditions; adverse geophysical conditions; site utilities and man-made features that may affect the geophysical operation; data acquisition and reporting; and geophysical program QC requirements.

Geophysical instruments will be used during digital geophysical mapping (DGM) survey operations that record instrument response digitally, allowing for the subsequent download and interpretation of the data. DGM instruments will be operated by the DGM subcontractor.

Geophysical instruments used during operations such as clearing locations for emplacement of survey stakes will be analog, meaning these instruments will be used to detect metallic items in the subsurface on a real-time basis and the instrument response will not be recorded. Generally, analog instruments indicate the presence of metallic anomalies through sound or visual display. Analog instruments will be operated by an unexploded ordnance (UXO) Technician II or III.

2.0 Safety Issues

Personnel are required to adhere to the project Health and Safety Plan. Surface metal will be removed at each of the land sites prior to DGM operations. MEC avoidance will be practiced during geophysical surveys and will be provided by one UXO Technician II (or higher) or the CH2M HILL Senior UXO Supervisor (SUXOS). DGM survey personnel will not access land areas outside of the survey area or access routes, as directed by the SUXOS or UXO Technician. Personnel are prohibited from touching, handling, moving, or investigating any item that resembles MEC or material potentially presenting an explosive hazard (MPPEH). Upon encountering a potential MEC/MPPEH item, DGM personnel will retreat to a designated rally point and immediately inform the SUXOS. The SUXOS will inform DGM personnel when it is safe to re-enter an area, escorted by a UXO Technician Level II or higher.

3.0 DGM Personnel Qualifications

DGM operations will be conducted by personnel experienced in MEC geophysical operations and led by a qualified MEC geophysicist. All DGM support personnel onsite will have documentation of completion of the 40-hour Occupational Safety and Health Administration (OSHA) certification, any necessary re-certification (8-hour refresher), and OSHA-compliant medical monitoring physical exams. At least one DGM team member will be qualified to administer first aid and cardiopulmonary resuscitation. Throughout DGM operations, DGM support personnel will strictly adhere to the general practices given in this GIP and specifically in the project Health and Safety Plan.

4.0 Areas to be Investigated

The areas to be investigated are shown in Figures 3-1 through 3-3 of the Work Plan. Control points will be placed on the ground using either a real-time kinematic (RTK) global positioning system (GPS) or conventional survey equipment as required to operate the DGM systems.

5.0 Past, Current, and Future Site Uses

Detailed discussions of the past uses of the sites are provided in Section 1.6 of the Work Plan.

6.0 Anticipated MEC Types, Composition, and Quantities

Table 1 presents a summary of the types of MEC expected to be present in the sites, based on information collected for previous historical records reviews and the 2005 Site Inspection. Also presented in this table are the mechanisms by which the MEC were released. The typical release mechanisms for the sites are intentional activities, such as firing into a target area, and unintentional activities, such as rounds fired falling outside the target area or rounds discarded for various reasons at the firing points.

TABLE 1
Anticipated MEC Types

Range	Potential Munitions	Primary Release Mechanism	Potential MEC
Anti-Tank/Rocket Grenade Range	M6A1, 2.36” Rocket M9A1 Heat Rifle Grenade M17 Fragmentation Grenade MII A1 - MII A4 Practice Grenade M19A1 White Phosphorus Smoke Grenade M21 Practice Grenade M28A2, 3.5” Rocket M9 Rifle Grenade	Munitions firing, potentially from the following weapon systems: 2.36” shoulder-fired rocket, M1 Rifle with rifle grenade attachment, and 3.5” shoulder-fired rocket	Partially/fully functioned grenades/fuzes and rockets/fuzes
Infiltration/Grenade Range	Small arms ammunition .30-caliber ammunition M2/MK2 Hand Grenade M17 Fragmentation Grenade MII A1 - MII A4 Practice Grenade	Hand thrown, and munitions firing, potentially from the following weapon systems: Machine guns, M1 Rifle with rifle grenade attachment	Partially/fully functioned grenades/fuzes
.22-Cal Target Butt	Small arms ammunition	Munitions firing	None

7.0 Anticipated Depth of MEC Items

The anticipated depth of potential MEC items at the sites is from near-surface to greater than 4 feet below ground surface (if buried in disposal pits).

8.0 Vegetation and Topography

Most of the Anti-Tank/Rocket Grenade Range site (39 acres) is now part of the installation golf course. This portion of the site has typical flat to gently rolling golf course terrain with little vegetation other than well-maintained grass. The remaining 18 acres of the site is heavily wooded with underbrush that may be thick after the spring growth season. The wooded terrain is uneven, with much greater topography than the neighboring golf course. Much of the wooded ground surface is covered with fallen limbs and trees.

Most of the Infiltration/Grenade Range site (34 acres) now contains the installation Equestrian Center and golf course driving range. This portion of the site has flat terrain with little vegetation other than well-maintained grass. Numerous buildings, stables, and fenced horse corrals and paddocks fill the southern portion of the site, while the driving range in the north is open. The remaining 10 acres of the site is heavily wooded with underbrush that may be thick after the spring growth season. The wooded terrain is uneven, with much greater topography than the neighboring Equestrian Center and driving range, and numerous horse trails meander through the site. Much of the wooded ground surface is covered with fallen limbs and trees.

The .22-Cal Target Butt site is heavily wooded with underbrush that will be thick after the spring growth season. The terrain is uneven, and several small streams with steep banks meander through the site. A dirt road runs east to west through the northern portion of the area, and a cleared power line right-of-way cuts east to west through the southern portion. A fitness trail with exercise stations passes through various sections of the site.

9.0 Geologic Conditions

The geology of Fort Rucker and the surrounding area is composed of Coastal Plain sediments of Cretaceous and Tertiary age. These deposits primarily consist of unconsolidated sand and clay units with some limestone, sandstone, and siltstone beds. Previous investigations have identified, from oldest to youngest, the Ripley, Providence, Clayton, Nanafalia, Tuscahoma, Hatchetigbee, Tallahatta, and Lisbon formations as present in the stratigraphy of Fort Rucker and the surrounding area. These formations strike east-west, dip to the south, and have a total thickness of approximately 1,200 feet.

The soils of Fort Rucker belong to the Shubata, Cuthbert, Boswell, Eustis, and Ruston series and the Lakeland, Eustis, Norfolk, Ruston, and Cuthbert series. The former series consists of well-drained to poorly drained soils derived from ridge tops and side slopes and has a clayey subsoil, while the latter series contains excessively drained, deep soils derived from ridge tops and steep side slopes. Surface soils are described as high to moderate permeable sandy/silty clays, moderate reddish orange to moderate reddish brown in color. At locations where surface soil samples were collected, soils consisted of a thin topsoil veneer overlying orange to brown sand with varying amounts of silt.

10.0 Shallow Groundwater Conditions

At Fort Rucker and the surrounding area, three distinct aquifer zones have been identified within the unconsolidated and consolidated sediments of the subsurface. The Lisbon aquifer is the uppermost aquifer unit and receives recharge from precipitation. It is unconfined and consists of geologic material of the Lisbon, Tallahatta, and Hatchetigbee formations. Water levels in the Lisbon aquifer range from ground surface to approximately 20 feet below grade, and regional groundwater flow is to the south. The Tuscahoma confining unit separates the Lisbon aquifer from the lower aquifer.

The Nanafalia-Clayton aquifer is the middle aquifer unit and consists of geologic material of the Nanafalia and Clayton formations. This aquifer serves as a source of drinking water for Fort Rucker and surrounding towns. Recharge to the Nanafalia-Clayton aquifer is to the north of Fort Rucker, where the formations are at the ground surface. Regional groundwater flow in this aquifer is to the south, with localized cones of depression at Fort Rucker and surrounding areas as a result of pumping wells. Previous investigations have reported the transmissivity of the Nanafalia-Clayton aquifer at 7.8 square feet per day.

The Providence-Ripley aquifer is the lowermost aquifer of the area and is composed of the Providence and Ripley formations. It is separated from the Nanafalia-Clayton aquifer by a confining clay unit. Recharge to this aquifer is to the north of Fort Rucker, where the formations are at ground surface, and groundwater flow is to the south.

The Fort Rucker potable water supply is provided by groundwater from the Nanafalia/ Clayton and Providence Sand/Ripley formations. The aquifers retain an abundant water reserve to supply the needs of Fort Rucker and the surrounding communities.

Surface water at Fort Rucker occurs in the form of numerous streams and four man-made lakes. The streams primarily serve as wildlife habitats and are not used for recreational or water supply purposes. Lake Tholocco is used for swimming, and Beaver Lake, Buckhorn Lake, and Ech Lake are used for fishing. None of the lakes are used for water supply; however, small groundwater supply wells are located near the shore of Lake Tholocco.

11.0 Adverse Geophysical Conditions

There are no known adverse geophysical conditions that might affect DGM operations.

12.0 Site Utilities

The Anti-Tank/Rocket Grenade Range and the Infiltration/Grenade Range have been developed as part of the installation golf course, Equestrian Center, and golf course driving range. Site utilities, including electricity, sprinkler systems, and drinking and wastewater, are expected throughout the golf course at the Anti-Tank/Rocket Grenade Range and the Equestrian Center at the Infiltration/Grenade Range site. These utilities may affect DGM data in localized areas.

13.0 Man-made Features Potentially Affecting Geophysical Operations

The Anti-Tank/Rocket Grenade Range site contains golf course features such as bunkers, teeing grounds, and putting greens. The Infiltration/Grenade Range site contains driving range features as well as buildings, stables, corrals, bleachers, and fences associated with the Equestrian Center.

14.0 Site-specific Dynamic Events

No site-specific dynamic events (for example, unusually strong winds or harsh weather conditions) that might affect the DGM survey operations at the site are anticipated. Although it is possible that weather conditions may impede operations at some time during the project, no significant delays or effects on geophysical instruments resulting from weather are expected.

15.0 Overall Site Accessibility and Impediments

The survey areas are readily accessible via paved or dirt roads, and access impediments are not anticipated. DGM activities will need to be coordinated with installation personnel to avoid scheduling conflicts with activities at the golf course and Equestrian Center.

16.0 Potential Worker Hazards

No potential worker hazards are apparent at the site other than those associated with conducting project field work. Such hazards are addressed in the project Health and Safety Plan.

17.0 Geophysical System Verification

A geophysical system verification (GSV) process will be used to validate the DGM system to be use for the surveys. The GSV Plan is provided as Attachment 3-2 of the Work Plan.

18.0 DGM MQOs

The primary objective of the DGM activities at the site is to identify metallic anomalies that may be MEC, MPPEH or non-MEC metallic items. MQOs specific to the DGM surveys at the site are provided in the GSV Plan (Attachment 3-2 of the Work Plan). Achievement of the MQOs will be verified by the CH2M HILL Project/QC Geophysicist.

19.0 Geophysical Instrumentation

19.1 Analog Geophysical Instruments

The analog geophysical instruments to be used during non-DGM operations where a geophysical instrument is needed to detect metallic items will be a Schonstedt GA-52Cx magnetometer. The Schonstedt GA-52Cx fluxgate gradiometer is a handheld analog magnetometer that detects ferrous objects and ferromagnetic minerals. The instrument provides an audible signal representing the magnitude and direction of the local magnetic field. In application, the operator sweeps the instrument back and forth in the area of interest and monitors the change in pitch of the sound emanating from the instrument. The change in pitch is the magnetometer response to a secondary magnetic field produced by a ferrous metallic item in the area of interest. This instrument will only be used in areas where non-ferrous MEC items are not considered likely to be present.

In cases where non-ferrous MEC items are potentially present, the White's XLT will be used. The White's XLT is an electromagnetic (EM) metal detector that uses a transmitter coil to establish a localized EM field that induces eddy currents in nearby conductive materials. A co-located receiver coil then measures the eddy current response and the system provides an audible and visual signal representing the magnitude of the response. In application, the operator sweeps the instrument back and forth in the area of interest and monitors the change in pitch of the sound emanating from the instrument.

19.2 DGM Instruments

Geonics EM61-MK2. The DGM instrument to be used for the DGM survey will be the EM61-MK2. The EM61-MK2 is a high-resolution time-domain electromagnetic instrument designed to detect, with high spatial resolution, shallow ferrous and non-ferrous metallic objects. In comparison with other metal detectors, especially magnetometers, it is much better suited for work in close proximity to man-made structures and in areas of dense subsurface metallic debris. The standard EM61-MK2 system consists of two air-cored, 1-meter (m) by 0.5-m coils, a digital data recorder, batteries and processing electronics. The EM61-MK2's transmitter generates a pulsed primary magnetic field, which then induces eddy currents in nearby metallic objects. Each of the two spatially separated receiver coils measures these eddy currents. The EM61-MK2 offers the ability to measure the eddy currents at three distinct time intervals in the bottom coil or four intervals if no top coil measurements are recorded. Earlier time gates provide enhanced detection of smaller metallic objects. Secondary voltages induced in both coils are measured in millivolts. The arrangement of coils in the standard setup is such that there is a vertical separation of 40 centimeters (cm). Assuming accurate data positioning, target resolution of approximately 0.5 m can be expected.

Positioning of the EM61-MK2 data will be performed either using an RTK GPS or, in areas of the site where tall vegetation will obstruct line-of-sight with the satellites required for global positioning system (GPS) positioning, odometer or fiducial positioning methods will be used.

Global Positioning Systems. GPS satellites orbit the earth transmitting a signal that can be detected with a GPS receiver. The GPS receiver uses the known locations of the satellites and the time of signal transmittal to calculate its position. Differential GPS increases the accuracy of GPS readings through the use of two receivers: a stationary receiver that acts as a base station and collects data at a known location and a second roving receiver that makes the position measurements. The base stations can be configured to either transmit the correction data to the rover system or to save the data to be used to correct positional data during post-processing. RTK GPS instruments are ideal for field-mapping applications when satellite visibility conditions are adequate because they provide the highest (sub-centimeter accuracy) GPS accuracy possible. Typical accuracies of geophysical data positioning after adding errors induced by the DGM system operation are in the range of 20 to 50 cm.

Odometer and Fiducial Methods. Odometer methods use a procedure wherein a measuring device (for example, wheel-based, thread-feeding) is used to calculate the distance traveled along a linear transect. Using this approach, a series of survey lanes are established over a grid. Flags are placed at the beginning and end of each lane and an operator walks down the lane while sensor readings are collected when triggered by the odometer system at a pre-defined interval (for example, every 20 cm). As the operator walks past the starting and ending points in the survey lane, the operator stops the data collection. By assuming the operator walked in a straight line, the total distance recorded by the odometer system is compared to the known distance travel and the down-line position for each of the data points is adjusted accordingly.

Fiducial methods use a time-marking procedure to obtain the spatial location of the collected data. As in the odometer approach, a series of survey lanes are established over a grid. Flags are placed at the beginning and end of each lane, and at equal distances along the transect (for example, every 30 m). An operator walks down the lane while the data logger collects sensor readings at a prescribed sampling interval. As the operator walks past the starting, fiducial, and end lines in the survey lane, the operator presses a button on the data logger that places a fiducial time mark in the data stream. By assuming the operator walked in a straight line at a constant velocity, the location of each data point can be calculated.

20.0 Data Acquisition, Processing, and Reporting

20.1 Field Data Sheets

Field information will be recorded in the Munitions Response Site Information Management System (MR-SIMS) field devices and will include:

- Site ID
- Grid ID (or other identifier of surveyed area)
- Field team leader name
- Field team members' names
- Date of data collection
- Instrument used
- Positioning method used
- Instrument serial numbers
- File names in data recorders
- Data collection sampling rate
- Line numbers, survey direction, fiducial locations, start and end points
- Weather conditions
- Grid conditions
- Terrain conditions
- Cultural conditions (roads, landscaping, etc.)
- Survey area sketch

- Associated QC data file names
- Field notes (other)

20.2 Data Processing

Instrument-specific software will be used for initial data processing, and the output will be imported into Geosoft Oasis Montaj™ for additional processing, graphical display, anomaly selections, and quality assurance (QA)/QC. The types of processing used will be system-specific, but the general processing steps that may be performed on the data include the following:

- Positional offset correction
- Sensor bias, background leveling and/or standardization adjustment
- Sensor drift removal
- Latency or lag correction
- Geophysical noise identification and removal (spatial, temporal, motional, terrain induced)
- Contour level selection with background shading
- Digital filtering and enhancement (low pass, high pass, band pass, convolution, correlation, non-linear, etc.)

20.3 Interpretation/Anomaly Selection

MEC-experienced data processing geophysicists will use the following criteria, supplemented by site- and system-specific criteria established during instrument validation[1], for selecting and locating anomalies as potentially representing subsurface MEC:

- Maximum amplitude of the response with respect to local background conditions
- Lateral extent (plan size) of the area of response
- Three-dimensional shape of the response
- Decay curve characteristics
- Location of the response with respect to the edge of the grid, unsurveyable areas, land features, cultural features, or utilities within or adjacent to the grid
- Potential distortions in the response from interference of nearby cultural features

Anomalies potentially representing subsurface MEC will then be randomly selected for intrusive investigation.

---

[1] The targeting threshold will be determined through evaluating known EM61-MK2 response curves for specific munitions items potentially present within each area and the background geophysical “noise”. A threshold will be selected beneath the smallest expected amplitude but with a signal to noise ratio of at least 3 to 1.

20.4 Target Locations

The target analysis process culminates in the creation of digital target location sheets that contain target information, location, and amplitude and can be used for future investigation operations.

20.5 Grid Maps

With each target sheet, the DGM subcontractor will also provide a grid map containing the following information:

- Client
- Project
- Contractor
- Map creator
- Map approver
- Date map was created
- Map file name (full path and file extension)
- Scale
- Grid identification
- Grid corner locations
- Contoured data
- Anomaly locations with unique identification numbers
- North arrow, legend, title block, etc.

20.6 Records Management

All files will be made available for QC verification during the project to verify that the field and data processing procedures were properly implemented. All raw data files, final processed data files, hard copies, and field notes will be maintained for the duration of the project.

20.7 Final Reports, Maps, and Geophysical Mapping Data

No later than 3 work days after collection, the DGM subcontractor will provide each day’s data for QC inspection via the Internet using a file transfer protocol site, electronic mail (email) attachments for small files under 5 megabytes, or digital compact disk. Such data are considered to be in raw form. These data will e corrected for sensor offsets, diurnal variations, latency, heading error (if magnetometer is used), and drift. The DGM subcontractor also will provide a digital planimetric map, in Geosoft format and coincident with the location of the geophysical survey, so that each day’s geophysical data set can be registered within the original mission plan survey map.

All geophysical field data will be provided to CH2M HILL in delineated fields as x, y, z, v1, v2, and so on, where x and y are Universal Transverse Mercator grid plane coordinates in easting (meters) and northing (meters) directions and z (elevation is an optional field in feet), v1, v2, v3, and so on are the instrument readings. The last data field will be a time stamp. Each data field will be separated by a comma or tab. No individual file will be more than 100 megabytes in size and no more than 600,000 lines long. Each grid of data will be logically and sequentially named so that the file name can be easily correlated with the grid name used by other project personnel.

Within 45 days of data collection, the processed geophysical field data, all final maps, and supporting geophysical interpretations will be provided to CH2M HILL. All geophysical data will be accompanied by a report (standard report format out of MR-SIMS) documenting the field activities associated with the data and the processing performed. Information provided by the MR-SIMS report is summarized in Table 2.

TABLE 2
Processing Documentation Requirements

Information Type	"Raw" Data Delivery Report	Final Data Delivery Report	Must be in File Headers
Site ID	X	X	X
Geophysical instrument type used	X	X	
Positioning method used	X	X	
Instrument serial numbers (geophysical and positioning)	X	X	
Coordinate system and unit of measure	X	X	
Grid ID (or other identifier of surveyed area)	X	X	X
Date of data collection	X	X	X
Raw data file names associated with delivery	X	X	
Processed data file names associated with delivery	X	X	
Name of Project Geophysicist	X	X	
Name of Site Geophysicist	X	X	
Name of data processor	X	X	
Data processing software used	X	X	
Despiking method and details	X	X	
Sensor drift removal and details	X	X	
Latency/lag correction and details	X	X	
Sensor bias, background leveling and/or standardization adjustment method and details		X	
Portable document format (PDF) document showing graphical results of each field quality control test	X	X	
Geophysical noise identification and removal (spatial, temporal, motional, terrain induced) and details		X	
Other filtering/processing performed and details		X	
Gridding method		X	

TABLE 2
Processing Documentation Requirements

Information Type	"Raw" Data Delivery Report	Final Data Delivery Report	Must be in File Headers
Anomaly selection and decision criteria details		X	
Geosoft ".xyz" file for unit of survey being delivered (e.g., grid or area agreed upon with Geophysicist)		X	
Geosoft ".grd" file for unit of survey being delivered		X	
Geosoft ".map" file for unit of survey being delivered		X	
PDF of Geosoft map for unit of survey being delivered		X	
Geosoft ".map" mosaic of all processed data to date		X	
PDF mosaic of Geosoft map of all processed data to date		X	
Other processing comments		X	
Date data processing is completed	X	X	
Data delivery date	X	X	
Scanned copy of field notes and field mobile data collection device notes (if applicable)	X		

All sensor data will be correlated with navigational data, based on a local "third order" (1:5,000) monument or survey marker. If a suitable point is not available, a land surveyor will establish a minimum of two new monuments or survey markers with a minimum of third-order accuracy.

An extensive QC program will be applied to the DGM operations at the site, with documentation in MRSIMS (as described in Section 3.10.1 of the Work Plan). Figure 1 shows an overall chart of the QC steps.

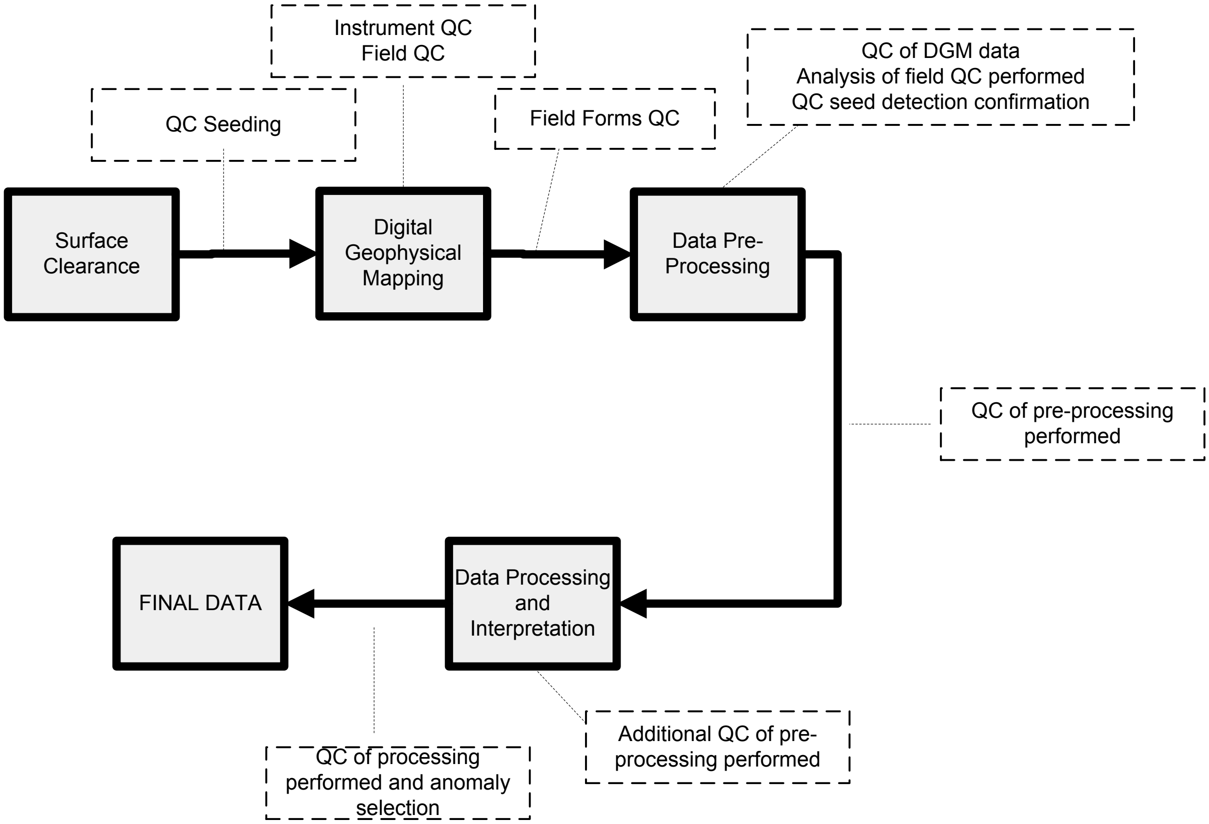

FIGURE 1
Overview of DGM Process QC

20.8 QC Tests

Each of the DGM systems will be field tested by the DGM field team to confirm proper operating conditions. Several basic QC tests will be performed in addition to instrument-specific tests. A description of each basic QC test, its acceptance criteria, and its frequency is provided below and summarized in Table 3.

1. **Equipment Warm-up**. This is an instrument-specific activity, although standard warm-up time is 5 minutes. Some geophysical systems require more warm-up time than others. Each system-specific standard operating procedure defines the equipment-specific warm-up time. Equipment warm-up will be performed the first time an instrument is turned on for the day or has been turned off for a sufficient amount of time for the specific instrument to cool down.
2. **Record Sensor Positions**. Positioning accuracy of the final processed data will be demonstrated by operating the equipment over one or more known points. The accuracy of the data positioning will be assessed by calculating the difference between a known location over which a positioning instrument is held and the displayed position. The sensor position test will be conducted at the beginning of the survey operation for each work day.
3. **Personnel Test.** *(Land-based system only.)* This test checks the response of instruments to personnel and their clothing/proximity to the system. On a daily basis, the instrument coils for those instruments being used that day will be checked for their response to the personnel operating the system. The response will be observed in the field for immediate corrective action and transmitted back to the processor, and analyzed and checked for spikes in the data that could create false anomalies. The personnel test will be conducted at the beginning of the survey operation for each work day.
4. **Vibration Test (Cable Shake).** This test checks the response of instruments to vibration. On a daily basis, the instrument coils/sensors for those instruments being used that day will be checked for their response to vibrations in the cables. The response will be observed in the field for immediate corrective action and transmitted back to the processor and analyzed and checked for spikes in the data that could create false anomalies. The vibration test will be conducted at the beginning of the survey operation for each work day.
5. **Static Background and Static Spike**. Static tests will be performed by positioning the survey equipment within or near the survey boundaries in an area free of metallic contacts and collecting data for at least 1 minute. During this time, the instrument will be held in a fixed position without a spike (known standard) and then with a spike. The purpose of the static test is to identify any unusual levels of instrument or ambient noise. The static background and static spike test will be conducted at the beginning and end of each survey operation.
6. **Repeat Data.** This test is performed to verify repeatability of the data and will be performed after the initial survey over an area. At least 2 percent of the survey area will be resurveyed.

TABLE 3
DGM Instruments Standardization Tests and Acceptance Criteria

Test	Test Description	Acceptance Criteria	Power On	Beginning of Day	Beginning and End of Day	2% of Total Area Surveyed
1	Equipment Warm-up	Equipment specific (typically 5 minutes)	X			
2	Record Sensor Positions	± 4 inches (2.54 cm)		X		
3	Personnel Test	Based on instrument used. Personnel, clothing, etc. should have no effect on instrument response		X		
4	Vibration Test (Cable Shake)	Data profile does not exhibit data spikes		X		
5	Static Background & Static Spike	± 20% of standard item response, after background correction			X	
6	Repeat Data	Qualitative comparison of data				X

20.9 QC Seed Items

At least one QC seed item, a small industry standard object (discussed in the GSV Plan in Attachment 3-2 of the Work Plan) will be seeded per 0.75 acre in the survey areas. The seed items will be tagged with labels identifying them as inert and providing a contract reference, a point of contact address, phone number, and a target identifier. CH2M HILL personnel will perform seeding using hand tools. The seed locations will be checked using a hand-held analog geophysical instrument to confirm that no existing anomalies are present at the seed location. Once placed, the locations of all seeded items will be surveyed using an RTK differential global positioning system or conventional survey equipment. The items will be placed at easily detectable depths in order to have a high enough signal-to-noise ratio to compare to known industry standard target values. Detection of the QC seed items will be monitored by CH2M HILL, and if an item is not detected, a root-cause analysis will be performed and corrective actions identified.

20.10 QC of DGM Data and Deliverables

Both the DGM subcontractor and CH2M HILL will perform QC of geophysical data and data deliverables at each step of the processing path. Figure 2 shows the processing path and the QC steps performed. Data will not move to the next stage until they have passed the QC check.

QC checks to be performed on field forms, pre-processed data, and processed data by the QC geophysicist can be found in Table 2.

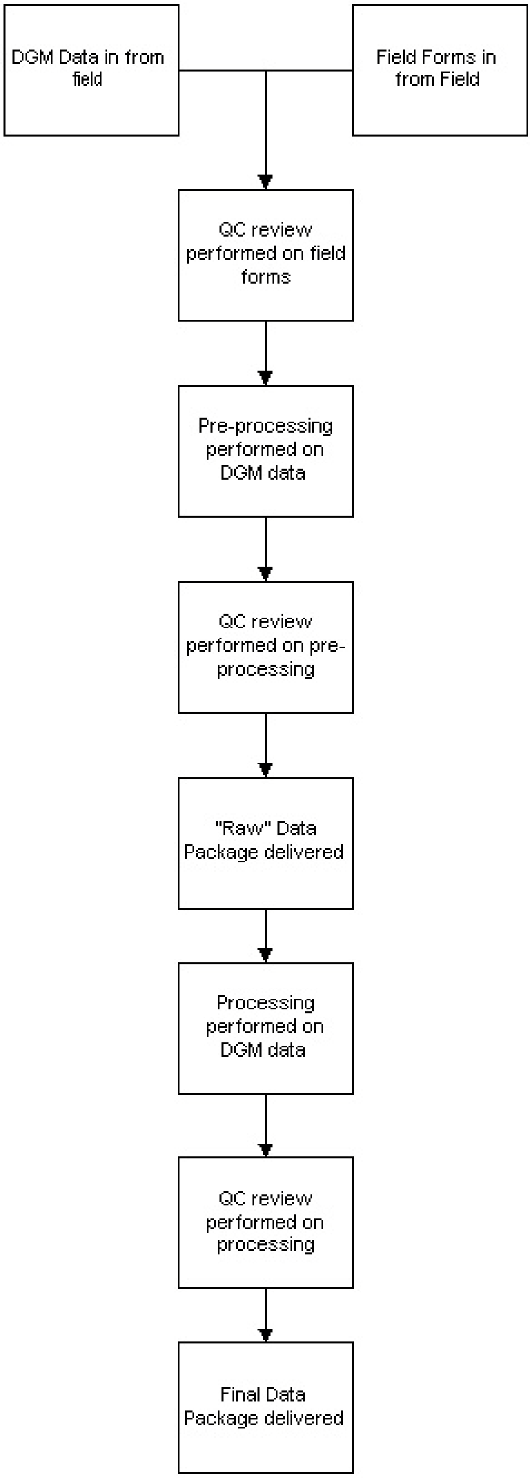

FIGURE 2
QC of DGM Data – Process Flowpath

20.11 Corrective Measures

Deficiency identification and resolution procedures are described in Section 4.5 of the Work Plan. Specific corrective measures for DGM survey are related to the type of geophysical equipment used; however, the following are the basic corrective measures to be followed in association with DGM surveying:

- Replacement of sensors if they fail to meet instrument check requirements.
- Resurvey of grids if seeded items are not identified (do not show in the DGM data).
- When there is a failure to select a seed item from the data but the item is clearly present in the DGM data, a re-analysis of the DGM data will be performed instead of a resurvey.

If DGM data do not pass the data QC requirements the data will be recollected.

21.0 Analog Geophysical Systems QC

QC over the analog geophysical instruments will be accomplished through daily checks that the instruments are functioning before using them for field activities. Each instrument will be operated over a small ferrous metallic item. If the instrument is not able to detect the item, it will be taken out of use until it is repaired.

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Attachment 3-2
Geophysical System Verification Plan

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Geophysical System Verification Plan

MEC RCRA Facility Investigation

Anti-Tank/Rocket Grenade Range - FTRU-001-R-01
Infiltration/Grenade Range - FTRU-003-R-01
.22-Caliber Target Butt - FTRU-004-R-01

Fort Rucker, Alabama

FINAL Revision 1

Contract W91ZLK-05-D-0014
Task Order No. 0001

Prepared for:

U.S. Army Environmental Command

Prepared by:

CH2MHILL

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Atlanta, Georgia

September 21, 2011

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Contents

Tables

Figures

Attachments

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Acronyms and Abbreviations

cm	centimeter
DGM	digital geophysical mapping
GIP	Geophysical Investigation Plan
GSV	geophysical system verification
GPS	global positioning system
in	inch
ISO	industry standard objects
IVS	instrument verification strip
MEC	munitions and explosives of concern
NRL	Naval Research Laboratory
MQO	measurement quality objective
QC	Quality Control
RTK	real-time kinematic

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Geophysical System Verification

Geophysical system verification (GSV) is a physics-based, presumptively selected technology process in which signal strength and sensor performance are compared to known response curves of industry standard objects (ISOs) to verify digital geophysical mapping (DGM) systems prior to and during site surveys. The GSV process is designed to perform initial verification of the proposed DGM system using an instrument verification strip (IVS), followed by a "blind" seeding program for continued verification throughout the field operations.

1. IVS

The initial phase of the investigation to locate munitions and explosives of concern (MEC) as well as non-MEC metallic items in the subsurface at each site will be verification of the presumptively selected DGM system using an IVS.

1.1 Personnel and Qualifications

The following individuals will be involved in the IVS:

- CH2M HILL Project/Quality Control (QC) Geophysicist
- DGM subcontractor's Site Geophysicist
- DGM subcontractor's Field Geophysicist or Geophysical Technician
- DGM subcontractor's Data Processor

DGM subcontractor personnel involved in performance of the IVS and the production geophysical surveys will meet the following qualifications:

- **Project/QC Geophysicist**: will have a degree in geophysics, geology, geological engineering, or a closely related field, and have a minimum of 5 years of directly related geophysical experience. This individual will be capable of managing a geophysical data collection and processing project/program, including several task orders/sites, and will have at least 1 year of experience in managing geophysical operations on a MEC site.

- **Site Geophysicist**: will have a degree in geophysics, geology, geological engineering, or a closely related field, and have a minimum of 2 years of directly related geophysical experience. This individual will be capable of competently managing personnel, equipment and data on projects requiring multiple geophysical field teams and geophysical data processors and will have at least 1 year of experience in performing geophysical operations on an MEC site.

- **Field Geophysicist**: will have a degree in geophysics, geology, geological engineering, or a closely related field, will have a minimum of 2 years of directly related geophysical experience and will have at least 1 year of experience in performing geophysical operations on an MEC site.

- **Geophysical Technician:** will have at least 6 months of experience in geophysical data collection on MEC-related projects.
- **Geophysical Data Processor:** will have a degree in geophysics, geology, geological engineering, or a closely related field, and will have at least 6 months of experience in processing geophysical data related to MEC projects.

1.2 Digital Geophysical Mapping System

The presumptively selected DGM system to be verified and used for the production surveys will consist of the Geonics EM61-MK2 time domain electromagnetic metal detector, with positioning provided by either a real-time kinematic (RTK) global positioning system (GPS) or odometer/fiducial methods. The system and positioning methods are discussed in detail in the Geophysical Investigation Plan (GIP), of which this document is an appendix.

1.3 Location and Length of IVS

An area near, or within, the site will be selected for the IVS. The exact location of the IVS will be selected during the initial mobilization to the site. The IVS will be set up as a strip of approximately 25 meters or longer.

1.4 Industry Standard Objects

The ISO items (see Figure 1-1) to be used in the IVS are 1-inch (in) (2.54 centimeters [cm]) by 4-in (10.16 cm) steel pipes (part number 44615K466) from the McMaster-Carr online catalog (http://www.mcmaster.com/):

Shape: Straight Nipple, Threaded Both Ends
Schedule: 40
Pipe Size: 1in (1.315-in outer diameter)
Length: 4in
Finish: Black Welded Steel

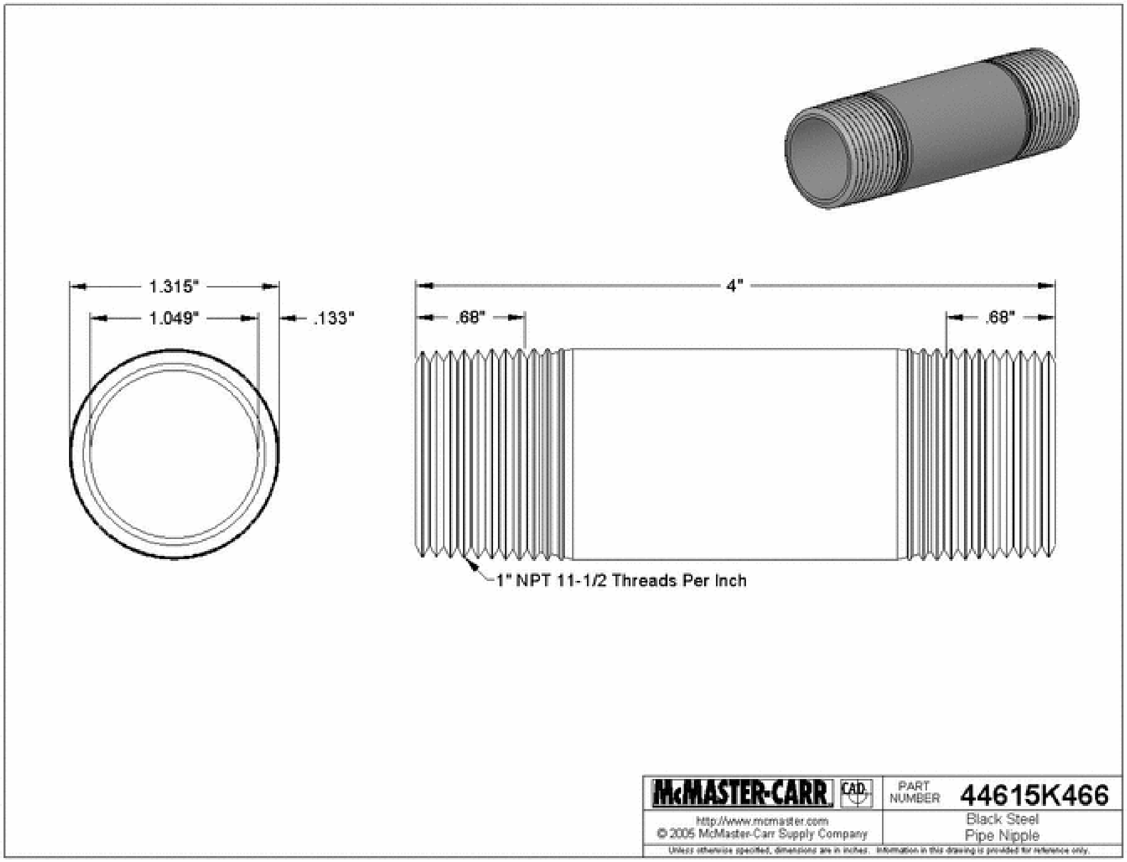


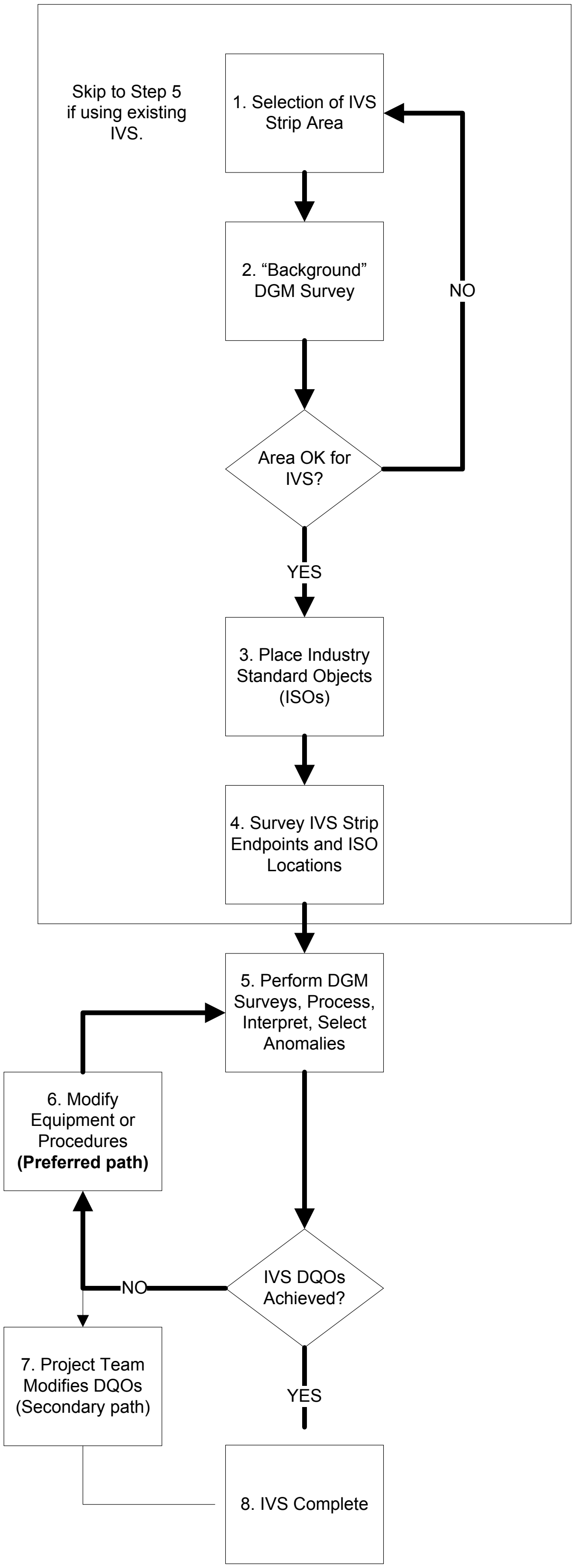
FIGURE 1-1
Industry Standard Object

Instrument response curves for this ISO have been developed by the Naval Research Laboratory (NRL) demonstrating their standard response under their best orientation (perpendicular to the EM61-MK2 instrument plane to cause the highest peak amplitude response) and worst orientation (parallel to the instrument plane and perpendicular to the direction of travel to cause the lowest peak amplitude response) at multiple distances from the instrument's bottom transmit/receive coil (NRL/MR/6110--09-9183, entitled "EM61-MK2 Response of Three Munitions Surrogates").

1.5 IVS Procedures

A qualified and experienced MEC DGM operations geophysical team (discussed in Section 1.1) will employ the system to be verified over the IVS. This section discusses the IVS process and the procedures to be employed (numbered in accordance with the steps shown on Figure 1-2) during site work.

FIGURE 1-2
IVS Process



1. An IVS area will be selected with preference for the following (although none of the conditions are vital for IVS success):
    (a) Terrain, geology and vegetation similar to that of a majority of the project site
    (b) Geophysical noise conditions similar to those expected across the survey area
    (c) Large enough site to accommodate all necessary IVS tests and equipment and for adequate spacing (at least 3m) of the ISO items to avoid ambiguities in data evaluation
    (d) Readily accessible to project personnel
    (e) Close proximity to the actual survey site (if not within the site)
2. A "background" DGM survey will be performed by the DGM subcontractor with the instrument to be validated over the IVS. This step will allow background geophysical conditions to be recorded, help determine the appropriateness of the location (e.g., few existing anomalies), and verify that ISOs are not seeded near existing anomalies. The data will be post-processed (e.g., filtered and positions attached to the geophysical data) and provided to the CH2M HILL Project Geophysicist for evaluation.
3. Following verification that the IVS area is clear of subsurface anomalies (or that existing anomalies can be avoided during seeding), two ISO items will be buried parallel to the plane of the EM61-MK2 system's transmit/receive coil (i.e., horizontally) and oriented along the direction of travel at depths of approximately three and seven times their diameter. The approximate IVS setup will be as shown on **Figure 1-3.**

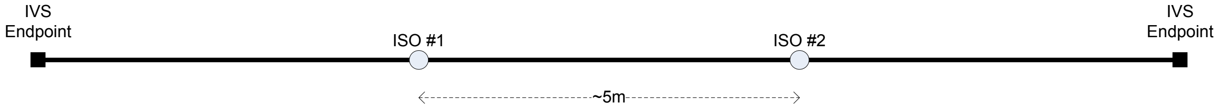


FIGURE 1-3
IVS Strip

4. Measurements of the item depths will be to the center of mass of each item. CH2M HILL personnel will bury the ISOs using shovels to dig the holes to the appropriate depths for burial of the seed items. The background survey data and anomaly avoidance techniques will be used to ensure that end stakes and ISOs are not placed on top of or near existing anomalies. Personnel will emplace ISOs and record the emplacement data (depth, orientation, and azimuth). An RTK GPS or conventional Total Station survey equipment will be used to record the center of each ISO location and the IVS endpoints. The holes will then be filled with soil and a polyvinyl chloride surveyor's flag or 6-inch wooden survey stake placed at each ISO location
5. A DGM survey will be performed by the DGM subcontractor over the IVS area, including transects as described in Table 1-1 and shown on Figure 1-4. The data will be processed and interpreted by the DGM subcontractor and provided to the CH2M HILL Project Geophysicist for confirmation within 12 hours of completion of the survey.

TABLE 1-1
IVS Transects Descriptions and Purpose

Transect	Description	Purpose
A	offset by 0.75m	Demonstrate horizontal drop off of item response
B	directly over center of strip	Verify response vs established response curves
C	offset by 0.37m (1/2 intended lane separation) from center of strip	Demonstrate horizontal drop off of item response
D	offset by 0.75m (on opposite side of strip from Transect A)	Demonstrate horizontal drop off of item response
E	offset by ~3m from strip	Measure background noise

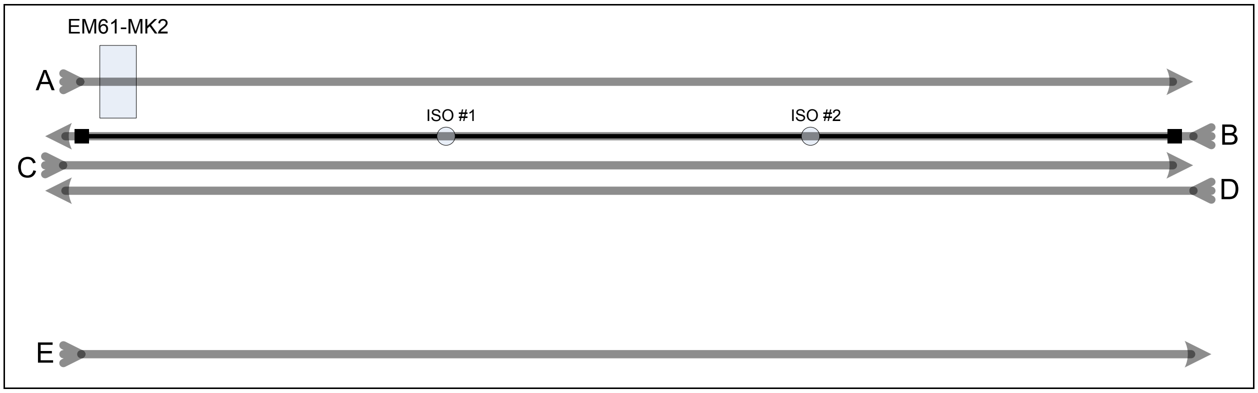


FIGURE 1-4
IVS Transects

6. If the initial measurement quality objectives (MQOs) have not been met, the CH2M HILL Project Geophysicist will meet with the DGM subcontractor to discuss whether modifications to instrumentation or procedures can be made to the DGM system in order to meet the MQOs.
7. If the MQOs cannot be met by the DGM subcontractor, the CH2M HILL Project Geophysicist will meet with the project team to discuss a resolution (i.e., modification of a MQO) prior to completing the IVS.
8. Once the surveys have been performed and the system has been determined to meet the initial (or modified) MQOs, the IVS will be complete.

1.6 Measurement Quality Objectives

The testing in the IVS area will verify the ability of the system to achieve the specific MQOs listed in Table 1-2. The system will not be used for site surveys until it is able to meet the IVS MQOs or until the project team agrees on reasoning behind a MQO not being met and an appropriate revised MQO.

Additional MQOs for production surveys will be monitored during through the ISO "blind"-seeding program and other quality control tests, as discussed in the GIP. The IVS MQOs, measurement performance criteria, and test method to be used during the IVS are summarized in Table 1-2 and discussed in detail in the following subsections.

General System Verification

DGM System Positioning

The MQO for DGM systems positioning is that the coordinates being obtained from the positioning system are at a sufficient enough accuracy to allow for appropriate relocation of MEC items for intrusive investigation. The measurement performance criterion is that the positional error at known monuments will not exceed 25cm (9.8 in). This will be evaluated during the IVS by ensuring that the anomalies representing the ISO seeds in the IVS data are positioned within this distance from the measured locations.

DGM System Munitions Detection

The MQO for munitions detection is to demonstrate that the system in use is capable of detecting munitions within industry standards. This is demonstrated through a physics-based presumptively selected technology process in which signal strength and sensor performance are compared to validated industry values. As an example, for the EM61-MK2 this process involves demonstrating that the maximum amplitude response over a standard item falls within the sensor response curve for that item, as demonstrated by NRL tests for that item (see Figure 1-5). Once it has been established that the system is responding comparably, a cross-correlation of industry experience with detection of munitions items can be assumed. In other words, the depths and orientations of munitions items which the EM61-MK2 has been shown to be effective at detecting under test scenarios[1] and other projects can be expected.

Because minor changes in the coil height as it passes over the item and slight variations in the path traveled down the IVS can significantly affect the amplitude response received from the instrument, the IVS results will be qualitatively evaluated. A determination that the geophysical instrument itself is responding within a specific threshold will be through the spike test results (see Section 1.7) wherein the distance from the coil and orientation of the item can be strictly controlled.

TABLE 1-2
Project Measurement Quality Objectives

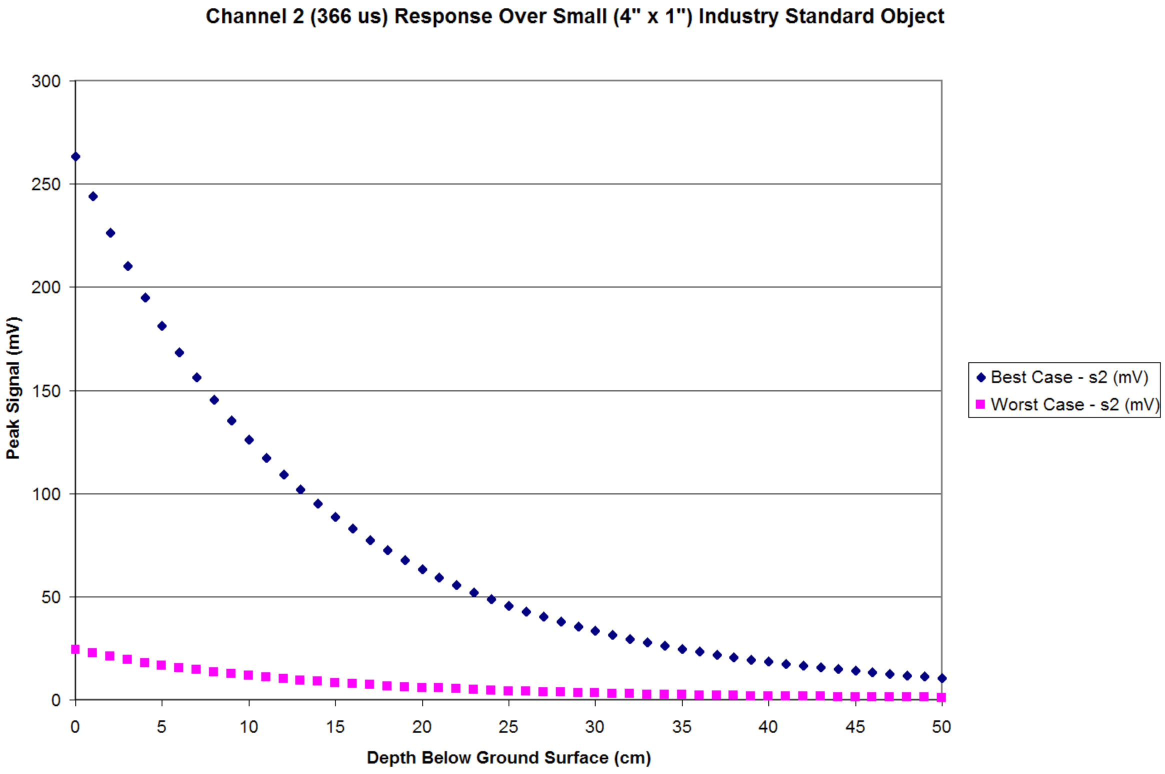
Data Quality Objective	Measurement Performance Criteria	Test Method During IVS
General System Verification		
DGM System Positioning. Accurate coordinates are being obtained from DGM positioning systems.	Positional error of ISO seeds will not exceed 25 cm (9.8 in).	Results of IVS DGM survey vs IVS seed locations will be evaluated to ensure compliance.
DGM System Munitions Detection. DGM system response is within industry standards for detection.	Response to ISO is comparable to published or calculated results for that item.[1] Response to standardized item will not vary more than ±20%of expected value in static test.	Results of IVS surveys over seed items in strip will be qualitatively reviewed. Results of static test will be quantitatively reviewed to ensure compliance.
DGM Surveys		
Ordnance detection: DGM survey system response is comparable to expected response of geophysical instrument.	Sensor response over specific items to be compared to response of geophysical instrument over similar items under previous test or field production conditions.	Results of IVS DGM survey vs. known IVS sensor responses over the seed items will be evaluated to ensure compliance.
Downline data density is sufficient to detect MEC items.	Over 98% of possible sensor readings are captured along a transect with a spacing of no greater than 0.7 ft (0.213 m) between points. In addition, any transect containing a downline data gap of 2 ft or greater does not meet the MQO.	The IVS DGM survey data will be evaluated to ensure compliance.
Positioning of detected anomalies is accurate.	95% of anomaly locations associated with a seeded item (blind seed) are within 1-meter radius of the item location.	The IVS DGM survey data will be evaluated to ensure compliance.
Data Handling		
All data must be delivered in a timely manner and in a useable format.	IVS data are completed and delivered within 12 hrs.	Evaluate based on actual delivery of data

---

[1] 1 NRL/MR/6110--08-9155 (EM61-MK2 Response of Standard Munitions Items), Final Report for the Evaluation of UXO Detection Technology at the Standardized UXO Test Sites Aberdeen and Yuma Proving Grounds, Standardized UXO

Technology Demonstration Site Program, SERDP, November 2007. Demonstrator scoring results: http://aec.army.mil/usaec/technology/uxo01f.html

FIGURE 1-5
NRL Results for Small (4 inch x 1 inch) Industry Standard Object Tested under EM61-MK2 Bottom Coil
Reference: NRL/MR/6110-09-9183



Data Handling

The MQO for data handling is that all data must be delivered in a timely manner and in a useable format. Because of the need for rapid feedback during IVS operations to effectively test potential DGM systems, the measurement performance criterion for data handling during IVS activities will require that initial data be completed and delivered to the CH2M HILL Project Geophysicist within 12 hours of data collection. Final processed data for the IVS shall be delivered to the CH2M HILL Project Geophysicist within 3 working days of data collection. This MQO will be evaluated based on the actual delivery of data during the IVS.

1.7 Quality Control

Achievement of the instrument evaluation MQOs will be verified by the CH2M HILL QC geophysicist. The selected IVS area, the process of emplacing the IVS items, and the survey locations will be verified through observation during the IVS. Geophysical subcontractor-provided standard operating procedures (SOPs) *(to be provided as an addendum to this Plan in the final version)* will be checked to ensure that equipment and procedures are being checked per standard procedures for the system employed. The QC tests listed in Table 1-3 and detailed in the following subsections will be performed on the geophysical system being utilized.

TABLE 1-3
Geophysical Instrument Standardization Tests and Acceptance Criteria

Test	Test Description	Acceptance Criteria	Power on	Beginning of day	Beginning and end of day
1	Equipment Warm-up	Equipment specific (typically 5 min)	x		
2	Record Sensor Positions	+/- 4 inch (2.54cm)		x	
3	Personnel Test	Based on instrument used. Personnel, clothing, etc. should have no effect on instrument response.		x	
4	Vibration Test (Cable Shake)	Data profile does not exhibit data spikes		x	
5	Static Background & Static Spike	+/- 20% of standard item response, after background correction			x

1. **Equipment Warm-up**. All geophysical equipment will be warmed up a minimum of 5 minutes. Equipment warm-up will be performed the first time an instrument is turned on for the day or has been turned off for a sufficient amount of time for the specific instrument to cool down.

2. **Record Sensor Positions**. Positioning accuracy of the final processed data will be demonstrated by operating the equipment over one or more known points. The accuracy of the data positioning will be assessed by calculating the difference between a known location over which a positioning instrument is held and the displayed position. The sensor position test will be conducted at the beginning of the survey operation for each work day.

3. **Personnel Test.** This test checks the response of instruments to personnel and their clothing/proximity to the system. On a daily basis, the instrument coils/sensors for those instruments being used that day will be checked for their response to the personnel operating the system. The response will be observed in the field for immediate corrective action and transmitted back to the processor, and analyzed and checked for spikes in the data that can possibly create false anomalies. The personnel test will be conducted at the beginning of the survey operation for each work day.

4. **Vibration Test (Cable Shake).** This test checks the response of instruments to vibration. On a daily basis, the instrument coils/sensors for those instruments being used that day will be checked for their response to vibrations in the cables. The response will be observed in the field for immediate corrective action and transmitted back to the processor and analyzed and checked for spikes in the data that can possibly create false anomalies. The vibration test will be conducted at the beginning of the survey operation for each work day.

5. **Static Background and Static Spike**. Static tests are performed by positioning the survey equipment within or close to the survey boundaries in an area free of metallic

contacts and collecting data for a specific period, while holding the instrument in a fixed position without a "spike" (small ISO placed at accurately measured distance and orientation from the transmitter coil, as in the example shown in Figure 1-6) and then with a "spike." The purpose of the static test is to determine whether unusual levels of instrument or ambient noise exist. The static background and static spike test are conducted at the beginning and end of each survey operation. This is the test that essentially "opens" and "closes" out a survey area (grid, grid block, set of transects, etc.)

The ISO can be placed above or below the EM61-MK2 transmitter coil as long as the distance is measured from the center of mass of the item to the horizontal plane of the coil (top of coil if item placed above coil, bottom of coil if item placed below), as illustrated in Figure 1-6.

1.8 Data Analysis and Interpretation

All data collected at the IVS test strip will be post-processed and analyzed. Instrument-specific data processing SOPs will be provided as an addendum to this Work Plan after subcontractor selection.

1.9 IVS Data Evaluation

The CH2M HILL QC Geophysicist will evaluate the data provided by the geophysical subcontractor and validate for the project team whether the selected geophysical system meets the IVS MQOs.

2. "Blind" Seeding

As a continuing part of the GSV process, ISOs will be used as "blind" QC seeds in the areas to be surveyed to provide ongoing verification that the DGM system is properly functioning and the munitions detection and positioning MQOs are continuing to be met.

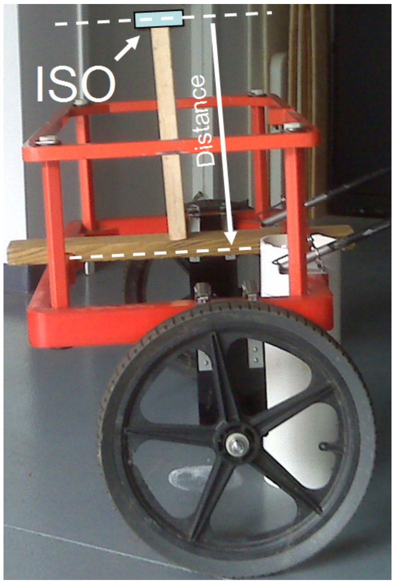


FIGURE 1-6
Example Spike Test Setup

2.1 Seeds Placement

Seeds will be buried vertically at a depth of approximately 6 to 12 in below ground surface, with the depth being measured to the center of mass of the item, as illustrated by Figure 2-1. Depths will be recorded in field notes.

The field team leader will be responsible for labeling each QC seed with a unique identifier. These can either be labeled with a paint pen or with a weather-resistant label taped to or secured within the seed.

QC ISOs (Nelson et al., 2009) will be placed along transects, directly between survey stakes so the data collection crews will pass over them, and an Alabama-licensed PLS will record these locations. For open areas in which transects are not bounded by cut vegetation and stakes, the QC seed will be placed along the section between two flags but the location will be obscured such that the team does not know where it is placed.

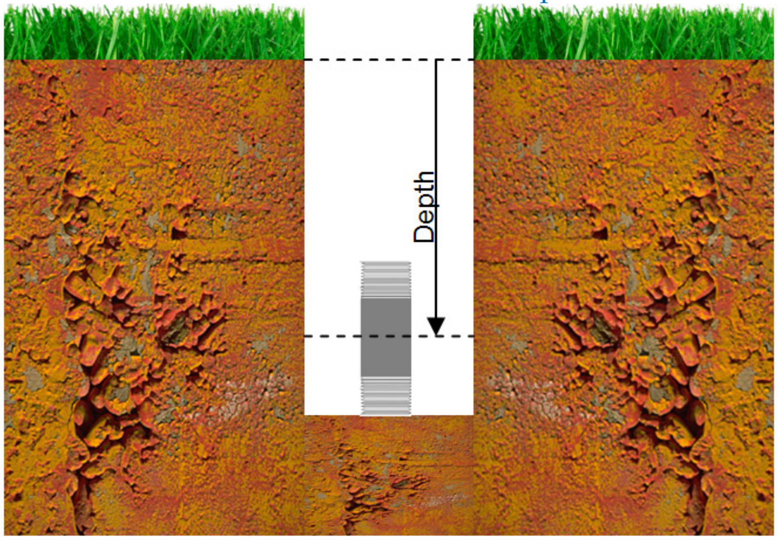


FIGURE 2-1
QC Seed Burial Illustration

2.2 Validation

After each data set is delivered to CH2M HILL by the DGM subcontractor, the CH2M HILL QC geophysicist will overlay the locations of the "blind" seeds and verify that the munitions detection and positioning MQOs are continuing to be met. Should an issue be detected (such as a data trend indicating a MQO limit is being approached) or a MQO is not met, a comprehensive root-cause analysis will be performed and a corrective action identified.

3. Reporting

Results of the IVS will be included in a technical memorandum prepared after the IVS has been performed. The memorandum will include a summary of the IVS operations, an as-built map of the IVS plot, and IVS results.

Results of the "blind" seeding evaluation will be provided as part of the RCRA Facility Investigation report.

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Attachment A
Geophysical Subcontractor Standard Operating Procedures

Naval Research Laboratory

Washington, DC 20375-5320

NRL/MR/6110--09-9183

EM61-MK2 Response of Three Munitions Surrogates

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14. ABSTRACT

Target response coefficients for three pipe nipples intended as surrogates for commonly encountered UXO items were calculated from measurements made using the recently developed NRL Time-domain Electromagnetic Induction array. These response coefficients were used to predict the signals expected from an EM61-MK2, the most commonly used geophysical survey instrument for UXO, for each of the three items as a function of orientation and distance of the center of the item below the bottom coil of the sensor. A series of EM61-MK2 survey measurements were made over the surrogates at the NRL Blossom Point Test site to confirm the predictions. The predicted EM61-MK2 signals are presented graphically as plots of the minimum signal expected at the second time gate as a function of distance from the sensor with the confirming survey measurements plotted on the same axes. The minimum signal at each of the four gates available from the EM61-MK2 is tabulated for depths corresponding to 3×, 5×, 7×, and 11× the object's diameter and all the results obtained are attached electronically as a spreadsheet.

15. SUBJECT TERMS

Unexploded Ordnance (UXO)
Electromagnetic Induction (EMI)
Munitions surrogates

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CONTENTS

FIGURES

TABLES

EM61-MK2 RESPONSE OF THREE MUNITIONS SURROGATES

INTRODUCTION

The EM61-MK2 Electromagnetic Induction sensor (Geonics Limited, Mississauga, Ontario, Canada) is the most widely used geophysical sensor for unexploded ordnance (UXO) detection surveys. Like all time-domain electromagnetic induction sensors, it produces a pulsed magnetic field (primary field) that induces a secondary field in metallic objects in the vicinity of the sensor. The decay of this induced field is sensed by monitoring the current in a wire-loop receiver coil in four time gates after the turn-off of the primary field. In the EM61-MK2, the main receiver coil is co-located with the transmit coil.

In a typical UXO detection survey, the sensor, with attached wheels or mounted on a cart, is used to survey the field in a raster pattern with a line spacing on the order of the 1-m width of the sensor. Smaller line spacings can be used to increase the data density for more advanced analyses. After data collection, the raw data are typically leveled, background corrected, and mapped. Then, either line-by-line or from a data image, regions of anomalous response are selected and marked as potential metal targets. This initial list of anomalies is used as input to an analysis step that selects anomalies for digging based on features extracted during further analyses such as target size and shape. A target of interest that does not appear on this anomaly list constitutes a detection failure.

One important component of the management of a geophysical investigation is to devise a quality assurance approach that will lead to confidence that the percentage of missed detections is low. Often, this has involved the construction of a geophysical prove-out (GPO) area on the site in which a selection of the targets of interest are buried at a number of different depths and orientations. Each geophysical survey crew is qualified by surveying this area and reporting the number and locations of anomalies detected. Since the identities and locations of the emplaced items in the GPO are blind to the crews, this procedure can serve to validate the survey procedures and data analysis and anomaly detection methods to be used on the site.

This procedure can break down however. The survey crew, who know they are being tested, will always perform with maximum efficiency and care on the GPO but as the production survey proceeds and complacency sets in their performance may slip. If this occurs, the performance measured at the GPO may not be confidently expected in later parts of the survey. This possibility has led a number of site managers and regulators to propose replacing the extensive GPO with a smaller performance confirmation strip, used for a daily confirmation of the survey procedures, coupled with a blind seeding program in the production areas. This approach has the advantage of confirming survey performance as often as a seed is encountered by comparing the measured anomaly location and amplitude to the known values.

Blind seeding, as discussed above, on a large production site will require a large number of items for seeding. One approach is to use inert munitions, matching those expected to be encountered on the site. This is problematic for two reasons. It is often not possible to obtain a sufficient supply of inert munitions at a cost the project can afford. Even if the inert munitions can be found, use of munitions as

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Manuscript approved January 29, 2009

seeds requires an extensive inventory and tracking procedure to be implemented; an inert munition left on the site will quite likely trigger a 911 call in the future.

Another, more attractive, approach is to use munitions surrogates (items intended to produce a signature similar to the munitions targets of interest but that do not resemble munitions) as the seed items. If chosen carefully, these surrogates can be widely available and relatively inexpensive. Once the seed items are chosen, the response of the sensor to the items as a function of depth must be determined so that the expected anomaly amplitudes can be predicted.

In an earlier report, we used sensor performance models to predict the response of an EM61-MK2 to a number of common munitions as a function of depth [1]. To validate the results, we collected survey data over those same objects at varying depths and orientations, extracted the maximum signal observed, and compared the measurements to our predictions. In all cases, the model accurately predicts the measured anomaly amplitudes. In this report, we extend this method to three standard steel pipe nipples that we propose for use as surrogates. After a brief description of the model employed and the data collection methodology, we present the predicted and measured anomaly data in graphical and tabular form.

DESCRIPTION OF THE MODEL

The response of a metallic object to an Electromagnetic Induction sensor is most simply modeled as an induced dipole moment represented by a magnetic polarizability matrix **B** [2]. As a consequence of electromagnetic reciprocity, the matrix **B** is symmetric. By a suitable rotation it can be transformed to diagonal form, so we can write

$$\mathbf{B} = \mathbf{U}\mathbf{B_0}\mathbf{U}^{\mathrm{T}} \tag{1}$$

with

$$\mathbf{B_0} = \begin{bmatrix} \beta_1 & 0 & 0 \\ 0 & \beta_2 & 0 \\ 0 & 0 & \beta_3 \end{bmatrix}. \tag{2}$$

In terms of yaw, pitch and roll Euler angles ϕ, θ and ψ [3], the rotation matrix **U** is given by

$$\mathbf{U} = \begin{bmatrix} \cos\theta\cos\phi & \cos\theta\sin\phi & -\sin\theta \\ \sin\psi\sin\theta\cos\phi - \cos\psi\sin\phi & \sin\psi\sin\theta\sin\phi + \cos\psi\cos\phi & \cos\theta\sin\psi \\ \cos\psi\sin\theta\cos\phi + \sin\psi\sin\phi & \cos\psi\sin\theta\sin\phi - \sin\psi\cos\phi & \cos\theta\cos\psi \end{bmatrix}. \tag{3}$$

The eigenvalues β_1, β_2, β_3 correspond to responses induced by the sensor transmit field components aligned with each of the object's principal axes. ϕ, θ and ψ together define the orientations of these principal axes relative to the X, Y and Z coordinate directions. Depending on sensor modality, the βs are functions either of time after the primary field cutoff or of the frequency of the primary field; the Euler angles are not.

In terms of **B** above, the time-domain EMI sensor signal S is modeled as

$$\mathrm{S}(t) = \mu_0 A I_0 \mathbf{C_R} \cdot \mathbf{C_T} \left\{ \frac{d}{dt} \int \hat{I}(t-\tau)\mathbf{B}(\tau)\mathrm{d}\tau \right\} \equiv \mu_0 A I_0 \mathbf{C_R} \cdot \mathbf{C_T}\mathbf{B_E}(t) \tag{4}$$

In equation (4), μ_0 is the magnetic permeability of free space ($4\pi\mathrm{x}10^{-7}$ volt-sec/amp-m); *A* is a scaling factor that depends on the number of turns in the transmit and receive coils, the receiver gain, etc.; I_0 is the peak amplitude of the transmit current pulse; $\mathbf{C}_\mathrm{T}$ and $\mathbf{C}_\mathrm{R}$ are coil sensitivity functions for the transmit and receive coils; and $\mathbf{B_E}$ is the effective polarizability matrix, a quantity which encapsulates the influence of the normalized transmit pulse $\hat{I}(t)$ on **B**. $\mathbf{C}_\mathrm{T}$ and $\mathbf{C}_\mathrm{R}$ depend only on coil geometry and location relative to the object, while **B** depends only on what the object is and how it's oriented, not where it is. The coil sensitivity functions are vectors that specify (a) the strength and direction of the primary field at the object ($\mathbf{C}_\mathrm{T}$) and (b) the sensitivity of the receive coil to the vector components of a magnetic dipole source at the object location ($\mathbf{C}_\mathrm{R}$). The vector $\mathbf{C}_\mathrm{T}\mathbf{B_E}$ describes the strength of the induced object response in the X, Y and Z coordinate directions. Taking the dot product with $\mathbf{C}_\mathrm{R}$ accounts for the relative sensitivity of the receive coil to each of these response components.

The strength and direction of $\mathbf{C}_\mathrm{T}$ and $\mathbf{C}_\mathrm{R}$ are sensitive functions of the location of the EMI sensor relative to the object. $\mathbf{C}_\mathrm{T}$ and $\mathbf{C}_\mathrm{R}$ are defined in terms of integrals around the coil involving the vector from the object to the coil:

$$\mathbf{C}_{\mathbf{T},\mathbf{R}}(\mathbf{r}_0) = \frac{1}{4\pi} \oint_{\mathbf{T},\mathbf{R}} \frac{d\mathbf{l} \times (\mathbf{r}_0 - \mathbf{r})}{\left|\mathbf{r}_0 - \mathbf{r}\right|^3} \tag{5}$$

where $\mathbf{r}_0$ is the location of the object and $\mathbf{r}$ is the location of a point on the coil.

The effective polarizability matrix $\mathbf{B_E}$, as expressed in (4), makes explicit reference to the filtering of **B** via the transmit pulse. However, in general, the situation may further be complicated by the effects of the receiver electronics, which also filter the response. In practice, the latter is accounted for by lumping an object-dependent scale factor into $\mathbf{B_E}$ and using standard test objects to calibrate the sensor by determining *A*. The eigenvalues (i.e. βs) of the effective polarizability matrix thus become the quantities which we work with.

In general, the aggregate magnitude of the βs determines the size of the object, while differences among the βs relates to the shape of the object. For axially symmetric shapes such as cylinders, prolate or oblate spheroids, and many UXO items, there is a basic longitudinal response along its length and two equal responses transverse to this.

Deriving the βs from EMI data collected over an object is fairly straightforward. As the sensor moves relative to the object, the object is excited from different directions, while the sensitivity of the receiver to the different response components also varies – data from different locations above the object combine the elements of the polarizability matrix $\mathbf{B_E}$ in different ways. As it turns out, if enough data are collected over an area whose dimensions are somewhat larger than the depth of the object, then all of the elements in $\mathbf{B_E}$ contribute enough, and in enough different ways to the overall response that the data can be inverted to determine the βs.

With data collected at N locations ($\mathbf{r}_i$, i=1,2,…,N) over an unknown object, we have an overdetermined set of N simultaneous equations with nine unknown quantities (three βs, three Euler angles that define the object's orientation, and the xyz coordinates of the unknown target location $\mathbf{r}_0$):

$$\mathrm{S}_i = \mu_0 A I_0 \mathbf{C}_{\mathbf{R}}(\mathbf{r}_0 - \mathbf{r}_i) \cdot \mathbf{C}_{\mathbf{T}}(\mathbf{r}_0 - \mathbf{r}_i)\mathbf{B}_{\mathbf{E}}, \qquad \mathrm{i}=1,2,\ldots,\mathrm{N}. \tag{6}$$

The equations are solved in a least-squares sense simultaneously for all values of time. This is accomplished by using a Levenberg-Marquardt gradient search technique to determine the target parameters that minimize the mean squared error between the dipole response model and the measured data.

A key assumption of the dipole response model outlined above is that the behavior with time of the induced currents within an object – from the early surface currents to the later volume currents – is fully embodied in **B** (and hence the βs) defined *at a single point in space*. For the case of a simple compact object sufficiently far from the sensor, this is a very good approximation and can be represented by a unique set of βs. For the case of composite and/or extended objects sufficiently far from the sensor, the model can still give a reasonably good approximation but must now be represented by different sets of βs that depend on the object orientation relative to the sensor.

Note from (4) that for the special case where $\hat{I}(t)$ is an ideal step function, $\mathbf{B_E} \equiv \mathbf{B}$ for all time *t* after the transition from one to zero occurs. For this reason, we refer to the βs from **B** as the *step response* βs and the βs from $\mathbf{B_E}$ as the *effective* βs. Figure 1 below shows plots of the step response and effective βs for a 3” chrome steel and a 4” aluminum sphere. The underlying black curves in each panel represent the step response βs as obtained from theory. Since the sphere is perfectly symmetric, $\beta_1=\beta_2=\beta_3$. Over-plotted in green are the theoretical effective βs for our time-domain electromagnetic sensor (TEM) array (described in the next section) computed solely by convolving the TEM transmit pulse with the step response βs followed by the time derivative, as prescribed by (4). The effective βs derived directly from data taken with the TEM array are shown in red. In this case, the βs (solid, dotted and dashed curves) are essentially identical, as expected. Note that for both the ferrous and nonferrous spheres, the derived effective βs from the TEM array data are an extremely good representation of the step response βs.

For comparison, the magenta curves show the theoretical effective βs for the EM61-MK2. These are computed again as prescribed by (4), but now the pulse being used is that of the EM61-MK2. Note that in this case, the derived effective βs are generally not a good representation of the step response βs. Coincidentally, however, in the regime of the EM61-MK2 time gates (shown as vertical dotted lines), the 3” chrome steel sphere βs are an approximate representation of the step response βs.

Since the EM61-MK2 signal vs depth curves in this report are generated via (4), and step response βs are given as derived from the TEM array data, it will be necessary to accurately convert these to effective βs for the EM61-MK2. A method which appears successful involves fitting each red curve with the sum of a weighted arbitrary number of loops using a procedure developed in SERDP project MM-1313 [4,5]. The cyan curves represent the result of convolving these fitted curves with the EM61-MK2 transmit pulse and taking the time derivative, as prescribed by (4).

Two examples of the predicted EM61-MK2 response in gate 2 are shown in Figure 2. The left panel plots the response expected from a 105mm projectile while the right panel plots the response expected from a 2.75″ rocket warhead. For both cases, the predicted responses are plotted as a function of the distance of the items center below the bottom coil of the sensor. In normal operation, the EM61-MK2 is deployed on wheels with the bottom coil 42 cm off the ground. For this case, the target depth below the ground will equal the abscissa reading minus 42 cm. Other deployment schemes have the EM61-MK2 sensors mounted on trays that are dragged across the ground. In those cases, a different offset would be applied.

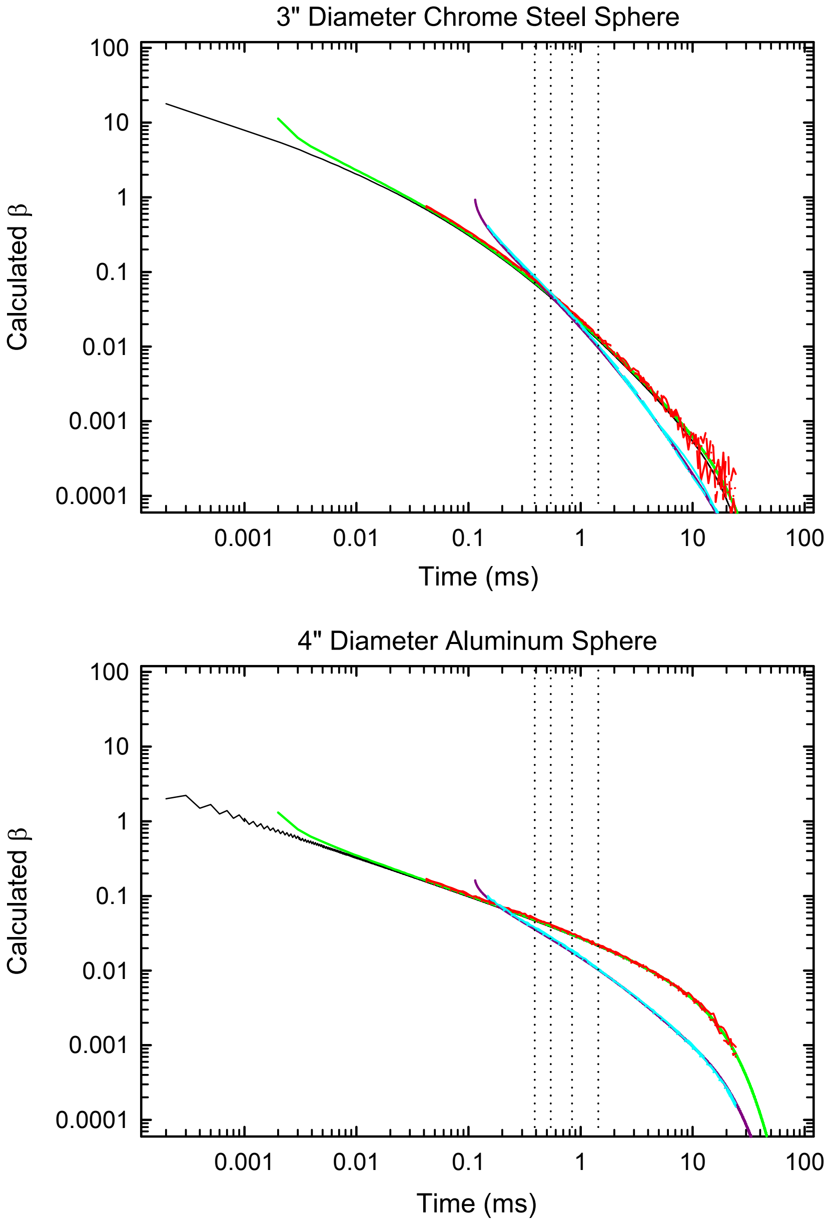

Figure 1 – Step response and effective βs for a 3" chrome steel and a 4" aluminum sphere. The underlying black curves represent the step response βs based on theory; the red curves represent the effective TEM array βs inverted from data; and the cyan curves represent the effective EM61-MK2 βs computed using the effective TEM array βs. Please refer to the text for a full description of the method used. The vertical dotted lines represent the EM61-MK2 *4-channel mode* time gates.

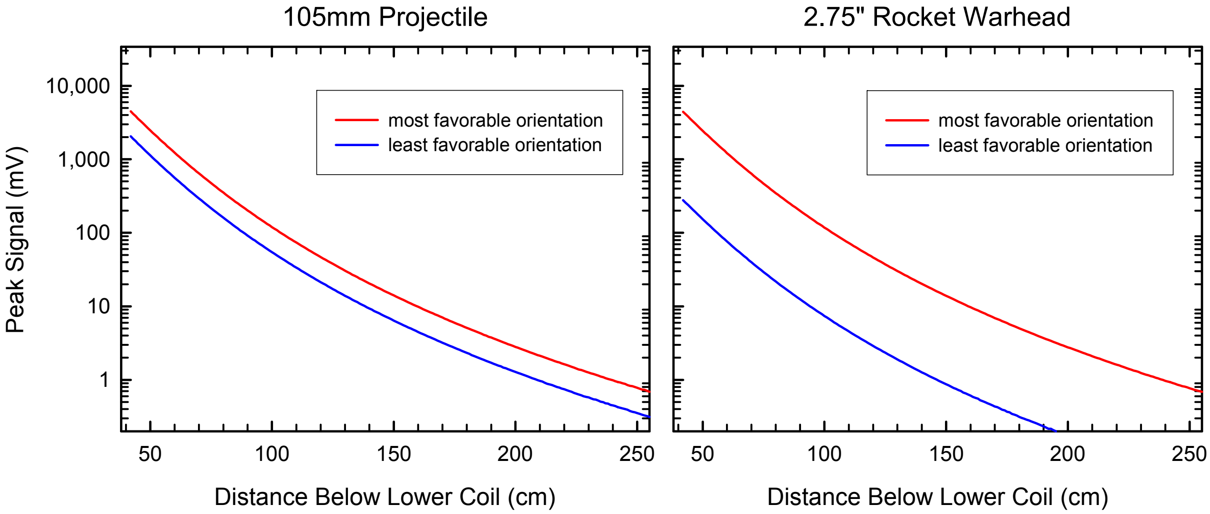

Figure 2 – Predicted EM61-MK2 signal at the second time gate as a function of depth for a 105-mm projectile (left) and a 2.75" rocket warhead (right). In both cases, the response to the object in its most favorable orientation is plotted as a red line and the least favorable orientation as a blue line.

For both items, the predicted response when the item is in its most favorable orientation (oriented vertically under the sensor) is plotted as a red line and that when the item is in its least favorable orientation (oriented horizontally under the sensor perpendicular to the sensor track) as a blue line. The length to diameter aspect ratio of the rocket warhead is substantially larger than that of the projectile accounting for the greater spread between the two responses in the right panel. The long axis of both targets is of similar size yielding similar responses in the most favorable orientation. Except in the most unfavorable conditions, site noise is typically 1 mV or below allowing both of these items to be detected at depths approaching 1 m under standard deployment conditions.

MUNITIONS SURROGATES

In keeping with our goal of widely available and inexpensive surrogates, we have chosen to use pipe nipples. Each of the three surrogates employed is a black, welded steel, Schedule 40 straight pipe nipple, threaded on both ends. We obtained the samples for this study on-line from McMaster-Carr (http://www.mcmaster.com/) but they are widely available from a variety of sources. The details of the three surrogates are given in Table 1.

Table 1. Munitions Surrogates Used in this Work.

Item	**Nominal Pipe Size**	**Outside Diameter**	**Length**	**Part Number**
Small Surrogate	1"	1.315" (33.4 mm)	4"	44615K466
Medium Surrogate	2"	2.375" (60.3 mm)	8"	44615K529
Large Surrogate	4"	4.500" (114.3 mm)	12"	44615K137

DATA COLLECTION PROCEDURES

Two data collections were carried out for each of the munitions items studied. Although the target response coefficients needed to predict the sensor signal as a function of depth can be determined from a series of EM61-MK2 measurements, it proved to be more efficient to determine the βs using our TEM array using the procedures outlined above. This instrument, developed with ESTCP support, comprises a five-by-five array of time-domain EM sensors each consisting of a 35-cm transmit coil and an inner 25-cm receive coil, Figure 3. With the munitions item to be investigated placed under the center sensor in the array, the transmit coils are energized sequentially and decay data are collected from all 25 receive coils; 625 individual decays in total, from 40 μs to 25 ms after the primary is turned off.

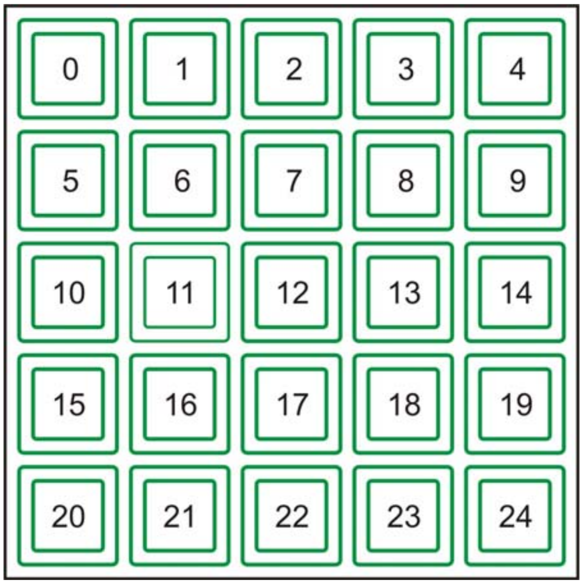

Figure 3 – Schematic of the 25-element TEM array used to determine the response coefficients of the test objects

A small subset of the data collected from a 2.75-in warhead oriented horizontally along track 35cm below the sensor array is shown in Figure 4. The nine decay curves shown are the response measured at the nine central receivers when the corresponding transmit coil is energized (monostatic response). Some of the shape information available from these sensors is evident in the plot. The decays measured using sensors 7 and 17, which primarily excite longitudinal modes of a prolate spheroidal target oriented along track, have distinct decay behavior from sensors 11 and 13, which primarily excite transverse modes.

TEM array data were collected from each of the three surrogates at different target orientations. These data were inverted for target response coefficients, β, as described above. Combined with the known transmit and receive properties of the EM61-MK2, these βs were used to predict the sensor response to the three items as a function of depth.

In order to validate these predictions, EM61-MK2 surveys were conducted over each of the surrogates positioned at a variety of depths and orientations in our test pit at Blossom Point. These surveys consisted of a single pass of the sensor at normal survey speed over the object starting ten meters in front of the pit and continuing ten meters past the pit. Before and after each series of measurements, data were collected over the empty pit to ensure that the sensor background was at reasonable levels. The

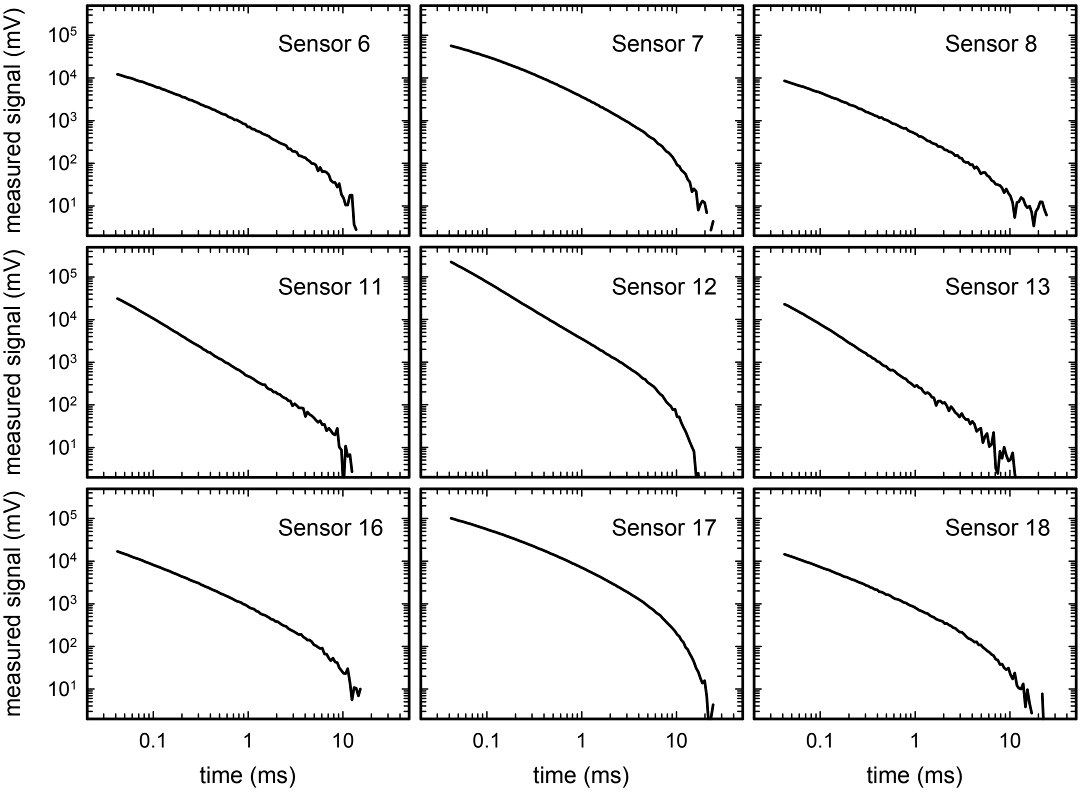

Figure 4 – Measured response of a 2.75-in warhead oriented horizontally along track 35 cm below the TEM array. The nine decays shown represent the response of the nine central receivers (see Figure 1) when the corresponding transmitter is energized.

survey data were background corrected using data collected before and after the test pit and the largest amplitude signal for each of the four time gates selected. In many cases this is not the measurement directly above the object; for a cylinder placed flat and oriented along the survey track, the peak signals are observed before and after the object. Each object was measured at nine to twelve unique position/orientation combinations.

For all EM61-MK2 data reported in this report, the sensor was operated in 4-channel or “4” mode with four sampling gates devoted to the lower, primary receive coil. The nominal delay time from the initial turn-off of current to the coil for each of the four gates is listed in Table 2. A standard EM61-MK2 was used for this work; the instrument manual lists delays from complete turn-off of current.

Table 2. Nominal delay time and receive coil used for each of the EM61-MK2 gates in “4 channel” mode

Gate	Receive Coil	Nominal Delay
1	Lower	216 μs
2	Lower	366 μs
3	Lower	660 μs
4	Lower	1266 μs

RESULTS

The results of this investigation are shown in Figures 5 through 7. For each of the figures, the top panel is a photograph of the actual item measured and the bottom panel shows the predicted and measured EM61-MK2 response at the second time gate. The predicted response when the item is in its least favorable orientation is plotted as a solid blue line. Measured responses are plotted as crosses. In all cases, the measured responses are described well by the calculated curve. The system noise, which limits the ultimate depth of detection of the item under investigation, determined at the site is plotted as a dash-dot line. The RMS noise at this site was 0.5 mV for gate 2 but this is a strong function of the roughness of the terrain and may be higher at other sites. The observed static and moving RMS noise amplitudes for all gates are given in Table 3.

Table 3. Measured RMS noise for each of the four gates in static and survey mode.

Gate	Static (mV)	Survey (mV)
1	0.5	0.8
2	0.1	0.5
3	0.2	0.4
4	0.3	0.3

The minimum signals predicted for all three surrogates investigated for all four gates for depths corresponding to 3x, 5x, 7x, and 11x the items diameter are tabulated in Table 4. All predicted sensor responses are tabulated in a spreadsheet which is attached electronically as Appendix A.

The results presented here are for data collected when the test object passes directly under the middle of the sensor. Depending on the objectives of a particular survey (detection vs. classification, large deep items vs. small shallow items) the survey lane spacing chosen may result in some potential targets passing off-center under the sensor. Figure 8 plots the measured signals from a test sphere and the small surrogate as a function of distance from the center of the sensor. In each case, the items were positioned with their center 50 cm below the lower coil of the EM61-MK2.

The upper panel of Figure 8 shows the response from a standard 4-in aluminum sphere. As expected, the response is relatively constant near the center of the coil and then begins to fall off as the sphere approaches and then passes outside the edge of the coil which is indicated with a dotted line. The lower panel plots the response of the small surrogate oriented along- and across-track with the scaled response of the sphere for reference. The surrogate oriented along track results in fall-off behavior that matches the sphere data. As the across-track surrogate is moved toward the edge of the transmit coil, more of the long-axis response of the pipe is excited and the signal rises dramatically before beginning to fall as the surrogate moves outside the sensor coil.

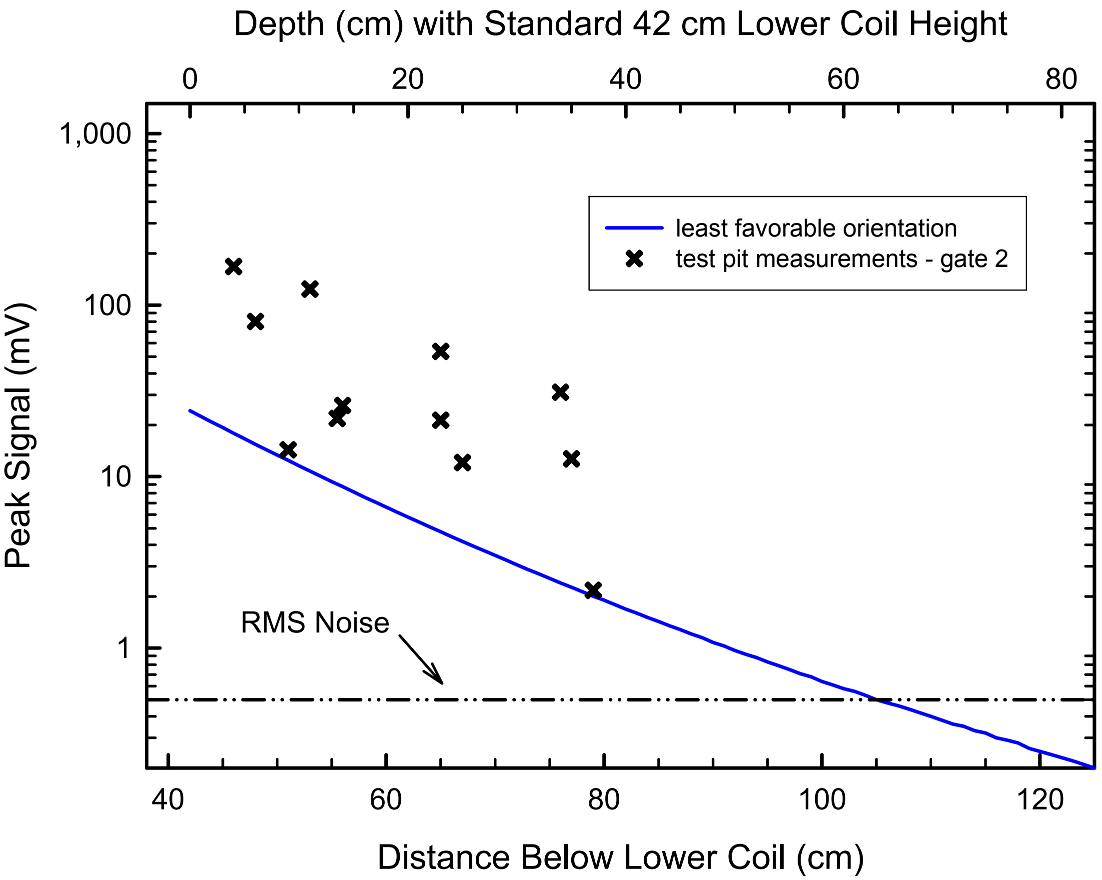

Figure 5 – EM61-MK2 signal at the second time gate as a function of the distance of the center of a small munitions surrogate below the sensor's bottom coil. The predicted response to the object in its least favorable orientation is shown as a solid line, test pit measurements are plotted as crosses, and the site noise is shown as a dot-dash line.

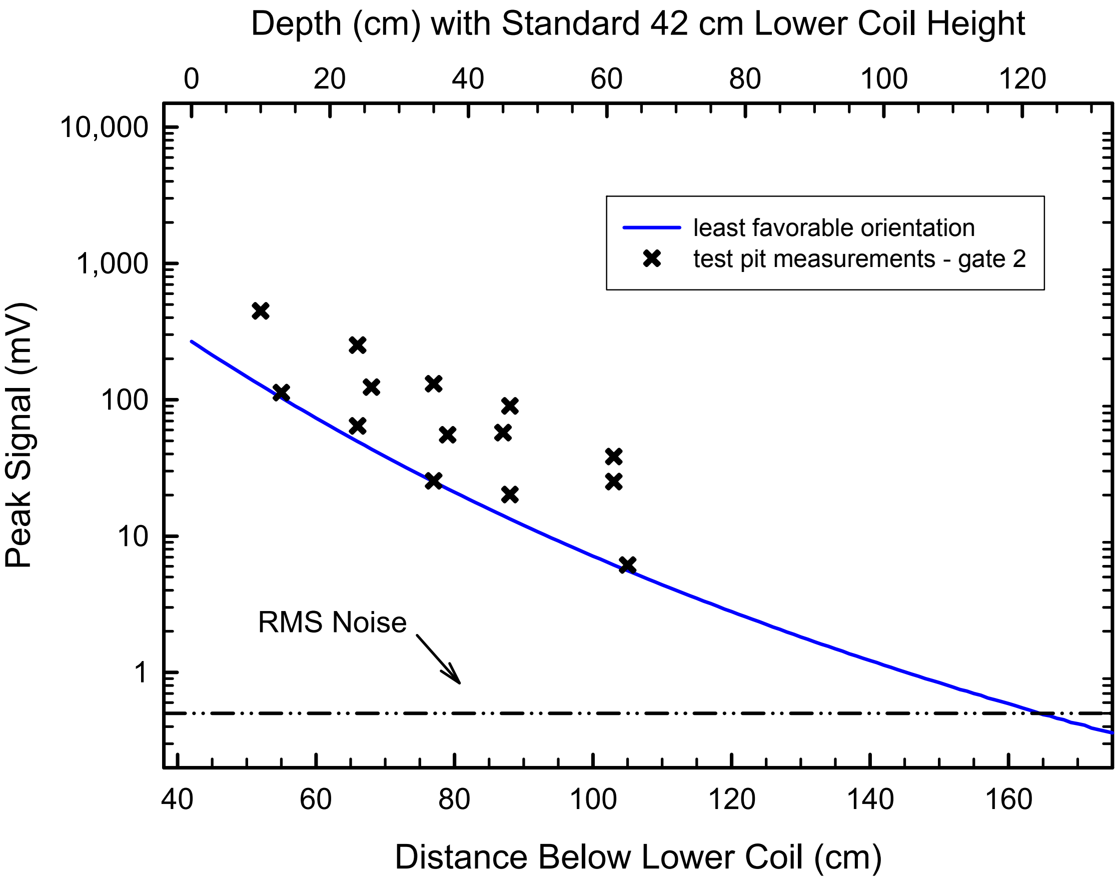

Figure 6 – EM61-MK2 signal at the second time gate as a function of the distance of the center of a medium-sized munitions surrogate below the sensor's bottom coil. The predicted response to the object in its least favorable orientation is shown as a solid line, test pit measurements are plotted as crosses, and the site noise is shown as a dot-dash line.

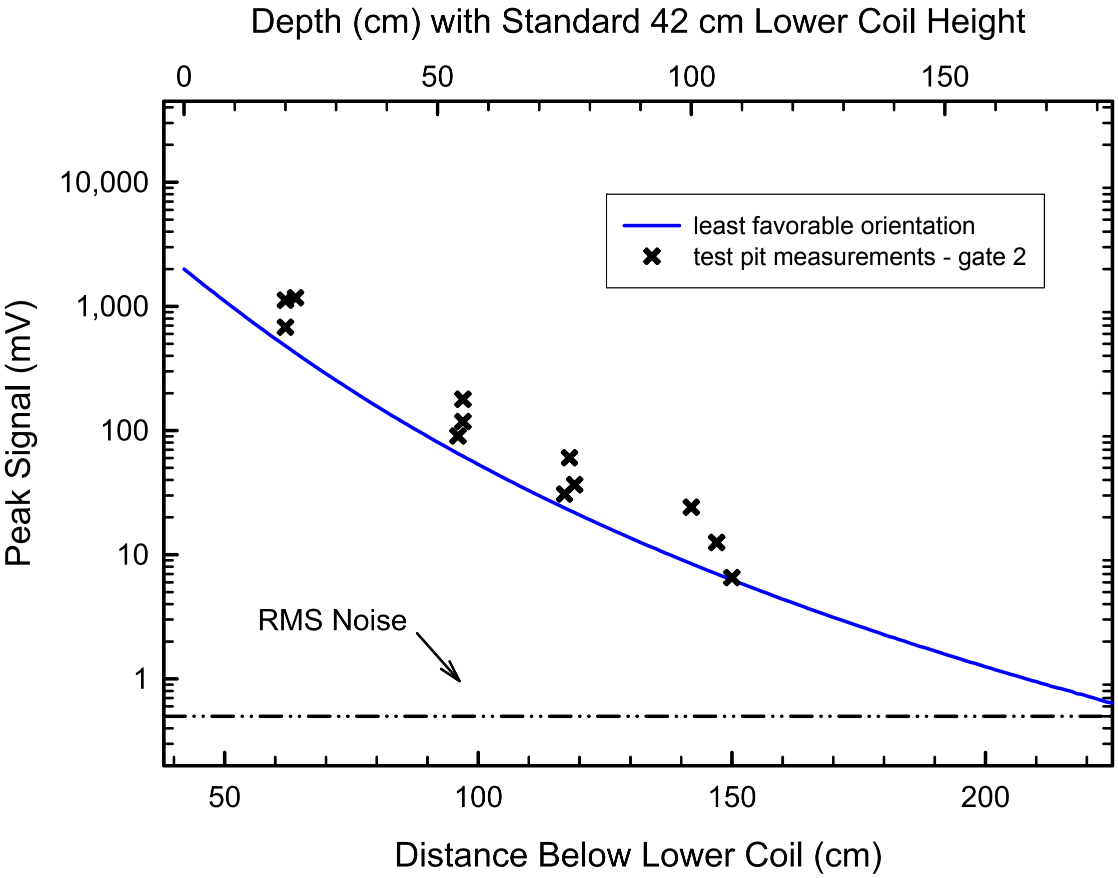

Figure 7 – EM61-MK2 signal at the second time gate as a function of the distance of the center of a large munition surrogate below the sensor's bottom coil. The predicted response to the object in its least favorable orientation is shown as a solid line, test pit measurements are plotted as crosses, and the site noise is shown as a dot-dash line.

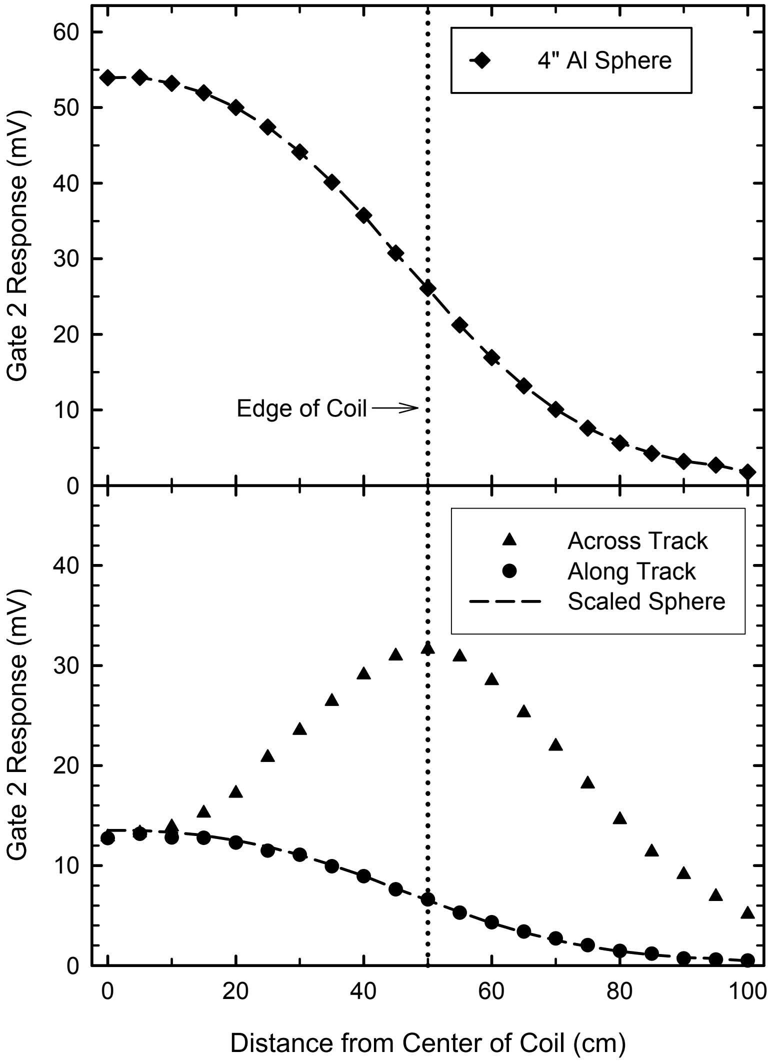

Figure 8 – Test item response as a function of cross-track distance from the center of an EM61-MK2 oriented with the 1-m axis perpendicular to the survey direction. The top panel shows the response of a 4-in aluminum sphere located 50 cm below the lower coil. The bottom panel shows the response of the small surrogate oriented both along the direction of survey and across the direction of survey. The scaled response of the sphere is shown for reference. In both panels, the edge of the sensor coil is indicated by a dotted line.

Table 4. Predicted minimum EM61-MK2 signal for the three munitions surrogates at a depth corresponding to 3x, 5x, 7x, and 11x their respective diameter. The sensor is assumed to be deployed on its standard wheels which correspond to the bottom coil 42 cm above the ground.

Item	Depth (cm)	Gate 1 (mV)	Gate 2 (mV)	Gate 3 (mV)	Gate 4 (mV)
3x Depth					
Small Surrogate	10	20.9	11.6	5.2	1.8
Medium Surrogate	18	131	73.4	33.2	12.7
Large Surrogate	34	324	199	98.8	40.2
5x Depth					
Small Surrogate	17	12.8	7.1	3.2	1.1
Medium Surrogate	30	60.4	33.9	15.3	5.8
Large Surrogate	57	91.6	56.1	27.9	11.3
7x Depth					
Small Surrogate	23	8.6	4.8	2.1	0.8
Medium Surrogate	42	29.8	16.7	7.6	2.9
Large Surrogate	80	31.2	19.1	9.5	3.9
11x Depth					
Small Surrogate	37	3.6	2.0	0.9	0.3
Medium Surrogate	66	8.6	4.8	2.2	0.8
Large Surrogate	128	5.1	3.1	1.6	0.6

SUMMARY

We have used the NRL TEM Array to characterize three standard pipe nipples intended to serve as surrogates for munitions items commonly found on Military Munitions Response Sites. Using these data we have determined EM response coefficients for each object. These response coefficients have been used to calculate the expected signal from an EM61-MK2 over each surrogate as a function of depth and orientation. These results have been presented graphically and the minimum signal expected at a depth corresponding to 3x, 5x, 7x, and 11x the objects diameter has been tabulated.

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1. Nelson, H. H., Bell, T., Kingdon, J., Khadr, N., and Steinhurst, D.A., “EM61-MK2 Response of Standard Munitions Items,” NRL/MR/6110--08-9155, October 6, 2008.

2. Baum, C. (ed.), Detection and Identification of Visually Obscured Targets, Taylor and Francis, 1999.

3. Goldstein, H., Classical Mechanics, 2nd ed., Addison-Wesley, 1980.

4. Miller, J., and Furuya, T., “Variability of Real UXO,” Symposium on the Application of Geophysics to Engineering and Environmental Problems 2007, Denver CO.

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Attachment 3-3
SOPs

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MRP – SOP – 0001

MUNITIONS RESPONSE PROGRAM (MRP)
STANDARD OPERATING PROCEDURE (SOP)
MUNTIONS AND EXPLOSIVES OF CONCERN (MEC) 0001
SURFACE & SUBSURFACE ANOMALY AVOIDANCE

1.0 OBJECTIVE:

Provide safe procedures to avoid Munitions and Explosives or Concern (MEC) during visitor/personnel escort, land survey, vegetation reduction, sediment sampling, soil boring, drilling, direct push technology-core sampling, or other environmental or construction activities conducted in an environment where the presence of MEC is suspected.

2.0 PURPOSE:

This SOP provides guidance, for avoiding surface military munitions (e.g., MEC, Unexploded Ordnance (UXO), Discarded Military Munitions (DMM), and Material Potentially Presenting an Explosive Hazard (MPPEH)), and subsurface anomalies.

3.0 APPLICABILITY:

This SOP applies MEC avoidance processes per Department of Army Engineering Pamphlet (EP) 75-1-2 Munitions and Explosives of Concern Support During Hazardous Toxic and Radioactive Waste (HTRW) and Construction Activities.

4.0 TECHNCIAL GUIDANCE:

This SOP lists processes and procedures that comply with the following sources:

- DOD 6055.09-STD Ammunition and Explosives Safety Standards, February 2008;
- USN Environmental Restoration Program (MRP Chapter 12) August 2006;
- USN NAVSEA OP 5Volume 1; Ammunition and Explosives Safety Ashore, July 2009;
- NOSSA Instruction 8023.11(series), Standard Operating Procedure Development
- USAF Manual 91-201 Explosive Safety Standards November 2008
- DA Pamphlet 385-64 Ammunition and Explosives Safety Standards October, 8, 2008
- DA Field Manual (FM) 21-16, Unexploded Ordnance (UXO) Procedures August, 1994
- DA Engineering Manual (EM) 1110-1-4009 Military Munitions Response Actions, June ,2007
- DA Engineering Pamphlet (EP) 1110-1-18 Military Munitions Response Process, April 2006
- DA Engineering Manual (EM) 385-1-97 Explosives, Health and Safety September 2008;
- **Note: Electronic copies for the sources listed above are available via CH2M HILL SUXOS Laptop Computer**

5.0 SOP VALIDATION RECORD:

SOP Title: MEC Anomaly Avoidance................................Work Instruction Identification/ SOP: # MRP-SOP-0001

Author: K. Lombardo Date: December 1, 2009.................Revision Date: None

Review: D Young, Date: December 11, 2009.....................Approval; J. Bowles (Date OPEN)

Validation Date: December 14, 2009 ....Process Observer: Kevin Lombardo, December 14, 2009

6.0 HAZARDOUS MATERIALS:

Hazardous Chemicals: None; Product Name: N/A; Material Safety Data Sheets: N/A; Health Hazards: N/A

7.0 EMERGENCY RESPONSE INFORMATION

Work Site Name (location) address/building # Street):

____

Nearest intersection (cross streets) or entrance gate:

____

Safe Area Rally Point (gate/building or intersection) Note: Rally Point should be upwind of work location:

____

UXO Qualified Technician Incident Commander: (name) ______________________________

Personnel Injury or Medical Distress:

1. Summon Emergency Medical Services (EMS)
2. Administer Fist Aid and/or CPR
3. Notify Project Manager
4. PM implements CH2M HILL SOP 111, Incident Notification, Reporting, and Investigations.

Fire:

1. Evacuate personnel from the Munitions Response Site and Area to safe rally point
2. Notify Fire Department of "Work site Name," fire location, and personnel safe rally point
3. Obtain head count, ensuring all personnel are present and or accounted for.
4. Notify Project Manager
5. PM implements CH2M HILL SOP 111, Incident Notification, Reporting, and Investigations.

(Fire/Rescue radio call sign): ______________________ **Phone #** ______________________

Medical Services radio call sign: ___________________ **Phone #** ______________________

Range Control radio call sign: _____________________ **Phone #** ______________________

Project Manger POC: _____________________________ **Phone #** ______________________

Identify local disaster warning system (radio, PA, phone, other):________________________

Flag(s): ____

Warning Bells/Horns/Sirens/Lights/Strobes: __________________________________

Public Address System: ____

Weather Radio Channel: ____

Other: ____

8.0 PERSONNEL ROLES AND RESPONSIBILITY

Note: Roles and responsibilities are dependent upon work plan direction; one or all roles and responsibilities may be applicable.

1. Project/Construction Manager (P/CM): Provides the necessary resources and personnel to safely and efficiently accomplish the scope of work. Ensures CH2M HILL unexploded ordnance (UXO) personnel shall be qualified in accordance with:
   - OPNAVINST 8020.14/MCO P8020.11 (series).
   - And are certified to perform the job assigned and that the certification is current. Contractors who perform those duties described in NAVSEA OP5, paragraph 2-3 involving ammunition and explosives shall comply with NAVMED P117 Article 15-107.
   - Prior to site operations, CH2M HILL will verify training, medical qualification statements by physicians, and conformance to substance abuse testing and reporting programs.
   - Shall confirm active explosive certification program conformance for personnel compliance to requirements for UXO personnel identified IAW DDESB Technical Paper (TP) 18, and monitors these personnel for conformance to the Bureau of Alcohol, Tobacco, Firearms, and Explosives, Safe Explosives Act 2003 Certification requirements for "Employee Possessor," and or "Responsible Person."
2. Senior UXO Supervisors or Unexploded Ordnance Technician III or II: Supervises the operational resources necessary to implement, and accomplish this procedure and requirements set forth within the Work, Health, Safety, Quality and Accident Prevention Plans. May stop work at anytime to prevent accidents, remedy unsafe conditions, stop an unsafe act, or question the safety of a process or procedure or

observe non conformance to this SOP and/or plans. Provides a Site Specific Tailgate Safety Briefing to include MEC, construction, industrial, environmental, and natural safety hazard awareness. Provides the plan of day. As applicable provide a Hazardous Materials briefing for items used, consumed, or required for this SOP. This person shall brief personnel on communications, security, emergency/medical response, evacuation, rally points, IAW with project instructors, and plans. This person shall inform personnel to prevent disclosure of classified work, site observations, or information. This person performs personnel escort, and anomaly avoidance.

3. Non-UXO Qualified Personnel are obligated to follow guidance within this SOP, Work, Health and Safety and Accident Prevention Plans.

9.0 PRE-OPERATIONAL CHECK LIST

1. ( ) CH2M HILL Inc. ORE and Explosive Safety Submission Determination (ESSD) (Navy Projects)	2. ( ) Project Task/Work/ Instructions
3. ( ) Work Plan/Accident Prevention Plan/ Health and Safety Plan, Quality Control Plan	4. ( ) Personal Protective Equipment (PPE) IAW Safety Plan
5. ( ) Emergency P.O.C List	6. ( ) Directions and map to hospital
7. ( ) Communications (2 methods)	8. ( ) First aid/Fire Extinguisher/- (GPS/compasses optional)

10.0 ANOMALY DETECTION EQUIPMENT (as required by project instruction)

( ) Ferrous Metal Detector (Schonstedt GA 52CX or Ferex 4.021 MK 26 Mod 0 or equivalent), with extra batteries, carry case, & instruction manual (as required by project instructions)

( ) All Metals Detector (White Spectrum XLT or equivalent) with extra battery, carry case, & instruction manual (as required by project instructions)

( ) Down-hole Instrument Direct Push Technology – Schonstedt MG 230 Gradiometer maximum 2.12-inch "Outside Diameter" (OD) Probe Head - Extra batteries and instruction manual (as required by project instructions)

11.0 EXPLOSIVE ORDNANCE RECONNAISSANCE EQUIPMENT

WARNING

Direct physical contact with or movement of MEC or MPPEH is not authorized.

( ) Tape Measure, ruler, pen/paper, item for scale prospective (e.g. dollar bill),

( ) Camera (digital), with spare batteries (as required by project instructions)

( ) Small dry erase white board and dry erase marker for photograph item number, date, time, location, and description.

12.0 GENERAL INFORMATION

CATEGORY **MEC/Anomaly Avoidance**	**DIRECTIONS** **(S)** = Safety, **(O)** = Operations, **(Q) =** Quality Control

Note: (o) PM shall obtain MISS Utilities Check and or local Dig (intrusive) Permits prior to intrusive actions (such as use of direct push technology, drilling, and use of hand augers)

(WARNING)

Fire: (s) Do not attempt to fight a fire, evacuate area, move upwind or crosswind to safe rally point, notify fire department.

Wildlife: (s) Aggressive/defensive – Avoid wildlife –withdraw from area

Hunters: (s) Withdraw from area, retreat to vehicle, contact project authority

CWM: (s) Evacuate upwind to safe rally point, mark area on map, contact PM

Severe Weather (lighting, winds, and storms): (s) Evacuate to vehicle, follow PM guidance

13.0 SAFETY

Munitions Response Group Safety Officer	George DeMetropolis/SDO – George.DeMetropolis@CH2M.com Telephone (Office): **(619) 687-0120 x37239** Telephone (Cellular): **(619) 564-9627**
Safety Plan, Accident Prevention Plan and Activity Hazard Analysis	(s) All field personnel require reading, compliance, and acknowledging they understand and comprehend the safety information contained within these plans, SOP and AHA; attesting through signature and date
Visitors access to work location	(s) All visitors (contract/transient/witness) require a safety briefing, wearing of PPE IAW site specific safety plan, and conformance to UXO Technician instructions**.**
Safety Meeting:	(s) Each morning – Project Personnel shall participate in a tailgate safety briefing, discussing the operational activities (plan of the day), MEC/HTRW hazards/risks, safety controls, and emergency procedures; daily

	weather forecast, work activity OSHA PPE level, insect/poisonous plant avoidance, and heat/cold stress prevention. Personnel shall sign and date, the safety briefing acknowledgment form; confirming individual participation, understanding, and comprehension prior to operations. Personnel who do not participate in the safety briefing or, understand, or comprehend the safety briefing may not access work areas.
Safety Pre-field operations check list	(s) ( ) First Aid Kit (serviceable and supplies within shelf life) (s) ( ) Fire Extinguisher 10BC (or greater) (charged/indicator green) (s) ( ) Water (minimum 1 liter per person) (s) ( ) Cell phone/identified alternate land line location/or two/way Radio (s) ( ) Identification of wind direction, and rally points (s) ( ) PPE IAW Activity Hazard Analysis (s) ( ) Vehicles unlocked; keys in announced location (s) ( ) Insect repellant/sun screen (available)
Equipment Check-out: 1) Schonstedt – GA52CX magnetometer or equivalent 2) White's (E series) Spectrum model XLT Metal Detector or equivalent 3) Schonstedt gradiometer MG 230 for Down-hole or underwater search or equivalent 4) Forster Ferex 4.021 models K,L, & W or MK 26 MOD 0 magnetometer for down-hole or underwater search or equivalent	(o) Assemble/inspect, IAW manufacture instructions (o) Test geophysical instruments against a known source (ferrous or non-ferrous) for instrument response. (o) Source (ferrous) Schedule 40, 2-inch x 5-inch steel pipe or equivalent (q) Pass/Fail - instrument shall detect source on surface at 12-inches above item/fail non-detect - replace instrument (o) Source on surface (non-ferrous) ¾-inch x 6-inch Brass Pipe nipple (aka) couple fitting or equivalent (q) Pass/Fail - instrument shall detect source on surface at 6-inches above item/fail non-detect -

	replace instrument (q) Name of individual recording geophysical instrument source test results by instrument manufacturer with: type, model, serial number, by the date of daily equipment check. Record results for pass/fail source test with remarks. Reject and replace geophysical instruments that do not pass quality control source test.
14.0 SITE ACCESS	
WARNING: UXO Technician(s) shall not make physical contact with MEC, or commercial explosives. UXO Technicians assigned to implement this SOP shall not intentionally move MEC or explosives, incendiaries, smokes, propellants, or commercial explosives. **NOTE:** If MEC, to include Unexploded Ordnance (UXO), Discarded Military Munitions, (DMM) or Material Potentially Presenting an Explosive Hazard (MPPEH) are encountered, the UXO Technician shall respond IAW 3R training, avoid such items, and notify Project Manger IAW site-specific project instructions.	(o) Implement 3R (R, R, R) process, and procedures. (o) Recognize MEC, UXO, DMM, and or MPPEH; offset mark anomaly location with flag, ribbon, paint, stakes, other location identifier (o) Retreat from MEC location and avoid MEC location (o) Report & record MEC location in logbook and contact Project Manager IAW project instructions to request additional guidance. **Note:** MR Safety may instruct UXO Qualified Technician to perform a zero contact Explosive Ordnance Reconnaissance of the item requesting information for type by function, condition, filler, and nomenclature (if visually possible), supported by photographs of the item.
15.0 EXPLOSIVE ORDNANCE RECONNAISSANCE (EOR)	
EXPLOSIVE ORDNANCE RECONNAISSANCE Reconnaissance involving the investigation, detection, location, marking, initial identification, and reporting of suspected MPPEH in order to determine future action	
EOR Method UXO Qualified Technician is required prior to performing an Explosive Ordnance Reconnaissance to review Department of the Army, Field Manual (FM) 21-16, Unexploded Ordnance (UXO) Procedures, August 1994 –	(o) Use general Explosive Ordnance Disposal (EOD) safety precautions until munition type, fuzing , condition, and filler are identified (o) Upon identification, of type by function, fuzing, and condition use general EOD safety

A copy can be obtained from: WWW.UXOINFO.COM or from CH2M HILL MR Operations, Kevin Lombardo/WDC	precautions for the category of munition (e.g. Rocket; avoid approach to the front and rear of item, etc). (s) Approach Unexploded Ordnance (UXO) 45^0 to the rear (s) Do not cast shadows over UXO fuze (s) Remain cognizant to avoid dispensed wires, filaments, or other items that could initiate movement (s) Remain cognizant of Electromagnetic Hazardous Radiation, to Ordnance (HERO) precautions.
Information Recovery	(o) Photograph item from each vantage point. Identify each photograph with item name, view (side, front, rear, etc.), and distance from camera to item, (f-stop & shutter speed and film speed if applicable). It is required that a photograph log be kept for each item. Use a ruler in photo to demonstrate perspective of the item. (o) Close-up photograph fuze, markings, nose, tail, and or markings
16.0 PERSONNEL ESCORT	
Personnel Escort A minimum of one UXO qualified Technician(II) shall escort non-UXO qualified site personnel conducting access to a Munitions Response Area or Site The UXO qualified person shall visually search the surface of walking paths, roads, and parking areas to locate, mark, and avoid MEC during walking, driving, or setting-up	(o) Establish a wind streamer of tape/ribbon (flag) within/near the project site to observe wind direction. (o) A UXO Technician shall visually search the surface area, for MEC/HTRW to avoid such items. The UXO Technician may augment the visual search with the application of a geophysical instrument to detect surface/subsurface ferrous and or non-ferrous anomaly sources for the purpose of anomaly avoidance (o/s) When escorting non-qualified UXO personnel, a UXO Technician shall lead, and non-UXO qualified personnel shall follow along a path identified by the UXO Technician. (o) The UXO Technician shall identify surface hazards (MPPEH) and avoid such hazards. The location of a hazard requires, the UXO Technician to communicate the location to non-UXO qualified persons for avoidance around the item. (s) Communication can be by hand signals (pointing), or marking with flags, tape, ribbon, paint, stakes, or other means identified

equipment.	during a safety briefing. (s) Essential Personnel Limits - MR Escorts are a minimum of one UXO qualified Technician II or above, to no more than six (6) non-qualified persons. (s) Non UXO qualified personnel shall not approach and avoid a marked MPPEH or HTRW hazard.

17.0 MEC AVOIDANCE SUPPORT

LAND SURVEY, SEDIMENT SAMPLING, GROUNDWATER COLLECTION, ENDANGERED SPECIES SAMPLING/MONITORING

Applicable to Visitors, Land Survey, Sediment Sampling, Groundwater Collection, Endangered Species Sampling/Monitoring

WARNING: Subsurface intrusive acts could initiate MEC, through physical contact, movement, or shock.	(o) A UXO Technician shall search each intrusive point from the surface with a magnetometer and or all metals detector in accordance with the instruments manufactures instructions, to locate ferrous and/or non-ferrous subsurface anomalies. Location of such subsurface anomalies requires the placement of an offset marker (pin flag a minimum of 12-inches) to the north of the greatest signal strength for the anomaly. (s) For land survey and sampling activities where detection of an anomaly occurs, an alternative location free of ferrous and non-ferrous anomalies is required to proceed with intrusive activities. (q) The UXO Technician shall note within the daily logbook the rejection of the primary location and selection of the alternative location, with a written description of direction and feet/inches for the offset location from the primary point.

NOTE:

Personnel performing subsurface intrusive activities for the purpose of land survey and environmental sampling require a UXO Technician to search the subsurface with either or both (dependant on MEC site-specific history) a magnetometer and/or all metals detector to confirm the subsurface is free of ferrous and or non-ferrous anomalies.

A UXO Technician shall mark the boundaries /limits for ingress/egress access from a safe area (i.e.: road) to the work activity location or provide escort to and from the work activity location.

18.0 VEGETATION REDUCTION MEC AVOIDANCE (MANUAL/MECHANICAL)

WARNING:

DO not apply vegetation cutting closer than six inches to ground surface.

Vegetation reduction actions that occur less than six inches above ground surface, may result in movement, or shock to MEC, resulting in an unintentional detonation or functioning as designed of the item.

(o) A UXO Technician shall escort vegetation reduction personnel, perform a visual and/or magnetometer and/or all metals detection instrument search of surface access routes, walking paths, and vegetation reduction locations for MEC/HTRW and or obstruction hazards.

(o) The UXO Technician shall operate a magnetometer and or all metals detection instrument to locate surface anomalies with potential to be a hazard to vegetation reduction crews.

(o) The UXO Technician shall perform a visual surveillance of the surface to locate surface hazards (MEC, HTRW) or obstructions to equipment, mark the location and instruct vegetation reduction crews to avoid the location.

(s) The UXO Technician shall remain away from the immediate operating radius of powered equipment and remain alert for flying debris

(s) The UXO Technician shall wear high visibility outerwear, use hearing, and eye protection, and avoid swing radius of powered equipment.

Warning :

Personnel performing vegetation reduction activities shall not operate equipment closer than 6-inches to the ground thus, all brush cutting equipment (chain saws, weed whackers, string trimmers, brush cutters, bush hogs, hydro-ax, or debarking equipment) shall operate six-inches or greater above ground.

19.0 MEC AVOIDANCE (DOWN HOLE)

WARNING:

When applying MEC avoidance procedures for drilling or the use of direct push technology, the steel mass of drill rigs and DPT power plants will influence gradiometers, and magnetometer reporting instruments. Thus, drill rigs and DPT equipment shall be withdrawn a minimum of ten feet from intrusive points while performing down-hole avoidance search.

(o) Prior to drilling, the UXO Technician will conduct a visual reconnaissance of access paths and drilling area. The reconnaissance will include locating the designated sampling or drilling location(s) ensuring that the locations do not have surface MEC, or MPPEH, and magnetometers or all metal detection search do not indicate the presence of subsurface anomalies. If detection of subsurface anomalies occurs, at the sampling point, the sampling point is abandoned. Once the designated sampling point has been determined free of anomalies, an access route for the sampling crew's vehicles is searched. The access path requires twice the width of the widest vehicle and marking along the sides with flags, ribbon, engineer tape, stakes, or equivalent to define limits.

<table>
<tr><td></td><td>(s) If an observation of MEC or MPPEH should occur, the UXO Technician shall mark the item, avoid it, and notify the PM for either military EOD or UXO Contractor support.
(o) A UXO Technician will clear each work site for drilling/DPT and clearly mark the safe to walk, and drill or DPT, boundaries. Each drill/DPT safe area will be large enough to accommodate the drilling equipment and provide a work area for the crews. As a minimum, the safe area will be a rectangle, with a side dimension equal to twice the length of the largest vehicle or piece of equipment for use on site.</td></tr>
<tr><td colspan="2">NOTE:
(p) Drilling and application of DPT may require an ingress route and pad turning radius, twice the width, and length of the mechanical equipment.</td></tr>
<tr><td colspan="2">NOTE:
MEC may exist within the subsurface up to 30 feet below ground surface, dependant on site-specific history. Refer to project instruction to determine maximum depth for down-hole MEC avoidance support.</td></tr>
<tr><td>The UXO Technician is required to escort personnel and remain with personnel when sampling/drilling at an MRP or MEC/MPPEH suspect site.</td><td>(o) Soil bore holing may be by hand auger, power-auger, drilling, or direct push technology (DPT). A UXO Technician will examine, prior to sampling/drilling, the borehole location with a down-hole gradiometer or magnetometer, a minimum of every one (1) foot, to the deepest sampling depth or a maximum of 30 feet below ground surface to ensure avoidance of anomalies, or to depth identified within the project instruction.</td></tr>
<tr><td>WARNING:
Drilling equipment may produce injury from snapping cables, pinch points, chain failures or falling booms, derricks, and drill piping. Avoid the immediate operational radius of drillers when supporting efforts.</td><td>(o) Drilling down–hole monitoring requires at a minimum of one (1) foot increments of search, during the actual well drilling operation. This will require the withdrawal of the drill rod or augers from the hole and moving the drill rig a minimum of 10 feet or enough feet away from the drill-hole location to prevent the metal in the rig from influencing the magnetometer/gradiometer.
(o) The UXO Technician shall perform down-hole monitoring for anomalies at each location identified within the project instruction.</td></tr>
</table>

20.0 ACTIVITY COMPLETION

Completion of documentation:	( ) Project site logs to Project Manager ( ) Tail gate safety meeting log to Project Manager ( ) Equipment check-out report to Project Manager ( ) Quality control reports to Project Manager

21.0 EQUIPMENT

ITEM	QUANTITY
Cellular telephone	1
Dow-hole (only) Magnetometer/Gradiometer capable of down-hole operations to 30 feet	1 or (as required by Project instruction)
Magnetometer capable of monitoring to a depth of two-feet below ground surface for ferrous items	1 or (as required by Project instruction)
All metals detector capable of monitoring to a depth of 6-inches below ground surface for non-ferrous items	Optional
Multi colors of marking flags, ribbon, and tape	As determined by SUXOS
Batteries	Two day supply for instruments
First –aid Kit (25 person)	1 within the work area
Water	Minimum 1 liters per person in work area
Camera/Tape Measure/Ruler/Calipers/Paper Pencil	As determined by SUXOS
Hand tools, (hammer, general purpose tools, etc.)	Assorted As determined by SUXOS

MINIMUM PERSONAL PROTECTIVE EQUIPMENT: IAW with Safety Plan and AHA or a minimum of OSHA LEVEL "D"

Coveralls (or long pants, sleeved shirt)

Boots (level "D")

Cover (cap, floppy, skull)

Gloves (leather)

Safety Eye protection (as required by AHA)

Hard hats (when working in an area with a potential for head injury or heavy equipment e.g. drill rig)

Because this is a possible HTRW operation, the MR Supervisor will direct the required explosive safety site PPE conditions.

SPECIAL TRAINING AND REFRESHER REQUIREMENTS:

UXO Technicians will be qualified at a minimum Level II designation and be graduates of the U.S. Naval School of Explosive Ordnance Disposal or other DOD DEDSB TP 18 approved course or school/course of instruction, Hazard Waste Operations IAW 29CFR 1910.120 (e) & (f) and medical clearance physical authorization to perform work.

WAIVERS, EXEMPTIONS, SPECIFIC AUTHORIZATIONS, OR APPROVED DEVIATIONS THAT APPLY TO THIS OPERATION: None

ACTIVITY HAZARD ANLAYSIS

Safe Work Method Statement/ Job Hazard Analysis

Company Name: **CH2M HILL**	Project Name/#: SOP MRP 0001- MEC Anomaly Avoidance
Work Activity/Task: MEC Anomaly Avoidance	Principal Contractor: **CH2M HILL**
Date: December 09, 2009	Note: Sign off to be provided at Tool Box talk
Prepared by: Dan Young	Supervisor: TBD by project location
Signature:	Safety Coordinator (SC): TBD by project location
All metals detection equipment, metal detection instruments, magnetometry equipment, gradiometers, and military ordnance detection equipment, plant & equipment required: - machinery: maintenance checks provided and recorded by subcontractor or operator: suitably qualified and competent, with health, safety, and environment (HS&E) training	Training Requirements 29 CFR 1910.120 (e) & (f); DDESB TP 18 minimum qualifications for Unexploded Ordnance Technicians; OPNAVINST 8020.14/MCO P8020.11 (series) and are certified to perform the job assigned and certification is current. NAVSEA OP5, paragraph 2-3 involving ammunition and explosives shall comply with NAVMED P117 Article 15-107. Prior to site operations, CH2M HILL will verify training, medical qualification statements by physicians, and conformance to substance abuse testing and reporting programs. CH2M HILL has an active explosive certification program and monitors these personnel for conformance to the Bureau of Alcohol, Tobacco, Firearms, and Explosives, Safe Explosives Act 2003 Certification requirements for "Employee Possessor," and or "Responsible Person." 3R training for non-UXO qualified Personnel. (in addition to those in project's written safety plan: - OHS Construction Induction - Waste Management for waste streams and materials

Job Step	Potential Hazard	Controls
Forms/Permits	Unknown client-specific hazards. MEC Surface/Subsurface	• UXO qualified personnel, SOP MR 0001, 3Rs Training for Non-UXO qualified personnel, Metal (ferrous/nonferrous) detection equipment, DA EP 75-1-2. • Well driller license, drill rig permit • Well installation or abandonment notification • Dig/drill permit obtained, where required by client facility • Water withdrawal permit obtained, where required

Job Step	Potential Hazard	Controls
Site Setup	Striking underground utilities, impact with MEC	• Location of underground utilities and installations identified •Daily briefing • Avoid Surface and Subsurface MEC through the Sue MR SOP 0001 – MEC Anomaly Avoidance
	Striking overhead utilities	• Locate and take appropriate precautions with required distances from power lines • Lower mast and secure during travel
	Physical environmental hazards	• Use of appropriate personal protective equipment (PPE) where required. Safety boots, hard hats, safety glasses and hearing protection are mandatory. Respirators when chemical hazards exist. No loose-fitting clothing, rings, watches, etc.; long hair to be restrained close to the head.
	Dermal or inhalation exposure to contaminants	• Investigate history of area; determine nature and degree of contaminants that could be present • Conduct air monitoring for potential hazardous atmospheres as described in the project's written safety plan. • Use respirators and other PPE as prescribed in the project's written safety plan
	Fire /Explosion	• No smoking around the drill rig – MR SOP-0001 MEC Anomaly Avoidance
	Struck by vehicles	• Follow traffic control plan • Wear high-visibility warning vests
	Drill rig travel	• Ensure stable ground and adequate footing for machinery. Adequate ground preparation to support loads and accommodate waste materials. • Drill rig travel will be conducted with mast secured in its lowered position • Tools and equipment secured prior to rig movement • Only personnel seated in cab are to ride on the rig vehicle • Ensure clearance of overhead power lines • Use alarm or spotter when reversing rig
	Illegal offsite impacts	• Excavation area checked for wetlands, endangered species, cultural/historic resources
	Spread of contamination from contaminated drill cuttings	• Manage cuttings in accordance with all project plans

Job Step	Potential Hazard	Controls
Drilling Activities	Rotating machinery parts of drill rig MEC- surface/Subsurface – physical contact	• Daily inspection of drill rig & equipment • Ensure appropriate guards are installed or suitable barriers to forewarn personnel of dangers • Personnel clear during set up, clear of rotating parts • Loose clothing, long hair, and jewelry to be safely secured • Hands or feet should not be used to move cuttings away from auger • Rig in neutral and augers stopped rotating before cleaning • Kill switch installed, clearly identified and operational • Rig placed in neutral when operator not at controls • Pressurized lines and hoses secured from whipping hazards Advance Drill/bore hole/DPT in one foot increments applying MR SOP 0001-MEC Anomaly Avoidance Procedures
	Hoisting operations	• Ensure all personnel are clear of operation to a suitable safe distance
	Overturning of drill rig	• Establish drill pad if necessary • Drill rig level and stabilized
	Securing ropes and cables	• Ensure security to stable fixture. Do not wrap around any part of the body. • Drill rig ropes in clean, sound condition

22.0 PROCESS SUPERVISOR'S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the processes described within 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 workers statement for this process. I will ensure the SOP is the most recent revision. If a major change to the SOP is necessary, I will ensure that the processes are stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards arise, I will stop activities, until hazards have been controlled, reduced, or eliminated to an acceptable risk level.

SOP MRP 0001 PROCEDURE SUPERVISOR ACKNOWLEDGEMENT

UXO Supervisor's Name (print):	Supervisor's Signature	Organization	Date

23.0 PERSONNEL STATEMENT

I have read this SOP and I have received adequate demonstration of the procedure, training to perform the process and procedure according to requirements, procedure, and guidance identified below. I agree to follow this SOP, unless I identify a hazard, work condition, or compliance issue not addressed within this SOP or encounter a situation, condition, or issue that, I cannot perform according to the SOP. If such a stoppage occurs, I will immediately notify the SUXOS, UXO Technician III, or II. Should the situation, condition, or compliance remain unresolved for greater than 24-hours, I shall contact the Munitions Response Safety Officer (251) 962-2963.

SOP MRP – 0001 - PERSONNEL STATEMENT ACKNOWLEDGEMENT

Personnel Name (print):	**Personnel Signature**	**Organization**	**Date**

MRP – SOP – 0006
MUNITIONS RESPONSE PROGRAM (MRP)
STANDARD OPERATING PROCEDURE (SOP)
MUNITIONS AND EXPLOSIVES OF CONCERN (MEC) EXCAVATION

1.0 OBJECTIVE:

Warning

- Geophysical instrument detected subsurface anomalies shall be considered as Munitions and Explosives of Concern (MEC) or Material Potentially Presenting an Explosive Hazard (MPPEH). Thus, during excavation the application of heat, shock, or friction to an anomaly could result in an unintentional detonation.

- Intentional contact with MEC by Earth Moving Equipment (EME) may result in an unintentional detonation. Intentional EME contact with MEC is a "High-input" operation requiring an Explosives Safety Submission (ESS) or Explosives Sighting Plan (ESP) with approval for specific engineering controls to mitigate hazards. Thus, do not apply EME directly to a known MEC item or MEC suspect anomaly without an approved ESS or ESP identifying controls to mitigate risks. EME shall avoid MEC and MEC suspect anomalies by halting mechanical excavation a minimum of 12-inches from any anomaly.

2.0 PURPOSE:

To provide UXO Technicians with procedures for excavation of geophysical instrument detected anomalies.

3.0 APPLICABILITY:

This SOP applies to manual and EME excavation of geophysical instrument detected anomalies.

4.0 TECHNCIAL GUIDANCE:

This SOP lists processes and procedures in compliance with the following references:

- DOD 6055.09-M, Ammunition and Explosives Safety Standards, August 2010;
- DA 385-64, Ammunition and Explosive Safety Standards, August 2008;
- DA Engineering Manual (EM) 385-1-97 Explosives, Health and Safety, September 2008;

Note: Electronic copies for references listed above are available via CH2M HILL Senior UXO Supervisors (SUXOS)

5.0 SOP VALIDATION RECORD:

SOP Title: MEC Excavation ....Work Instruction Identification/ SOP: # MRP-SOP-0006

Author: K. Lombardo Date: October 11, 2010..................Revision: Revision #0;

Review: D Young, Date: October 12, 2010........................Approval; J. Bowles, Date: October 12, 2010

Validation Date: October 19, 2010 ....Process Observer: Kevin Lombardo,

6.0 HAZARDOUS MATERIALS:

Hazardous Chemicals: None; Product Name: N/A; Material Safety Data Sheets: N/A; Health Hazards: N/A

7.0 EMERGENCY RESPONSE INFORMATION

(Review Site Specific Accident Prevention Plan for insertion of details)

Work Site name, and location (address/building #): ____

Nearest intersection (cross streets) or entrance gate: ____

Safe Area Rally Point (gate/building or intersection):____

Note: Rally Point should be upwind of work location

7.1 UXO TECHNICIAN OR INITIAL ON SCENE LEADER :

UXO Technician or On Scene Leader :

(name) ____

A: Personnel Injury or Medical Distress:

1. Summon Emergency Medical Services (EMS): Call 9-1-1 or :___________________________
2. Identify address or nearest cross street intersection
3. Administer Fist Aid and/or CPR
4. Notify Project Manager (PM)
5. PM implements CH2M HILL SOP 111, Incident Notification, Reporting, and Investigations.

B: Fire:

1. Evacuate personnel from the Munitions Response Site/Area to safe rally point
2. Notify Fire Department of "Construction Site Name, (address, cross street intersection)," fire location, and personnel safe rally point; Call 9-1-1 or :_____________________________
3. Obtain head count, ensuring all personnel are present and or accounted for.
4. Notify Project Manager (PM)
5. PM implements CH2M HILL SOP 111, Incident Notification, Reporting, and Investigations.

7.2 EMERGENCY CONTACT NUMBERS:

Direct Telephone Numbers:

(Fire/Rescue radio call sign): ________________________ Phone # ________________________

Medical Services radio call sign: ____________________ Phone # ________________________

Range Control radio call sign: _______________________ Phone # ________________________

Project Manger POC: _______________________________ Phone # ________________________

Identify local disaster warning system (radio, PA, phone, other):__________________________

Local Warning Flag(s):____

Warning Bells/Horns/Sirens/Lights/Strobes: ____

Public Address System: ____

Weather Radio Channel: ____

Other: ____

8.0 PERSONNEL ROLES AND RESPONSIBILITIES

1. Project/Construction Manager (PM/CM): Provides the necessary budget and personnel to safely and efficiently accomplish the scope of work. Ensures CH2M HILL unexploded ordnance (UXO) personnel shall be qualified in accordance with DDESB Technical Paper (TP) 18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel and are certified to perform the job assigned and that certifications are current. Prior to site operations, CH2M HILL will verify training, medical qualification statements by physicians, and conformance to substance abuse testing and reporting programs. CH2M HILL has an active explosive certification program for personnel consistent with the requirements for UXO personnel at various levels of responsibility as identified IAW DDESB TP 18.
2. Senior UXO Supervisors and Unexploded Ordnance Technicians III or II: Supervise the operational resources necessary to implement, and accomplish the procedures and requirements set forth within the Work, Health, Safety, Quality and Accident Prevention Plans. May stop work at anytime to prevent accidents, remedy unsafe conditions, stop an unsafe act, or question the safety of a process or procedure or observe non conformance to this SOP and/or plans. The SUXOS provides a Site Specific Tailgate Safety Briefing to include MEC, construction, industrial, environmental, and natural safety hazard awareness and provides the plan of the day. As applicable, they provide a Hazardous Materials briefing for items used, consumed, or required for this SOP. This person shall also brief personnel on communications, security, emergency/medical response, evacuation, rally points, IAW with project instructions and plans. This person shall inform personnel to prevent disclosure of classified work, site observations, or information.
3. Unexploded Ordnance Quality Control Specialist (UXOQCS): Assists with the implementation of this SOP. Reports to the Munitions Response Quality Control Manager. Monitors conformance to this SOP and Work, Health, Safety, Quality, and Accident Prevention Plans.
4. Unexploded Ordnance Safety Officer (UXOSO) and/or UXOQCS (may be a dual-hatted position for small projects, reports to the Munitions Response Safety Manager). The UXOSO performs risk assessment to determine the number of visitors permitted, provides a safety briefing, and verifies training and medical surveillance qualifications of personnel. Responsible to implement health and safety/ activity hazard analysis, accident prevention plan requirements, assist the SUXOS to provide daily tailgate safety briefing, and enact emergency contingency plans as identified in plans. May implement on small projects quality control processes and procedures IAW quality control pan and or project instructions.
5. Earth Moving Equipment (EME) operator – Authorized as essential personnel to support mechanical excavations. Shall have a letter from the employing organization stating competence to operate assigned equipment. EME operators may be a non-UXO Qualified Person who is obligated to follow guidance within this SOP, Work, Health and Safety and Accident Prevention Plans and is under the direct supervision of a UXO Technician.

9.0 PRE-OPERATIONAL CHECK LIST

1. ( ) Applicable ESS, ESP, or Range Explosives Safety Criteria	2. ( ) Project Task/Work/ Instructions

3. ( ) Work Plan/Accident Prevention Plan/ Health and Safety Plan, Quality Control Plan	4. ( ) Personal Protective Equipment (PPE) IAW Safety Plan
5. ( ) Emergency P.O.C List	6. ( ) Directions and map to hospital
7. ( ) Communications (2 methods)	8. ( ) First aid/Fire Extinguisher 10lb BC
9. ( ). Manufactures equipment operations manual	

9.1 Anomaly Excavation General

Anomaly excavation operations will be executed by UXO-qualified personnel under the direct supervision of a UXO Technician III. The excavation team will not dig directly down to the item but will dig to the side to avoid striking the anomaly with digging implements. Extreme care will be taken during anomaly excavation to avoid striking, moving or otherwise disturbing potentially hazardous anomalies.

10.0 SURFACE CLEARANCE

A surface clearance is typically performed prior to subsurface excavation. UXO personnel will carefully identify and remove metallic debris identified during a surface clearance using MRP SOP 005 techniques to remove metal impeding subsurface detection. The UXO Team will typically consist of one UXO Technician III and generally not exceed six UXO Technicians II/I.

10.1 Preparation Excavation:

10.1.1 Prior to the start of excavation operations the Project Manager, SUXOS or UXOSO will establish an exclusion zone (EZ) based upon a determination of the Munition with the Greatest Fragment Distance (MGFD) as outlined within the ESS and Work Plan, both of which are required to be on site.

10.1.2 Only the minimum number of mission essential personnel or authorized visitors, consistent with safe and effective operations, will be in the established EZ during anomaly excavation operations. Minimum composition of the dig team shall be two UXO Technicians, one of whom must be a UXO Technician II. The dig team will work under the direct supervision of a UXO Technician III. Direct supervision for the purposes of this paragraph means that the UXO Technician III will be physically located at the location where intrusive operations are being conducted and team members can promptly obtain his/her attention or assistance.

10.1.3 PPE and safety equipment will be readily available and emergency communications established prior to the commencement of excavation operations. Personnel will be trained on their role/duties, operator hand signals, and emergency actions as assigned by the UXO Technician III.

10.1.4 Ensure the area to be excavated is free of non-explosive buried hazards such as utilities or HTRW (Hazardous, Toxic, or Radiological Waste). If such hazards are present, ensure the crews are aware of the hazards, there locations and proper precautions have been established.

10.2 Excavations:

Note: Excavation procedures shall conform to Excavation and Trenching Safety (Enterprise Standard Operating Procedure HSE-307)

10.2.1 Locate the center of the anomaly or object if possible. This will normally be indicated by a plastic pin flag typically placed one foot north of the anomaly during Digital Geophysical Mapping (DGM) anomaly reacquisition for digital geophysical mapping or as indicated by the equipment operator during "metal detection and digging" operations.

10.2.2 Do not dig directly down on or over the top of an anomaly or object. Manual - Select a point approximately 12 inches from the center of the anomaly or object to begin hand digging.

10.2.3 Tools used for excavating may include a hand shovel or trowel for small shallow items. .

10.2.4 Physical contact with the anomaly is not authorized until a positive identification is made. The hole should be checked periodically with metal detection equipment to assist in pinpointing the location of the anomaly and to assist in letting the team know when they are close to exposing the anomaly. The last 12 inches shall be dug using hand excavation implements.

10.2.5 Once the dig team nears the object, further excavation should be done with extreme care to avoid moving or otherwise disturbing the object until it can be properly identified. The hole should be maintained sufficiently large to permit proper identification of the object and to prevent collapse of the hole from disturbing the object; avoid "rat-holing", i.e. too narrow for adequate excavation with a hand tool.

10.2.6 Once the item has been identified as MPPEH, excavation should continue only to the extent necessary to ensure proper identification of the object, its hazards, its physical condition, and to facilitate disposition or disposal in place.

10.2.7 If the object is determined to be non-hazardous, it may be removed from the excavation and disposed of in accordance with the project work plan. The hole should be checked using the prescribed detection equipment to ensure the anomaly was completely removed and there are no other anomalies present.

10.2.8 Upon completion of anomaly excavation and after removal or disposal in place, the hole should be refilled or left open as prescribed in the Work Plan for Quality Control.

10.2.9 Anomalies deeper than two to three feet should be assisted by mechanical excavation of buffer layers of confining soils by EME such as a backhoe or track excavator. Mechanical excavation should be performed by specifically trained individuals and may require additional safety procedures including step downs, shoring, or confined space considerations and the placement of spoils. The UXOSO will monitor mechanical excavations and will prescribe additional safety procedures as required by ESS, ESP, and or Work Plan.

10.2.10 If excavation is deeper than four feet a "Competent Person" must be on site. Sshoring or sloping may be necessary. Contact the UXOSO who will assess the requirements for engineer controls.

11.0 GENERAL INFORMATION

CATEGORY:	**DIRECTIONS:**
MEC/Anomaly Avoidance	**(S)** = Safety, **(O)** = Operations, **(Q) =** Quality Control

(WARNING)

- **Fire: (s)** Do not attempt to fight a fire, evacuate area, move upwind or crosswind to safe rally point, notify fire department.
- **Wildlife: (s)** Aggressive/defensive – Avoid wildlife – slowly withdraw from area
- **Hunters: (s)** Withdraw from area, retreat to vehicle, contact project authority
- **CWM: (s)** Evacuate upwind to safe rally point, mark area on map, contact PM
- **Severe Weather (lighting, winds, and storms): (s)** Evacuate to vehicle, follow PM guidance

12.0 SAFETY

Munitions Response Safety Officer	Dan Young/NVR – Dan.Young@ch2m.com Telephone (Office): **(251) 962 – 2963** Telephone (Cellular): **(251) 752 – 0148**
Explosive Safety, Accident Prevention Plan (APP) and Activity Hazard Analysis (AHA)	(s) Mandatory – UXO Technician(s) are required to read, comply, and acknowledge they understand and comprehend warnings, notes, technical information, safety requirements contained within construction plans, SOP(s) and AHA(s); attesting through signature and date
Visitor(s) access to work location	(s) Visitors (contract/transient/witness) require a safety briefing, wear of PPE IAW site specific safety plan, and conformance to UXO Technician instructions.

Safety Meeting:	(s) Each morning personnel shall participate in a tailgate safety briefing, discussing operational activities (plan of the day), MEC/HTRW hazards/risks, safety controls, and emergency procedures; daily weather forecast, work activity PPE OSHA level, insect/poisonous plant avoidance, and heat/cold stress prevention. Personnel shall sign and date, the safety briefing acknowledgment form; confirming individual participation, understanding, and comprehension prior to operations. Personnel who do not participate in the safety briefing or, understand, or comprehend the safety briefing may not access work areas during Munitions Response activities.
Safety Pre-field operations check list	(s) ( ) First Aid Kit (serviceable and supplies within shelf life) (s) ( ) Fire Extinguisher 10BC (or greater) (charged/indicator green) (s) ( ) Water (minimum 1 liter per operational person) (s) ( ) Cell phone/identified alternate land line location/or two/way Radio (s) ( ) Identification of wind direction, and rally points (s) ( ) PPE IAW Activity Hazard Analysis (s) ( ) Vehicles unlocked; keys in announced location (s) ( ) Insect repellant/sun screen (available)
13.0 EXCAVATION EQUIPMENT	

Equipment Check-out: as required by Team leader –(equivalent types and selections optional) 1) Shovels 2) Buckets 3) Hand Tools (excavation) 4) Tape Measure 5) EME in accordance with manufactures Instructions	(o) Tools sharp, free of damage, cracked handles, or loose connections (o) EME IAW with manufactures operating instruction

14.0 QUALITY CONTROL

The QC Manager will be responsible for ensuring this SOP is effectively implemented. Surveillances and/or inspections will be conducted to ensure SOP compliance.	UXOQC personnel shall document nonconforming materials, items or activities in a NCR based on surveillances and/or inspections

15.0 ACTIVITY COMPLETION

Completion of documentation:	( ) Project site logs to Project Manager ( ) Tail gate safety meeting log to Project Manager ( ) Equipment check-out report to Project Manager ( ) Quality control reports to Project Manager

16.0 EQUIPMENT

ITEM	**QUANTITY**
Cellular telephone (HERO Safe)	1
Magnetometer capable of monitoring to a depth of two-feet below ground surface for ferrous items	1 or (as required by Project instruction)
All metals detector capable of monitoring to a depth of 6-inches below ground surface for non-ferrous items	Optional

Multi colors of marking flags, ribbon, and tape	As determined by SUXOS
Batteries	Two day supply for instruments
First –aid Kit (25 person)	1 within the work area
Water	Minimum 1 liter per person in work area
Camera/Tape Measure/Ruler/Calipers/Paper Pencil	As determined by SUXOS
Hand tools, (trowles, general purpose tools, etc.)	Assorted As determined by SUXOS

MINIMUM PERSONAL PROTECTIVE EQUIPMENT: IAW with Safety Plan and AHA or a minimum of OSHA LEVEL "D"

Coveralls (or long pants, sleeved (may be short sleeved) shirt)

Boots (level "D")

Cover (cap, floppy, skull)

Gloves (leather)

Safety Eye protection (as required by AHA)

Hard hats with chin straps (when working in an area with a specific potential for head injury or heavy equipment e.g. drill rig)

The SUXOS will direct the required explosive safety site PPE conditions.

17.0 SPECIAL TRAINING AND REFRESHER REQUIREMENTS:

SPECIAL TRAINING AND REFRESHER REQUIREMENTS:

UXO qualified personnel will be graduates of the U.S. Naval Explosives Ordnance Disposal (EOD) School at Indian Head, MD or other DDESB TP 18 approved course or school of instructions, Hazard Waste Training IAW 29CFR 1910.120 (e) & (f) and medical clearance physical authorization to perform work.

EME operators shall be certified by employer organization as component

WAIVERS, EXEMPTIONS, SPECIFIC AUTHORIZATIONS, OR APPROVED DEVIATIONS THAT APPLY TO THIS OPERATION: None

18.0 ACTIVITY HAZARD ANALYSIS

Safe Work Method Statement/ Job Hazard Analysis

Company Name: **CH2M HILL**	Project Name/#:
Work Activity/Task: SOP MRP 0006 MEC Excavation	Principal Contractor:
Date: December 09, 2009	Note: Sign off to be provided at Safety Tailgate Meeting
Prepared by: Dan Young	Supervisor: TBD by project location
Signature:	Safety Coordinator (SC): TBD by project location
Excavate MEC	Training Requirements 29 CFR 1910.120 (e) & (f); DDESB TP 18 minimum qualifications for Unexploded Ordnance Technicians. Prior to site operations, CH2M HILL will verify training, medical qualification statements by physicians, and conformance to substance abuse testing and reporting programs. CH2M HILL has an active explosive certification program and monitors these personnel for conformance to the Bureau of Alcohol, Tobacco, Firearms, and Explosives, Safe Explosives Act 2003 Certification requirements for "Employee Possessor," and or "Responsible Person." 3R training for non-UXO qualified Personnel. (in addition to those in project's written safety plan: - OHS Construction Induction - Waste Management for waste streams and materials)

Job Step	**Potential Hazard**	**Controls**
Walking and working surface	Slips, trips and falls	• Daily tool box meeting will address the hazards of slips, trips, and falls on the job site. • Individuals will not carry anything that will block their vision of where they are stepping. • All holes will be backfilled as soon as possible to eliminate this hazard. • Sturdy work boots shall be worn within the EZ. •
Surface Removal of	Blast and fragmentation	• MEC/MPPEH will be identified, stored or disposed of IAW approved ESS and Work Plan.

metallic objects		• Only authorized personnel shall perform surface removal activities. • Emergency procedures shall be brief and tested prior to actual field work commencement. •
	Slip, trips and falls, Blast and fragementation	Same as above. Pin flag shall be placed one foot north of the anomaly.
Re-acquiring of anomaly and pin flag placement Anomaly Investigation	Blast & fragmentation – Slip, trips and falls	• Same as above. • Offset digging only. • Only UXO Technicians may dig on an anomaly. • Limited number of personnel allowed within the EZ during intrusive activities. • Briefing of personnel on emergency requirements and testing of the plan prior to field activities. • Hole will be filled in after QC/QA activities – to ground level • Pin flag will be removed from the hole. • Contact with anomaly is prohibited until a positive identified can be made. • Safety to move must be agreed to by the SUXOS and UXOSO. • Approved ESS and Work Plan must be followed. •

Job Step	Potential Hazard	Controls
Field Activities	Fire /Explosion	• No smoking or open flames in the EZ
	Struck by vehicles	•Follow traffic control plan •Wear high-visibility warning vests • Approach vehicles only after eye contact with driver/operator is obtained.
		•Ensure stable ground and adequate footing for machinery. Adequate ground preparation to support loads and accommodate waste materials. • Construction equipment travel will be conducted with equipment secured in its lowered position, as applicable •Use alarm or spotter when reversing equipment • EME will only be operated by competent person.

19.0 PROCESS SUPERVISOR'S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the processes described within 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 workers statement for this process. I will ensure the SOP is the most recent revision. If a major change to the SOP is necessary, I will ensure that the processes are stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards arise, I will stop activities, until hazards have been controlled, reduced, or eliminated to an acceptable risk level.

SOP MRP 0006 PROCEDURE SUPERVISOR ACKNOWLEDGEMENT

UXO Supervisor's Name (print):	Supervisor's Signature	Organization	Date

20.0 PERSONNEL STATEMENT

I have read this SOP and I have received adequate demonstration of the procedure, training to perform the process and procedure according to requirements, procedure, and guidance identified below. I agree to follow this SOP, unless I identify a hazard, work condition, or compliance issue not addressed within this SOP or encounter a situation, condition, or issue that, I cannot perform according to the SOP. If such a stoppage occurs, I will immediately notify the SUXOS, UXO Technician III, or II. Should the situation, condition, or compliance remain unresolved for greater than 24-hours, I shall contact the Munitions Response Safety Officer (251) 962-2963.

SOP MRP – 0006 - PERSONNEL STATEMENT ACKNOWLEDGEMENT

Personnel Name (print):	Personnel Signature	Organization	Date

MRP – SOP – 0009

MUNITIONS RESPONSE PROGRAM (MRP)

STANDARD OPERATING PROCEDURE (SOP)

MUNTIONS AND EXPLOSIVES OF CONCERN (MEC)

EXPLOSIVE DETONATION OPERATIONS

Warning

Munitions and Explosives of Concern (MEC)(specifically, Unexploded Ordnance (UXO) and Discarded Military Munitions (DMM)), Material Documented as an Explosive Hazard (MDEH), Material Potentially Presenting an Explosive Hazard (MPPEH) and Commercial Explosives may initiate when subjected to heat, shock, or friction resulting in an unintentional explosion, fire, or dispersal to the environment. Unintentional detonations may result in catastrophic, severe, or secondary fatalities, injuries, or fire and property damage.

Warning:

Electrical Detonation Procedures Will Not Be Performed Within 500 Feet Of Energized Power Lines

Detonation Operations

1.0 OBJECTIVE:

To provide authorized CH2M Hill UXO Technicians with safe processes and procedures to reduce, limit, or eliminate controlled detonation explosive risks to the public, other workers, and the environment. To establish guidance for controlled detonations of MEC, MDEH, UXO, DMM, and MPPEH, or commercial explosives; providing safe processes and procedures to prevent, limit, control and or reduce adverse effects from unintentional or intentional detonations.

2.0 PURPOSE:

This SOP provides step-by-step procedures for explosive detonation operations ensuring compliance with applicable Federal, DOD, state, and local laws, regulations, policies, procedures, and practices.

3.0 APPLICABILITY:

This SOP applies to detonation operations located on US federal and state land, private property, formerly used defense sites (FUDS), and on active installations or ranges

4.0 TECHNCIAL GUIDANCE:

This SOP lists processes and procedures in compliance with the following references:

- OSHA General Industry Standards 29 CFR 1910
- OSHA Construction Standards 29 CFR 1926
- DOD 6055.09"M" Ammunition and Explosives Safety Standards, August 2010;
- DOD 4145.26-M Contractors Safety Manual for Ammunition and Explosives August, 1997
- Technical Manual 60A-1-1-31 Explosive Ordnance Disposal Procedures
- USN NAVSEA OP 5Volume 1; Ammunition and Explosives Safety Ashore, July 2009;
- NOSSA Instruction 8023.11A, Standard Operating Procedure Development, August, 2004
- USAF Manual 91-201 Explosives safety Standards November 2008
- DA Pamphlet 385-64 Ammunition and Explosives Safety Standards October, 8, 2008
- DA Field Manual (FM) 21-16, Unexploded Ordnance (UXO) Procedures August, 1994
- DA Engineering Manual (EM) 1110-1-4009 Military Munitions Response Actions, June, 2007
- DA Engineering Pamphlet (EP) 1110-1-18 Military Munitions Response Process, April 2006
- DA Engineering Manual (EM) 385-1-97 Explosives, Health and Safety September 2008;
- **Note: Electronic copies of references listed above are available via CH2M HILL Senior UXO Supervisors (SUXOS).**

5.0 SOP VALIDATION RECORD:

SOP Title: Explosive Detonation Operations ....Work Instruction Identification/
SOP: # MRP-SOP-0009

Author: K. Lombardo Date: September 18, 2010 ....Revision: Revision #1; October 1, 2010

Review: D Young, Date: October 1, 2010 ....Approval; J. Bowles October 12, 2010

Validation Date: September 22, 2010.................................Process Observer: Kevin Lombardo,

6.0 HAZARDOUS MATERIALS:

Hazardous Materials, Hazard Class/Division: Explosives 1.1, Detonators 1.1 or 1.4, Primer Cord 1.1; Jet Perforators 1.4, Initiators 1.4, or Exploding Bride Wires (EBW's) 1.4, or Nonel© Shock Tube 1.4

Product Name, UN #, EX #: (print information below)

1.____

2.____

3.____

4.____

5.____

Attach applicable Material Safety Data Sheets (MSDS):

7.0 EMERGENCY RESPONSE INFORMATION

(Review Site Specific Accident Prevention Plan for insertion of details)

Work Site Name (location) address/building # Street): ________________________

Nearest intersection (cross streets) or entrance gate: ________________________

Safe Area Rally Point (gate/building or intersection) Note: Rally Point should be upwind of work location:

____

7.1 SUXOS or Initial On Scene Leader :

(name) ____

A: Personnel Injury or Medical Distress:

1. Summon Emergency Medical Services (EMS): Call 9-1-1 or :________________________
2. Identify address or nearest cross street intersection
3. Administer Fist Aid and/or CPR
4. Notify Project Manager (PM)

5. PM implements CH2M HILL SOP 111, Incident Notification, Reporting, and Investigations.

B: Fire:

1. Evacuate personnel from the Munitions Response Site/Area to safe rally point
2. Notify Fire Department of "Construction Site Name, (address, cross street intersection)," fire location, and personnel safe rally point; Call 9-1-1 or :____________________________
3. Obtain head count, ensuring all personnel are present and/or accounted for.
4. Notify Project Manager (PM)
5. PM implements CH2M HILL SOP 111, Incident Notification, Reporting, and Investigations.

Direct Telephone Numbers:

(Fire/Rescue radio call sign): _______________________ **Phone #** _______________________

Medical Services radio call sign: ____________________ **Phone #** _______________________

Range Control radio call sign: ______________________ **Phone #** _______________________

Project Manger POC: ______________________________ **Phone #** _______________________

Identify local disaster warning system (radio, PA, phone, other):_________________________

Local Warning Flag(s):____

Warning Bells/Horns/Sirens/Lights/Strobes: ____

Public Address System: ____

Weather Radio Channel: ____

Other: ____

8.0 PERSONNEL ROLES AND RESPONSIBILITIES

Note: Roles and responsibilities are dependent upon work plan direction; one or all roles and responsibilities may be applicable.

1. Project/Construction Manager (PM/CM): Provides the necessary budget and personnel to safely and efficiently accomplish the scope of work. Ensures CH2M HILL unexploded ordnance (UXO) personnel shall be qualified in accordance with DDESB TP-18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel and are certified to perform the job assigned and that certifications are current. Prior to site operations, CH2M HILL will verify training, medical qualification statements by physicians, and conformance to substance abuse testing and reporting programs. CH2M HILL has an active explosives certification program for personnel conforming to requirements for UXO personnel identified IAW DDESB TP 18, and monitors these personnel for conformance to the Bureau of Alcohol, Tobacco, Firearms, and Explosives, Safe Explosives Act 2003 Certification requirements for "Employee Possessor," and or "Responsible Person."
2. Senior UXO Supervisor (SUXOS): Supervises the operational resources necessary to implement, and accomplish the procedures and requirements set forth within the Work, Health, Safety, Quality and Accident Prevention Plans, may stop work at anytime to prevent accidents, remedy unsafe conditions, stop an unsafe act, or question the explosives safety of a process or procedure or observe non conformance to this SOP and/or plans. Provides a Site Specific Tailgate Safety Briefing to include MEC, construction, industrial, environmental, and natural safety hazard awareness. Provides the plan of day. This person shall brief personnel on communications, security, emergency/medical response, evacuation, rally points, IAW with project instructors, and plans. This person shall inform personnel to prevent disclosure of classified work, site observations, or information. Prior to commencement of detonation operations, the SUXOS shall designate an experienced and trained UXO Supervisor (UXO Technician III) to act as the Detonation Supervisor.
3. Detonation Supervisor (DS): Detonation activities shall be conducted under the direct control of the DS specifically assigned the responsibility of supervising detonation operations within the Munitions Response Site (MRS). The DS shall be responsible for preparing on-site UXO personnel assigned to the DS team regarding the nature and hazards of the materials handled, the Material Safety Data Sheet (MSDS) warnings, and emergency response actions, and the precautions necessary to safely perform detonations. The DS will ensure a daily operational log entry is made with ordnance and explosives accountability log entries (as applicable), Demolition Records and inventory records are properly completed and accurately depict the demolition events and demolition material consumption for each day's operations. The DS shall be present during all detonation or demolition operations.
4. Unexploded Ordnance Technician (UXOT) III: Implements this procedure and monitors the explosives safety of field personnel, has the same authority and responsibility as the SUXOS to suspend explosives operations for explosives safety concerns.
5. UXO Technician, II: Authorized to implement these procedures and site specific project instructions. Has the same authority as the UXO Technician III to suspend explosives

operations for explosives safety concerns.

6. UXO Technician, I: Authorized to implement these procedures as authorized by DDESB TP 18, may handle and support use of commercial explosives (restricted from handling MEC, MDEH). Authorized to suspend explosives operations for explosives safety concerns

7. UXO Quality Control Specialist (UXOQCS): Has the same authority and responsibility as the SUXOS. Assists with the implementation of this SOP. Reports to the MR Quality Control Manager. Monitors conformance to this SOP and Work, Health and Safety, Quality, and Accident Prevention Plans. The

8. Unexploded Ordnance Safety Officer (UXOSO) and or UXOQCS (may be a duel position for small projects, reports to the Munitions Response Safety Manager). Has the same authority and responsibility as the SUXOS to suspend explosives operations for explosives safety. The UXOSO performs risk assessment to determine the number of visitors permitted, provides a safety briefing, and verifies training and medical qualifications of personnel. Responsible to implement health and safety/activity hazard analysis, accident prevention plan requirements, assist the SUXOS to provide daily tailgate safety briefings, and enact emergency contingency plans as identified in planning documents. The UXO Safety Officer (UXOSO) for the site is responsible for ensuring that all demolition operations are being conducted in a safe and healthful manner, and is required to be present during all MEC demolition operations. The only exception to this rule is when the project site has multiple sites conducting various types of UXO investigation and remediation operations being conducted concurrently with periods where there may be continuous demolition operations throughout the day. In that event a demolition team UXOSO will be designated. This individual will report to the UXOSO and assume the UXOSO's responsibilities at the demolition range. In this situation, the UXOSO will conduct periodic safety audits of the demolition team and assist the demolition team UXOSO in the performance of his duties.

9.0 PRE-OPERATIONAL CHECK LIST

1. Applicable ESS or ESP or Operational Range Instructions reviewed by essential personnel and available on site in hard copy. ✓ ( ) SUXOS shall confirm step completion	**2.** Explosives Management Plan (EMP): ✓ ( ) DS confirms EMP review by essential personnel and EMP is available on site in hard copy.

3. Emergency P.O.C., list with telephone numbers: ✓ ( ) posted or location identified to essential persons and personnel supporting this SOP	**4.** Permit/inspections posted or present (as required by permit); ✓ ( ) Federal ATF Permit (posted) ✓ ( ) Federal Hazardous Material Permit ✓ ( ) Applicable state/county permits, State blaster/magazine inspections ✓ ( ) States & counties can require permits to transport hazardous materials (consult work plan) ✓ ( ) Have a written route plan IAW explosives listed within 49 CFR 397.19.
5. Directions and map to hospital: ✓ ( ) DS confirms hospital directions and travels to hospital/clinic/aid station, or heliport, applying directions (as required edits and corrects as applicable) ✓ ( ) Directions and map reviewed by SOP assigned essential persons and support personnel, ✓ ( ) Detonation and safety support vehicles have (corrected as applicable) directions and map to hospital/clinic /aid station, or heliport in each vehicle.	**6.** Safe Area Rally Point(s) identified to operational personnel and visitors ✓ ( ) Rally Point #1 detonation firing location (essential personnel): ______________________________ ✓ ( ) Rally Point #2 detonation safe area (non- firing location) non–essential personnel located outside Maximum Fragmentation Distance (MFD)- Horizontal (H): ______________________________ ✓ ( ) Rally Point #3 Emergency Evacuation outside MRS for all personnel: ______________________________
7. 911 Call Center: ✓ ( ) 24 hour date & time notification to 911 call center (as applicable to location)	**8.** NOTAM: ✓ ( ) 24 hour date & time Notice To Airmen and/or Mariners (NOTAM)
9. Fire Department: ✓ ( ) 24 hour date & time notification to Fire Department	**10.** Law Enforcement: ✓ ( ) 24 hour date & time notification to Law Enforcement (as applicable to location)
11. Emergency Response Equipment: ✓ ( ) First-aid kit (25 person) ✓ ( ) Fire Extinguisher (1) 20lb BC (firing point)	**12.** Communications: ✓ ( ) 2 methods/means ✓ ( ) DS announce radio call signs
13. Essential Personnel:	**14.** . Entry Control Points (ECP's)

✓ ( ) UXOSO authorized number (____) of essential personnel based on risk analysis ✓ ( ) DS documents number of essential personnel in logbook by: date, event, and team composition, identifying each person by position title	✓ ( ) ECP's posted with signs or staffed (as applicable to local conditions). Locations: ✓ ( ) ECP #1: ______________________ ✓ ( ) ECP #2: ______________________ ✓ ( ) ECP #3: ______________________ ✓ ( ) ECP # 4:______________________
15. Detonation item "specific" Safety: ✓ ( ) Hazardous Fragment Distance (HFD)________ ft; ✓ ( ) MFD-H _______ ft , ✓ ( ) Maximum Fragmentation Distance – Vertical (MFD-V) ________ft, ✓ ( ) Buried Explosion Module (BEM) feet of cover ________; ✓ ( ) Sandbag cover thickness: _______ inches	**16.** Detonation Explosive Limit: ✓ ( ) Maximum Net Explosive Weight (NEW) for detonation event identified within ESS or ESP or identified by Range Control or Work Plan ✓ ( ) Maximum NEW(*) :_________ lbs (*) NEW = Item explosive weight + donor explosives
17. Warning Signals: ✓ ( ) DS confirms warning signal briefing to operational and visitor personnel: ✓ ( ) Horn – One 30 second sound = prior to Explosive Material Preparation and Handling ✓ ( ) Horn – (3) three, 15 second horn sounds = (1) one minute prior to Detonation Event ✓ ( ) Oral – (15) fifteen seconds prior to initiation of detonation, (3) three shouts "Fire in the Hole!", shouted toward direction of detonation location, and 90 degrees right and left of detonation location. ✓ ( ) Horn – (2) two, 30 second sounds, sounds separated by 5 second quite time = detonation "All Clear"	18. Warning Flag(s) BRAVO "RED" ✓ ( ) Operational Range (specific) ✓ ( ) Bravo "Red" Flag flying; (prior to delivery of explosive materials) ✓ ( ) Entry point (flag flying) ✓ ( ) Bravo "Red" Flag removed; (conclusion of detonation operations and return of potential unused explosive materials).
WARNING	

Vehicle Accidents:

- Warn others of explosive danger, keep bystanders away, do not allow smoking or open flames within 25 feet of vehicle. If either vehicle is on fire, withdraw persons a minimum of 200 feet, contact emergency services. Remove all explosives before separating vehicles involved in a collision. Place explosives a minimum of 200 feet from vehicles, traffic, inhabited buildings, and maintain security of explosive materials, or load to vehicle DOT inspected to transport explosive materials.

  Note: If security of explosive materials is unobtainable from injury or other circumstances, request law enforcement assistance.

Vehicle Mechanical Failure:

- Warn others of explosive danger, keep by standards away, do not allow smoking or open flames within 25 feet of vehicle , do not accept assistance from a unknown persons; request assistance through explosives transportation provider or permit holder, or local law enforcement, do not abandon control of explosive materials to seek assistance.

Ref: DOT Federal Motor Safety Carrier Administration

19. ( ) Movement of Explosive Materials:

- ✓ ( ) (IAW49 CFR 171.180 & 49 CFR 173-.56.
- ✓ ( ) Transport Route (restrictions)
- ✓ ( ) Shipping papers or manifest with MSDS for Hazmat
- ✓ ( ) Vehicle has latest edition of DOT Hazardous Materials Emergency Response Guidebook in vehicle,
- ✓ ( ) Vehicle has emergency "Red" warning flags, or reflector triangles, or battery powered electric lanterns (note: flares, fuses, pyrotechnic railroad signals, or open flame devices are prohibited)
- ✓ ( ) Vehicle has DOT approved wheel chocks (2) two and are in use when vehicle is loaded or unloading explosive materials
- ✓ ( ) No Smoking within 25 feet of explosive loaded vehicle or staging, handling or use
- ✓ ( ) DD form 626 completed (IAW active installation requirements)
- ✓ ( ) Fire Extinguishers (2) two Underwriter

20. Vehicle Operation:

- ✓ ( ) Vehicle operator has valid Commercial Drivers License (CDL) for class of vehicle assigned to operate
- ✓ ( ) Vehicle operator CDL has appropriate state endorsement for Hazardous Materials Transportation (HAZMAT)
- ✓ ( ) Vehicle operator has current DOT physician approval to perform to DOT standards
- ✓ ( ) Conformance to CDL restrictions identified on permit (e.g.: corrective lens)

Laboratories (UL) rated-20lb BC ✓ ( ) Placards (IAW applicable Hazard Class/Division hazardous materials classifications) ✓ ( ) Storage shipping container(s) rated for explosives transportation with non-sparking lining for each explosives compatibility group.	
10.0 Electric Detonators	
Electric detonators and electric blasting circuits may be energized to dangerous levels from outside sources such as static electricity, induced electric currents, and radio communication equipment. Safety precautions will be taken to reduce the possibility of a premature detonation of the electric detonator and explosive charges of which they form a part.	
The shunt shall not be removed from the leg wires of an electric detonator until ready to perform a continuity check of each detonator	
When uncoiling or straightening the electric detonator leg wires, keep the explosive end of the detonator pointing away from the body and away from other personnel. When straightening the leg wires, do not hold the detonator itself; rather hold the detonator leg wires approximately six inches from the electric detonator body. Straighten the leg wires by hand; do not throw or wave the wires through the air to loosen them. When complete barricade caps, or boosters under sand bag or other work plan authorized barricade.	
Prior to use, each electric detonator shall be tested for continuity in the following manner:	
Warning: This process shall be accomplished at least 25 feet from and downwind of MEC/MDEH/MPPEH or donor explosive detonation materials. In addition, all personnel on the detonation range shall be reduce to authorized essential personnel limits, alerted prior to electric blasting circuit testing, and positioned a safe distance away from detonators and donor explosive materials.	

11.0 Detonator Test

1) To conduct the test, place the detonators in an approved container, pre-bored hole in the ground or place them under a sandbag; walk facing away from the detonators, and stretch lead wires to their full length, being sure to not pull the detonators from the approved container, hole or sand bag.

2) With the leg wires stretched to their fullest length, test the continuity of the detonators one at a time by un-shunting the leg wires and attaching them to the galvanometer and checking for continuity.

3) After this test, re-shunt the electric detonator lead wires by twisting the two exposed wire ends together in a braid.

4) Repeat this process for each detonator until all detonators have been tested.

12.0 Detonating (Det) Cord

1) Det cord will be cut using approved method, and only the amount required should be removed from inventory.

ii. Det cord will not be placed in clothing pockets or around the neck, arm, or waist. Det cord will be placed at least 50 feet away from detonators and detonation materials until ready for use. To ensure consistent safe handling, each classification of detonation material shall be separated by at least 50 feet until ready for use.

iii. When utilizing sensitized det cord, cap and det cord mating will be done 50 feet away from all donor explosives material and MEC/MDEH/MPPEH items

iv. When ready to “tie in” either the det cord to donor explosives, or det cord to detonator, the det cord will be connected to the donor explosives and placed IAW the Explosive Ordnance Disposal procedure for the MEC/MDEH/MPPEH item.

13.0 Time/Safety Fuse

1) Prior to each daily use, the burn rate for the time/safety fuse must be tested to ensure the accurate determination of the length of time/safety fuse needed to achieve the minimum burn time of ten minutes needed to conduct detonation operations.

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

3) Accurately measure and cut off an eighteen inch long piece of the time/safety fuse from the roll.

4) Take the eighteen-inch section, downwind and 50 feet away from all explosive material/MEC/ MDEH/ MPPEH, and attach a fuse igniter.

5) Ignite the time fuse and verify the eighteen-inch section burns for approximately one minute (Start a stop watch at ignition and stop at spit).

6) No less than fifteen feet (ten minutes Safe Separation Time (SST)) of time fuse will be used for non-electric firing systems

14.0 Perforator Use:

1) Keep perforators stored at the detonation site at least 50 feet away from detonators and detonation materials, until ready for use.

2) When ready to use, place the det cord through the priming slot on the perforator or secure perforator in place for attack on the target and then place det cord through slot on the perforator. Ensure the cord fits securely and has good continuity with the perforator.

15.0 Detonation Charge Placement on MEC/MDEH/MPPEH items:

Warning:

Do not rely on color coding to distinguish between a live and practice munition

15.1 Items 5 inches in diameter and smaller:

1) Place jet perforator in alignment with the appropriate position of the MEC/MDEH/MPPEH item. Counter charge the main charge or counter charge cone as appropriate.

2) If the MEC/MDEH/MPPEH item is HE filled the jet perforator will initiate the main charge and produce a high order detonation.

3) If the MEC/MDEH/MPPEH item is inert the jet perforator will visually expose the inert filler and positively ascertain that the MPPEH item is

inert and may be documented as material documented as Safe (MDAS). In addition, this process will produce a vent hole which will allow for further demilitarization procedures (i.e. hand torch operations or other approved methods).

15.2 Items 5 inches in diameter and larger, to include MK-80 series and M-series bombs:

1. As applicable, place an explosive charge on/in the nose and tail fuze wells or position the charge on the forward and aft areas of the bomb body to vent and visually expose the inert filler and to allow further demilitarization procedures (i.e. hand torch scoring followed by shear operations).

2. If the MEC/MDEH/MPPEH item is HE filled this process will counter charge the main charge and produce a high order detonation.

16.0 Preparing Explosive Charge for Initiation:

1) All personnel not required to prime charges will depart and proceed to the firing point or safe area.

2) Ensure shunt is in place for opposing end of blasting wire and is secure to prevent shunt from dislodging

3) Secure detonator under barricade, hold lead wires, un-shunt lead wires, individually connect legs of lead wires to blasting circuit wire

4) Isolate each leg of lead wires to ensure bare wire contact is not possible between lead wires, insulate each lead wire at all connections with UL rated electrician tape.

5) Request permission from UXOSO to prime charge (If multiple charges are to be primed, only one request to prime is needed).

6) Remove electric detonator from barricade and place in explosive charge, prime the explosive charge.

7) Initiating charges

<u>Electrical Firing:</u>

a. Depart to the firing point and or safe area.

b. Check in with the UXOSO; to obtain an accurate head count and request permission to fire.

c. Once permission to fire is received from the UXOSO, three loud “fire in the holes” will be verbally shouted for a 360 degree coverage and one “fire in the hole” will be transmitted over the radio.

d. Utilizing a blasting machine or device initiate the detonation

<u>Non Electrical Initiation:</u>

a. All personnel not directly involved with the initiation process will depart to the safe area.

b. Ensure all personnel are accounted for and request permission from the UXOSO to fire.

c. Once permission to fire is received from the UXOSO, three loud “fire in the holes” will be verbally shouted for a 360 degree coverage followed by one “fire in the hole” transmitted over the radio.

d. The farthest team member will initiate the detonation and transmit over the radio “smoking hole on one”. The UXOSO will document the time to calculate and track the detonation safe separation time.

e. During multiple detonation operations, the time between detonations will be determined by the SUXOS. The SUXOS will calculate and ensure there is sufficient time (for all detonations) for all team members to safely transit to the designated safe area.

f. Once smoke is observed the Non electric initiation team members will proceed to the safe area utilizing the briefed route.

g. Once all detonations have been initiated the SUXOS will be the last team member to depart the detonation site.

h. Rendezvous at the safe area for muster.

17.0 Post Detonation Procedures

NOTE:

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

1) After final detonation initiation a 5-minute wait time will be observed.

2) The UXOSO will conduct a visible survey of the area before giving an "all clear" to proceed back down range.

3) The SUXOS and UXOSO will proceed down range to conduct a detonation verification inspection.

4) Once the SUXOS and UXO Technician III have inspected the detonation site and determined that the area is safe to re-enter, the team members will be authorized to proceed back downrange to perform post blast procedures.

5) Police all equipment as required.

18.0 MISFIRE PROCEDURES:

Warnings:

1) Do not move closer than the munitions with the greatest fragmentation (MGFD) MFD-H or the blast overpressure hazard (K factor) for the MGFD.
    a. The EZ will be maintained until the misfire is cleared

If other charges are awaiting detonation, they will be allowed to function prior to clearing a misfire

1) Electric firing system; make three attempts to initiate the detonation. Do not consider moving closer to the detonation site or to a location, which may improve machine /detonator communication.

2) If the electrically initiated charge still fails to detonate, the UXO Team Leader will inform the UXOSO that a misfire is suspected and request to hold for 30 minutes in a "hot" status until misfire procedures are completed.

3) Wait time:

    i. Electric firing system, observe at least a 30-minute wait-time before reentering the exclusion zone.

    ii. Nonelectric firing system, observe at least a 1 hour wait time before reentering the exclusion zone (EZ).

4) Review the appropriate "clearing misfire" procedures in blasting machine manual

5) The DS notifies the UXOSO that they are returning to the misfire site to clear the misfire.

6) Using the plan developed, the DS reenters the site to clear the misfire while another UXO qualified team member, remains a safe distance (25 feet), away, and prepared to render assistance as necessary. If the situation is different from what is expected, the DS will retreat, regroup, and re-plan, consult with UXOSO and SUXOS to obtain approval for new plan of

action.

19 LOW ORDER DETONATION PROCEDURES:

Warning:

Maintain the EZ until the low order is cleared.

1) Notify UXOSO and site personnel about the probability of a low ordered item.

- **i.** Observe a minimum 24 hour wait time prior to inspecting a suspected low ordered item.
- **ii.** Prior to reentering the area, the team will visually ascertain if there are any signs of smoke or fire in the area. If there is no smoke or fire, the team may reenter the area and determine if the item has completely burned out. If it has completely burned out, and all installed fuzing has functioned, no further action is required.
- **iii.** If the item has not completely burned out, and/or installed fuzing has not functioned, consider it as a UXO; report and scheduled it for destruction with SUXOS.

2) POST DETONATION PROCEDURES:

I. After at least a 5-minute wait time, the UXOSO will visually inspect the detonation site(s) for signs of fire, from an observation point. If fire or smoke is not visible, the UXOSO notifies team that the area appears safe for reentry.

II. The team then will then inspect each detonation site(s) for unexploded ordnance, loose explosives, and other hazards, as appropriate.

III. Dispose of any UXO or explosives IAW this SOP.

IV. Secure safe to move loose explosives.

V. Secure and process MPPEH.

VI. Retrieve Detonator Unit/s, wires, and firing train residue (expended igniters and burned time fuse). Properly dispose of all waste material.

NOTE:

At the discretion of the SUXOS explosive detonation materials may be returned to explosive storage or expended on site with applicable documentation recording events.

- The DS notifies the SUXOS that the area is safe.

The DS notifies guards to lower red bravo warning flags, stand down and returns control of the range to SUXOS.

20.0 GENERAL INFORMATION

(WARNING)

- **Fire: (s)** Do not attempt to fight a fire, evacuate area, move upwind or crosswind to safe rally point, notify fire department.
- **Wildlife: (s)** Aggressive/defensive – Avoid wildlife – slowly withdraw from area
- **Hunters: (s)** Withdraw from area, retreat to vehicle, contact project authority
- **CWM: (s)** Evacuate upwind to safe rally point, mark area on map, contact PM
- **Severe Weather (lighting, winds, and storms): (s)** Evacuate to vehicle, follow PM guidance

21.0 SAFETY

Munitions Response Safety Officer	George DeMetropolis/SDO – George.DeMetropolis@CH2M.com Telephone (Office): **(619) 687-0120 x37239** Telephone (Cellular): **(619) 564-9627**
Explosives safety, Accident Prevention Plan (APP) and Activity Hazard Analysis (AHA)	(s) Mandatory – UXO Technician(s) are required to read, comply, and acknowledge they understand and comprehend warnings, notes, technical information, safety requirements contained within construction plans, SOP(s) and AHA(s); attesting through signature and date
Visitor(s) access to work location	(s) Visitors (contract/transient/witness) require a safety briefing, wear of PPE IAW site specific safety plan, and conformance to UXO Technician instructions.

Safety Meeting:	(s) Each morning – personnel shall participate in a tailgate safety briefing, discussing operational activities (plan of the day), MEC/HTRW hazards/risks, safety controls, and emergency procedures; daily weather forecast, work activity PPE OSHA level, insect/poisonous plant avoidance, and heat/cold stress prevention. Personnel shall sign and date, the safety briefing acknowledgment form; confirming individual participation, understanding, and comprehension prior to operations. Personnel who do not participate in the safety briefing or, understand, or comprehend the safety briefing may not access work areas during Munitions Response activities.
Safety Pre-field operations check list	(s) ( ) First Aid Kit (serviceable and supplies within shelf life) (s) ( ) Fire Extinguisher 10BC (or greater) (charged/indicator green) (s) ( ) Water (minimum 1 liter per operational person) (s) ( ) Cell phone/identified alternate land line location/or two/way Radio (s) ( ) Identification of wind direction, and rally points (s) ( ) PPE IAW Activity Hazard Analysis (s) ( ) Vehicles unlocked; keys in announced location (s) ( ) Insect repellant/sun screen (available)
22.0 Quality Control	
The UXOQCS will be responsible for ensuring this SOP is effectively implemented. Surveillances and/or inspections will be conducted to ensure SOP compliance.	(q) The UXOQC is responsible for ensuring the completeness of detonation operations and for weekly inspecting an Ordnance Accountability Log, the Daily Operational Log, the detonation event record and the inventory of MEC and detonation material. (q) The UXOQC, assisted by detonation team personnel, will inspect each detonation pit and an area of up to 250 feet in radius after each detonation event to ensure there are no kick-outs, hazardous MEC components or other hazardous items. In addition, the pit will be checked with a magnetometer and large metal fragments four inches or greater and any hazardous debris will be removed on a per use basis. Any MEC discovered during

	the QC check will be properly stored for destruction at a later date. Extreme caution must be exercised when handling MEC which has been exposed to the forces of detonation. (q) UXOQC personnel shall document nonconforming materials, items or activities in a NCR.

23.0 ACTIVITY COMPLETION

Completion of documentation:	( ) Detonation and Explosive Issues and Use logs to Project Manager ( ) Tail gate safety meeting log to Project Manager ( ) Equipment check-out report to Project Manager ( ) Quality control reports to Project Manager

24.0 EQUIPMENT

ITEM

1) MINIMUM REQUIRED EQUIPMENT LIST:

   a. Supplies and Equipment

      i. One handheld radio per SUXOS, UXOSO, ECP's (staffed) and DS.

      ii. One 4x4, emergency response/personnel transport vehicle.

      iii. Galvanometer (when using MK 186 RFD).

      iv. One Blasting Tool kit.

   b. Safety Equipment:

      i. One Emergency Response Kit (ERK) (In emergency response vehicle).

ii. One red “BRAVO” warning flag for each range entrance/exit

iii. One “ Blasting ” warning sign for each range entrance/exit.

iv. One first aid kit per vehicle.

v. One emergency eye-wash kit per emergency vehicle.

vi. Two fire extinguishers per vehicle carrying explosives or detonators (2-:20lb-B:C minimum).

vii. Personnel Distress signaling device (Per Individual) e.g. whistle, mirror, horn etc.

2) MINIMUM REQUIRED EQUIPMENT LIST:

a. Supplies and Equipment.

i. One handheld radio per person. or cell phone

ii. Cell Phone (must have minimum of three bar tower reception)

iii. One 4x4, personnel transport vehicle.

iv. One collection vehicle.

v. Collection containers as required.

vi. EZ Signs (one for each road to be blocked).

vii. Marking flags, tape, engineer ribbon, poles and/or stakes.

viii. Plastic Pin Flags. Multiple colors

ix. Multicolor marking ribbons and spray paint.

x. One fire extinguisher per vehicle moving MPPEH (BC)

3) Lightning Detector (If required)

Water	Minimum. 12oz per person (MRS)
Camera/Tape Measure/Ruler/Calipers/Paper Pencil	As determined by SUXOS

Hand tools, (hammer, general purpose tools, etc.)	Assorted As determined by SUXOS

SPECIAL TRAINING AND REFRESHER REQUIREMENTS:

UXO qualified personnel will be graduates of the U.S. Naval Explosives Ordnance Disposal (EOD) School at Indian Head, MD or other DDESB TP 18 approved course or school of instructions, Hazard Waste Operations IAW 29CFR 1910.120 (e) & (f) and medical clearance physical authorization to perform work.

WAIVERS, EXEMPTIONS, SPECIFIC AUTHORIZATIONS, OR APPROVED DEVIATIONS THAT APPLY TO THIS OPERATION: None

ACTIVITY HAZARD ANALYSIS

Safe Work Method Statement/ Job Hazard Analysis

Company Name: **CH2M HILL**	Project Name/#:
Work Activity/Task: SOP MRP 0009 - Explosive Detonation Operations	Principal Contractor:
Date: December 09, 2009	Note: Sign off to be provided at Safety Tailgate Meeting
Prepared by: Dan Young	Supervisor: TBD by project location
Signature:	Safety Coordinator (SC): TBD by project location
Explosive Detonation Operations – Explosive Blasting – Training and Qualifications	
Detonation Operations – Explosive Blasting	Training Requirements 29 CFR 1910.109 Blasting ; DDESB TP 18 minimum qualifications for UXO Technicians and are certified to perform the job assigned and certification is current. Prior to site operations, CH2M HILL will verify ATF Certified Responsible Persons and Employee Possessor certifications, blaster training, medical qualification statements by physicians, and conformance to substance abuse testing and reporting programs. CH2M HILL has an active explosive certification program and monitors these personnel for conformance to the Bureau of Alcohol, Tobacco, Firearms, and Explosives, Safe Explosives Act 2003 Certification requirements for "Employee Possessor," and or "Responsible Person".

Job Step	Potential Hazard	Controls
Forms/Permits	ATF Permit – nonconformance with Federal Law	Operational Readiness Review (ORR) ensures permits are in place prior to mobilization
	State Permit – as applicable by state and work location – nonconformance with state or local ordinances	UXO qualified personnel, table top SOP MR 0009 prior to ordering explosive materials Quality Control confirms permits are in place and approves ordering of explosives
	Miss Utility Check	Quality control confirms MISS Utility marking for underground utilities do not encumber detonation point.

Detonation Location	Unintentional damage to buildings, foundations, basements, infrastructure (sewers, waterlines, drains etc,) from ground shock vibrations.	Evaluate area, topography, setting, distances, soils to ensure detonation events from 1lb to 27lbs NEW do not occur closer than 1000, feet to buildings, foundations, basements, infrastructure (sewers, waterlines, drains etc,) If detonation point is less than 1,000 feet, to buildings, foundations, basements, infrastructure (sewers, waterlines, drains etc,) stop work –consult MR safety for specific guidance.
Site Setup	Theft of explosives or unintentional detonation from heat, shock or friction during storage or poor grounding Storage location does not meet DOD or as applicable State requirements for explosive storage	Obtain 2 ATF Type II rated magazines and ground to 25 ohms or less of resistivity, separate magazines IAW ESP or ESS criteria, secure magazines with minimum 5 pin locks, and two sets. Fence area as required by ESP or ESS, remove friable combustible material from a 50 foot radius of the storage location. Grass may remain if cut close to surface. Avoid locations where tree limbs hang over magazines. Or Request just in time delivery of explosives avoiding storage hazards.
	Overhead power lines - EMR hazards to electric initiated devices or initiating explosives unintentional detonation from heat, shock or friction during storage or poor grounding	Locate and take appropriate precautions with required distances from power lines If detonation is required under or near power lines apply non-electric procedures using Nonel© products – consult with MR Safety prior to detonation near power lines or utilities
	Physical environmental hazards	Use of appropriate personal protective equipment (PPE) where required. Safety boots, hard hats, safety glasses and hearing protection are mandatory. Respirators, when chemical hazards exist. No loose-fitting clothing, rings, watches, etc.; long hair to be restrained close to the head.

	Dermal or inhalation exposure to contaminants	Investigate history of area; determine nature and degree of contaminants that could be present Conduct air monitoring for potential hazardous atmospheres as described in the project's written safety plan. Use respirators and other PPE as prescribed in the project's written safety plan
Job Step	**Potential Hazard**	**Controls**
Operational	Fire /Explosion loss of handling control of explosive materials or MEC/MDEH/MPPEH resulting in heat shock or friction to items and resulting in an unintentional detonation	Conform to ESS or ESP guidance – Reduce personnel to essential persons, enforce exclusion zones IAW ESS and ESP, Restrict handling of MECH/MDEH.MPPEH to UXO Technician III or II Restrict handling of commercial explosives and detonators to UXO Technician III I SUXOS or UXOSO shall discuss the movement, path of travel, locations to temporary stage, and method to secure explosives from moving once established for detonation, prior to handling explosives for each detonation event. Perform site preparation (brush clearing) as required to increase footing, reduce trip hazards, and enhance movements to and from the point of detonation.

21.0 PROCESS SUPERVISOR’S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the processes described within 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 workers statement for this process. I will ensure the SOP is the most recent revision. If a major change to the SOP is necessary, I will ensure that the processes are stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards arise, I will stop activities, until hazards have been controlled, reduced, or eliminated to an acceptable risk level.

SOP MRP 0003 PROCEDURE SUPERVISOR ACKNOWLEDGEMENT

UXO Supervisor’s Name (print):	Supervisor’s Signature	Organization	Date

22.0 PERSONNEL STATEMENT

I have read this SOP and I have received adequate demonstration of the procedure, training to perform the process and procedure according to requirements, procedure, and guidance identified below. I agree to follow this SOP, unless I identify a hazard, work condition, or compliance issue not addressed within this SOP or encounter a situation, condition, or issue that, I cannot perform according to the SOP. If such a stoppage occurs, I will immediately notify the SUXOS, UXO Technician III, or II. Should the situation, condition, or compliance remain unresolved for greater than 24-hours, I shall contact the Munitions Response Safety Officer (251) 962-2963.

SOP MRP – 0003 - PERSONNEL STATEMENT ACKNOWLEDGEMENT

Personnel Name (print):	Signature	Organization	Date

MRP—SOP—0008

MUNITIONS RESPONSE PROGRAM (MRP)

STANDARD OPERATING PROCEDURE (SOP)

PROCESSING OF MATERIAL POTENTIALLY PRESENTING AN EXPLOSIVE HAZARD (MPPEH) AND MATERIAL DOCUMENTED AS SAFE (MDAS)

1.0 OBJECTIVE:

Warning

- Military Munitions shall be considered Material Potentially Presenting an Explosive Hazard (MPPEH) until determined per applicable DOD instructions to be Material Documented as an Explosive Hazard (MDEH) or Material Documented as Safe (MDAS)

- Ensure that a "chain of custody" is maintained for MDAS until it has completed the disposition process.

  NOTE: A legible copy of the documentation of the determination of the material's explosives safety status shall accompany the material when it is transferred. This documentation shall be maintained by the generating DOD Component for a period of at least 3 years thereafter or any longer period required by DOD Component regulations.

-

NOTE: Scrap metal is often collected, stored for some time, then sold and resold. Once MDAS enters the recycling stream, the mere appearance of being a live munition may result in confusion and callbacks to military EOD personnel to remove a perceived explosion hazard. Therefore, demilitarization should, to the greatest extent possible, process certified MDAS until it no longer looks like ordnance. This means to process it until a reasonable person will not mistake it for a hazardous item. Strive to remove the "military look-alike."

2.0 Purpose:

To provide UXO Technicians with procedures for processing MPPEH and MDAS. To ensure that the explosives safety status of material to be transferred within or released from DOD control be assessed and documented as either safe or as having known or suspected explosive hazards based on one of the following two conditions

(1) After a 100-percent inspection and an independent 100-percent reinspection by qualified and designated personnel.

(2) After processing by a DDESB-approved means with an appropriate post-processing inspection.

3.0 APPLICABILITY:

This SOP applies MPPEH and MDAS inspection and verification criteria per Department of Defense Instruction (DODI) 4140.62, Material Potentially Presenting an Explosive Hazard (MPPEH) November 2008.

4.0 TECHNICAL GUIDANCE:

This SOP lists processes and procedures in compliance with the following references:

- DOD 6055.09-M, Ammunition and Explosives Safety Standards, August 2010;
- DODI 4140.62, Material Potentially Presenting an Explosive Hazard (MPPEH) November 2008
- DA Engineering Manual (EM) 385-1-97 Explosives, Health and Safety September 2008;

Note: Electronic copies for sources listed above are available via CH2M HILL Senior UXO Supervisors (SUXOS)

4.1 Definitions

- MDAS is MPPEH that has been assessed and documented as not presenting an explosive hazard and for which the chain of custody has been established and maintained. This material is no longer considered to be MPPEH.

- MDEH. (Formerly referred to as material documented as hazardous or MDAH.) MPPEH that cannot be documented as MDAS, that has been assessed and documented as to the maximum explosive hazards the material is known or suspected to present, and for which the chain of custody has been established and maintained. This material is no longer considered to be MPPEH. (The MDEH characterization only addresses the explosives safety status of the material.)

- MPPEH. Material owned or controlled by the Department of Defense that, prior to determination of its explosives safety status, potentially contains explosives or munitions (e.g., munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris) or potentially contains a high enough concentration of explosives that the material presents an explosive hazard (e.g., equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated with munitions production, demilitarization, or disposal operations). Excluded from MPPEH are munitions within the DoD-established munitions management system and other items that may present explosion hazards (e.g., gasoline cans and compressed gas cylinders) that are not munitions and are not intended for use as munitions.

- Transferred within or released from DOD control. A receiver has acknowledged receipt of MDEH or MDAS material by signed documentation (e.g., DD Form 1348-1, “Issue Release/Receipt Document,” or an equivalent document) and has taken physical custody of the

MDEH or MDAS from the DOD.

5.0 SOP VALIDATION RECORD:

SOP Title: MPPEH & MDAS Processing .... Work Instruction Identification/ SOP: # MRP-SOP-0008

Author: K. Lombardo Date: September 28, 2010 .... Revision: Revision #1; September 29, 2010

Review: D Young, Date: October 1, 2010 .... Approval; J. Bowles, October 12, 2010

Validation Date: September 29, 2010 .... Process Observer: Kevin Lombardo,

6.0 HAZARDOUS MATERIALS:

Hazardous Chemicals: None; Product Name: N/A; Material Safety Data Sheets: N/A; Health Hazards: N/A

7.0 EMERGENCY RESPONSE INFORMATION

(Review Site Specific Accident Prevention Plan for insertion of details)

Work Site name, and location (address/building #): ____

Nearest intersection (cross streets) or entrance gate: ____

Safe Area Rally Point (gate/building or intersection):____

Note: Rally Point should be upwind of work location

7.1 UXO TECHNICIAN OR INITIAL ON SCENE LEADER :

UXO Technician or On Scene Leader :
(name) ____

A: Personnel Injury or Medical Distress:

1. Summon Emergency Medical Services (EMS): Call 9-1-1 or :___________________________
2. Identify address or nearest cross street intersection
3. Administer Fist Aid and/or CPR
4. Notify Project Manager (PM)
5. PM implements CH2M HILL SOP 111, Incident Notification, Reporting, and Investigations.

B: Fire:

1. Evacuate personnel from the Munitions Response Site/Area to safe rally point

2. Notify Fire Department of "Construction Site Name, (address, cross street intersection)," fire location, and personnel safe rally point; Call 9-1-1 or :____________________________
3. Obtain head count, ensuring all personnel are present and or accounted for.
4. Notify Project Manager (PM)
5. PM implements CH2M HILL SOP 111, Incident Notification, Reporting, and Investigations.

7.2 EMERGENCY CONTACT NUMBERS:

Direct Telephone Numbers:

(Fire/Rescue radio call sign): _______________________ Phone # _______________________

Medical Services radio call sign: ____________________ Phone # _______________________

Range Control radio call sign: ______________________ Phone # _______________________

Project Manger POC: _______________________________ Phone # _______________________

Identify local disaster warning system (radio, PA, phone, other):_________________________

Local Warning Flag(s):____

Warning Bells/Horns/Sirens/Lights/Strobes: ____

Public Address System: ____

Weather Radio Channel: ____

Other: ____

8.0 PERSONNEL ROLES AND RESPONSIBILITIES

1. Project/Construction Manager (PM/CM): Provides the necessary budget and personnel to safely and efficiently accomplish the scope of work. Ensures CH2M HILL unexploded ordnance (UXO) personnel shall be qualified in accordance with DDESB TP-18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel and are certified to perform the job assigned and that certifications are current. Prior to site operations, CH2M HILL will verify training, medical qualification statements by physicians, and conformance to substance abuse testing and reporting programs. CH2M HILL has an active explosives certification program for personnel conforming to requirements for UXO personnel identified IAW DDESB TP 18, and monitors these personnel for conformance to the Bureau of Alcohol, Tobacco, Firearms, and Explosives, Safe Explosives Act 2003 Certification requirements for "Employee Possessor," and or "Responsible Person."

1. Senior UXO Supervisors and Unexploded Ordnance Technicians III or II: Supervise the operational resources necessary to implement, and accomplish the procedures and requirements set forth within the Work, Health, Safety, Quality and Accident Prevention Plans. May stop work at anytime to prevent accidents, remedy unsafe conditions, stop an unsafe act, or question the safety of a process or procedure or observe non conformance to this SOP and/or plans. The SUXOS provides a Site Specific Tailgate Safety Briefing to include MEC, construction, industrial, environmental, and natural safety hazard awareness and provides the plan of the day. As applicable, they provide a Hazardous Materials briefing for items used, consumed, or required for this SOP. This person shall also brief personnel on communications, security, emergency/medical response, evacuation, rally points, IAW with project instructions and plans. This person shall inform personnel to prevent disclosure of classified work, site observations, or information.

2. Unexploded Ordnance Quality Control Specialist (UXOQCS): Assists with the implementation of this SOP. Reports to the Munitions Response Quality Control Manager. Monitors conformance to this SOP and Work, Health, Safety, Quality, and Accident Prevention Plans.

3. Unexploded Ordnance Safety Officer (UXOSO) and/or UXOQCS (may be a dual-hatted position for small projects, reports to the Munitions Response Safety Manager). The UXOSO performs risk assessment to determine the number of visitors permitted, provides a safety briefing, and verifies training and medical surveillance qualifications of personnel. Responsible to implement health and safety/ activity hazard analysis, accident prevention plan requirements, assist the SUXOS to provide daily tailgate safety briefing, and enact emergency contingency plans as identified in plans. May implement on small projects quality control processes and procedures IAW quality control pan and or project instructions.

Non-UXO Qualified Personnel are obligated to follow guidance within this SOP, Work, Health and Safety and Accident Prevention Plans.

9.0 PRE-OPERATIONAL CHECK LIST

1. ( ) Applicable ESS, ESP, or Range Explosive Safety Criteria	2. ( ) Project Task/Work/ Instructions
3. ( ) Work Plan/Accident Prevention Plan/ Health and Safety Plan, Quality Control Plan	4. ( ) Personal Protective Equipment (PPE) IAW Safety Plan
5. ( ) Emergency P.O.C List	6. ( ) Directions and map to hospital
7. ( ) Communications (2 methods)	8. ( ) First aid/Fire Extinguisher 10lb BC
( ) Two (2) UXO Technicians are certified, in writing, (sample signatures on file with Project Manager) by the DoD component directly responsible for controlling the transfer or release of MPPEH, MDEH, or MDAS, as being technically qualified according to the standards provided in DODI 4140.62 and in DoD component procedures for management of MPPEH to perform such functions and, certified in conformance with contract requirements.	

10.0 MPPEH GENERAL

NOTE: Non-contractor personnel who are qualified and authorized to inspect MPPEH and document its explosives safety status as MDAS or MDEH, will be so designated in writing by direction of their Commanding Officer (CO). When the inspection and documentation of the material's explosives safety status is being performed by an unexploded ordnance (UXO) contractor under a contract with Naval Facilities Engineering Command (NAVFACENGCOM), the UXO contractor's project manager for the site must designate the personnel that are authorized and qualified to inspect MPPEH and document its explosives safety status as either MDAS or MDEH in writing to the Commanding Officer of the cognizant command or organization The designation letter will include sample signatures. A current list of personnel along with their sample signatures, who are qualified and authorized to inspect MPPEH and document its explosives safety status, shall be identified below:

✓ UXO Technician III Inspecting Person:

____

(Print name/title)

✓ UXO Technician III Verifying Person:

____

(Print name/title)

A. MPPEH processing includes any action or operation involving MPPEH, including but not limited to: collecting, consolidating, sorting, segregating, separating by metal type, inspecting, storing, decontaminating, transferring, certifying, releasing, demilitarizing (shredding, shearing, chopping, crushing, flattening, cutting, melting), and transporting materials.

B. MPPEH requires inspection and reinspection, or processing and inspection, to document material as either MDEH or MDAS.

C. Munitions that are encountered during a munitions response or other (e.g., operational range clearance) activities will be detonated in place. The exceptions are when technically qualified personnel performing the functions of the SUXOS and UXOSO (DDESB TP-18) determine the risk associated with movement is acceptable and movement is necessary for the efficiency of either the activities being conducted or the protection of people, property or critical assets. In such cases, the SUXOS and UXOSO responsible for the activity being performed or EOD personnel responding to an explosive or munitions emergency or supporting the activity may evaluate the munition and authorize its movement within the MRS or operational range to an approved location for destruction, either individually or as part of a consolidated shot. When EOD is not involved, both the SUXOS and UXOSO responsible for the activity being performed must agree with the risk determination.

D. Vent or expose any internal cavities of MPPEH, to include training or practice munitions, to confirm that explosive filler is not present and prevent the buildup of pressure if MDAS is later heated. Procedures used to achieve venting include use of shaped charges, crushers, drills, saws, etc.

E. Minimize the quantity and time MPPEH is accumulated and retained at any location. (Under some circumstances the accumulation of MPPEH, including "speculative accumulation," or its movement from either an operational range or the site of encounter, could require its management as waste military munitions under applicable Federal or State requirements

F. MPPEH shall be controlled and managed (e.g., sorted, segregated, stored, secured) to prevent its unauthorized use, transfer or release, and to protect personnel and property from uncontrolled exposures to potential explosive hazards. To prevent commingling, use a suitable combination of controls such as separate storage locations within the storage site, moveable signs and ribbon barriers, locked gates, locked containers, waterproof certification documents attached to boxes, container seals traceable to the transfer documentation, or other locally determined methods included in approved written operating procedures.

G. MPPEH and MDAS containers and holding areas for material being processed shall be secured and clearly marked as to the explosive hazard, (if any). MPPEH processing shall be managed in a manner that prevents MDEH from being commingled with MPPEH or MDAS.

H. MPPEH STORAGE. In order to maintain the chain of custody, do not commingle the following categories of material. Should commingling occur, MDAS and/or MDEH shall lose its documented explosives safety status and become MPPEH.

    i. MPPEH awaiting documentation of its explosives safety status.
    ii. MDEH.
    iii. MDAS.

I. The SUXOS shall ensure a chain of custody is developed from first encounter of MPPEH to final certificate of destruction or MDAS recycling. The SUXOS shall ensure that a chain of custody remains unbroken through release from DOD control by verifying that MPPEH awaiting documentation of its explosives safety status, MDEH, and MDAS are not commingled. This chain of custody shall be maintained on DD Form 1348-1 until MDEH or MDAS is released from DOD control and shall be attached to the final certificate of destruction. A legible copy of DD Form 1348-1 with explosive safety determination of the material's explosives safety status shall accompany MDAS when transferred out of DOD control. This documentation shall be maintained by the generating DOD component for a period of at least 3 years thereafter or any longer period required by DOD component regulations.

J. Documentation of material as safe will be provided using a Disposal Turn-in Document DD Form 1348-1 (series), or a local form as authorized by the commanding officer or contracting organization. The two signatures required for MDAS must be directly above the typed or clearly stamped or legibly printed full name, complete organization name and address, and phone numbers (commercial and Fax 7 Email. Documentation of material as safe (MDAS) shall include the following statement:

"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, is inert and/or free of explosives or related materials".

K. Documentation of material as an explosive hazard will be provided using a Disposal Turn-in Document DD Form 1348-1 (series). The certification document must provide information about:

a. Type of explosive hazard or contamination.
b. Presence of un-vented cavities.
c. Estimated maximum credible N.E.W.

Hazardous certifications shall include the following statement:

"This certifies that the material potentially presenting an explosive hazard listed has been 100 percent properly inspected and to the best of my knowledge and belief presents an explosive hazard".

The hazardous certification statement may be modified or augmented as required.

Note: MDEH and MDAS are no longer considered to be MPPEH as long as the chain of custody remains intact.

10.1 Identification and Classification of MPPEH, MDEH/MDAS:

A. The Senior UXO Supervisor (SUXOS) shall select a qualified UXO Technician(s) III and verify training and experience of the person(s) performing initial MEC/MPPEH identification and classification.

B. The SUXOS shall confirm individual(s) competency for identification and safe handling of used and unused military munitions and any potential explosive hazards that may be associated with site specific MPPEH or MDEH. The selected person(s) shall have recent experience in the management and processing of materials with explosive hazards equivalent to the category and type by function of suspected MPPEH or MDEH within the MRS.

C. The SUXOS shall review site history for MEC type and method of deployment for known or suspected MEC within the MRS. This review establishes: MEC category, type by function, fuzing(s), filler(s), and likely condition. Based on this review, applicable technical publications/diagrams for suspected types of MEC will be available on site to verify MPPEH identification and classification for:

1) Item Nomenclature
2) Fuzing Nomenclature
3) Functioning Method
4) Filler
5) Item specific safety warnings

6) External mechanical hazards
7) Internal hazardous components (e.g.: batteries, hydraulics, compressed gases, etc.)
8) Disposal method (item condition specific)
9) Acceptable to move criteria.
10) Not acceptable to move criteria.
11) External inspection criteria for MDAS Certification.
12) Internal inspection criteria for MDAS Certification
13) Demilitarization criteria
14) Demilitarization method
15) . Secondary processes (chemical neutralization, thermal, shredding, smelting, etc.)

The SUXOS may identify suspect and known MEC items and designated these items as Material Potentially Presenting and Explosive Hazard (MPPEH) based on design criteria, method of functioning, and delivery; example: BDU 33, 25-lb Practice Bomb with MK4 Mod 0 spotting charge cartridge is MPPEH until mechanically or explosively processed to expose 100% of the internal cartridge bore hole. This item is acceptable to move when nose and tail are pointed away from UXO Technician(s) and staged for processing. The SUXOS shall prepare such a list for submission to the UXOSO and Corporate MR Safety to confirm as acceptable for implementation.

The SUXOS shall develop, update, and announce during each morning s safety briefing specific safety precautions related to anticipated MEC and known MEC within the MRS.

10.2 MPPEH and MDEH/MDAS Activities/Actions:

A.) UXO Safety Officer will preview the list of suspect and known types of MEC for the MRS, and establish a written safety protocol list for: MPPEH avoidance, positive identification, MDEH, Munitions Debris (MD) or MDAS potential movement, and MDAS demilitarization or MDEH disposal.

Protocol Examples:

- Rocket Motor MK 40 Mod 3 - impact 30^0 to gourd warhead not visible, approach 45^0 to rear avoid approaching from nose or tail, flag “red” item 12-inchs to north, do not move or contact, avoid item, classify as MPPEH, photograph item IAW work plan, record coordinates, recommend to SUXOS/UXOS for further action.

- Mechanical Time Super Quick fuze, (cocked striker hazard) with booster cup, on surface, flag “red” item 12-inchs to north, do not move or contact, avoid item, photograph IAW Work Plan, record coordinates, classify as MDEH, recommended blow in place.

- Ammunition for Grenade Launchers, Cartridge 40mm, fired, color “Anodized Gold”, flag “red” item 12-inchs to north, do not move or contact, avoid item, photograph IAW Work Plan, record coordinates , classify as MDEH blow in place.

- Signal Star Parachute Ground Signal – Aluminum body – forward ejection propellant hazard, approach from side, observer end cap from angle, if end cap is missing and contents have functioned as designed, record coordinates as required by work plan, classify items as potential MD, relocate to Southwest Grid corner, request MDAS certification and verification.

B.) UXO Supervisor shall discuss MRS specific MEC protocols with team members

C.) The UXO Safety Officer (UXOSO) shall maintain a list of MEC encountered and discuss each morning the specific safety protocols for one MEC items each day from process step of identification through demilitarization or disposal.

D.) UXO Technician III or II, will assess each MPPEH item to determine:

1.) Category;
2.) Type by function;
3.) Fuzing;
4.) Condition;
5.) Likely and potential filler(s);
6.) Nomenclature;
7.) If the MEC item is Material Documented As Explosive Hazard (MDEH);
8.) If a disposal action is required in place

10.3 MPPEH, MDEH and MDAS Disposition

Note: The following process is designed to ensure unknown explosive hazards are not present when transferring MPPEH, MDEH, or MDAS within the Department of Defense, transferring MDEH to a qualified receiver, or releasing MDAS to the public. A determination that MPPEH or MDEH is safe for transport must be documented and signed by the individual making the determination. A copy of this certification must accompany the shipment and identify the hazard classification

Disposition Consideration:

(1) Visual inspections may be used when safety can be assured, but are not always sufficient for providing assurance that MPPEH does not present an explosive hazard. Other DDESB-approved means (e.g., thermal treatment) may have to be used to ensure that a release or transfer does not present an explosive hazard to a receiver.

(2) Post munitions debris and range-related debris visual inspection and based on the content, a single or combination of disposition method(s) may be recommended by the SUXOS. The SUXOS may recommend a mechanical and/or thermal closed-circuit process with a chain of custody from collection through witness release from DoD control as MDAS.

The SUXOS shall ensure that the explosives safety status of material to be transferred within or released from DoD control be assessed and documented as either safe or as having known or suspected explosive hazards based on one of the following two conditions:

a. After a 100-percent inspection and an independent 100-percent reinsertion
b. After processing by a DDESB-approved means with an appropriate post-processing inspection.

10.4 MDAS PREPARATION FOR TRANSPORTATION

MDAS shall be transported under a chain of custody with a DD Form 1348-1A identifying:

1) Date:
2) Point of Origin (contract number Project site Name Address, City, State, and PM Name)
3) Description of items contained within container
4) Estimated quantity or weight
5) DD form 1348-1 placed inside container and outside container
6) Persons Name and telephone number sealed container
7) Seal container
8) Seal Number entered in Site Log and QC report

10.5 WITNESS DESTRUCTION OF MDAS

1) Witness shall be present during removal of Chain of Custody seals associated with applicable MDAS containers)
2) Witness shall confirm seal numbers, container integrity, and contents
3) Witness shall record seal numbers
4) Witness shall confirm final disposition method identified in work plan or project instruction with recycler
5) Documents conformance to work plan or project instruction final method of treatment (shredding, thermal, smelting)
6) Complete DD form 1348-01 documenting final disposition and release to the public
7) Submit records for PM reports

11.0 GENERAL INFORMATION

CATEGORY: **MEC/Anomaly Avoidance**	**DIRECTIONS:** **(S)** = Safety, **(O)** = Operations, **(Q) =** Quality Control

(WARNING)

- **Fire: (s)** Do not attempt to fight a fire, evacuate area, move upwind or crosswind to safe rally point, notify fire department.
- **Wildlife: (s)** Aggressive/defensive – Avoid wildlife – slowly withdraw from area
- **Hunters: (s)** Withdraw from area, retreat to vehicle, contact project authority
- **CWM: (s)** Evacuate upwind to safe rally point, mark area on map, contact PM
- **Severe Weather (lighting, winds, and storms): (s)** Evacuate to vehicle, follow PM guidance

12.0 SAFETY

Munitions Response Safety Officer	George DeMetropolis/SDO – George.DeMetropolis@CH2M.com Telephone (Office): **(619) 687-0120 x37239** Telephone (Cellular): **(619) 564-9627**
Explosive Safety, Accident Prevention Plan (APP) and Activity Hazard Analysis (AHA)	(s) Mandatory – UXO Technician(s) are required to read, comply, and acknowledge they understand and comprehend warnings, notes, technical information, safety requirements contained within construction plans, SOP(s) and AHA(s); attesting through signature and date
Visitor(s) access to work location	(s) Visitors (contract/transient/witness) require a safety briefing, wear of PPE IAW site specific safety plan, and conformance to UXO Technician instructions.
Safety Meeting:	(s) Each morning –personnel shall participate in a tailgate safety briefing, discussing operational activities (plan of the day), MEC/HTRW hazards/risks, safety controls, and emergency procedures; daily weather forecast, work activity PPE OSHA level, insect/poisonous plant avoidance, and heat/cold stress prevention. Personnel shall sign and date, the safety briefing acknowledgment form; confirming individual participation, understanding, and comprehension prior to operations. Personnel who do not participate in the safety briefing or, understand, or comprehend the safety briefing may not access work areas during Munitions Response activities.
Safety Pre-field operations check list	(s) ( ) First Aid Kit (serviceable and supplies within shelf life) (s) ( ) Fire Extinguisher 10BC (or greater) (charged/indicator green)

	(s) ( ) Water (minimum 1 liter per operational person) (s) ( ) Cell phone/identified alternate land line location/or two/way Radio (s) ( ) Identification of wind direction, and rally points (s) ( ) PPE IAW Activity Hazard Analysis (s) ( ) Vehicles unlocked; keys in announced location (s) ( ) Insect repellant/sun screen (available)
13.0 INSPECTION EQUIPMENT	
Equipment Check-out: as required by Team leader –(equivalent types and selections optional) 1) Tape Measure (ruler) 2) Flash-light 3) Calipers (inside and outside diameter) 4) Brushes, (various) 5) Fine tools, (e.g.: plastic non-sparking picks, probes, etc) 6) Compressed air (can) 7) X-ray and film processor (SOP specific) 8) Magnifying glass 9) Detergent mild abrasive (liquid) cleaners 10) Digital Camera	(o) Assemble/inspect, IAW manufacture instructions (o) Ensure batteries are replaced as required (o) Team shall have one set of replacement batteries for each type of battery powered unit (o) Test compressed air cans to confirm operational readiness, replace as required (o) X-ray and film processor addressed in separate SOP (o) Ensure digital Camera batteries are charged or additional replacement batteries available
14.0 QUALITY CONTROL	
The QC Manager will be responsible for ensuring this SOP is effectively implemented. Surveillances and/or inspections will be conducted to ensure SOP compliance.	UXOQC personnel shall document nonconforming materials, items or activities in a NCR based on surveillances and/or inspections

15.0 ACTIVITY COMPLETION

Completion of documentation:	( ) Project site logs to Project Manager ( ) Tail gate safety meeting log to Project Manager ( ) Equipment check-out report to Project Manager ( ) Quality control reports to Project Manager

16.0 EQUIPMENT

ITEM	**QUANTITY**
Cellular telephone	1
Magnetometer capable of monitoring to a depth of two-feet below ground surface for ferrous items	1 or (as required by Project instruction)
All metals detector capable of monitoring to a depth of 6-inches below ground surface for non-ferrous items	Optional
Multi colors of marking flags, ribbon, and tape	As determined by SUXOS
Batteries	Two day supply for instruments
First –aid Kit (25 person)	1 within the work area
Water	Minimum 1 liters per person in work area
Camera/Tape Measure/Ruler/Calipers/Paper Pencil	As determined by SUXOS
Hand tools, (hammer, general purpose tools, etc.)	Assorted As determined by SUXOS

MINIMUM PERSONAL PROTECTIVE EQUIPMENT: IAW with Safety Plan and AHA or a minimum of OSHA LEVEL "D"

Coveralls (or long pants, sleeved shirt)

Boots (level "D")

Cover (cap, floppy, skull)

Gloves (leather)

Safety Eye protection (as required by AHA)

Hard hats (when working in an area with a potential for head injury or heavy equipment e.g. drill rig)

The SUXOS will direct the required explosive safety site PPE conditions.

17.0 SPECIAL TRAINING AND REFRESHER REQUIREMENTS:

SPECIAL TRAINING AND REFRESHER REQUIREMENTS:

UXO qualified personnel will be graduates of the U.S. Naval Explosives Ordnance School at Indian Head, MD or other DOD DEDSB TP 18 approved course or school of instructions, Hazard Waste Operations IAW 29CFR 1910.120 (e) & (f) and medical clearance physical authorization to perform work.

WAIVERS, EXEMPTIONS, SPECIFIC AUTHORIZATIONS, OR APPROVED DEVIATIONS THAT APPLY TO THIS OPERATION: None

18.0 ACTIVITY HAZARD ANLAYSIS

Safe Work Method Statement/ Job Hazard Analysis

Company Name: **CH2M HILL**	Project Name/#:
Work Activity/Task: SOP MRP 0008 MPPEH – MDAS	Principal Contractor:
Date: December 09, 2009	Note: Sign off to be provided at Safety Tailgate Meeting
Prepared by: Dan Young	Supervisor: TBD by project location
Signature:	Safety Coordinator (SC): TBD by project location
Process MPPEH and MDAS	Training Requirements 29 CFR 1910.120 (e) & (f); DDESB TP 18 minimum qualifications for Unexploded Ordnance Technicians. Prior to site operations, CH2M HILL will verify training, medical qualification statements by physicians, and conformance to substance abuse testing and reporting programs. CH2M HILL has an active explosive certification program and monitors these personnel for conformance to the Bureau of Alcohol, Tobacco, Firearms, and Explosives, Safe Explosives Act 2003 Certification requirements for "Employee Possessor," and or "Responsible Person." 3R training for non-UXO qualified Personnel. (in addition to those in project's written safety plan: - OHS Construction Induction - Waste Management for waste streams and materials)

Job Step	Potential Hazard	Controls
Forms/Permits	DD form 1348-1A Chain of custody certification and verification for MDAS, MPPEH comingled with MDAS could result in unintentional detonation from exposure to heat, shock or friction	Secure MDAS in lockable containers, and separate location a minimum of 200 feet from MPPEH holding or processing location, restrict placement of MDAS in containers to UXO Technician III approval, by item. •
Site Setup	Ensure surface areas for MDAS and MPPEH holding or processing are free of Surface and Subsurface MEC to six-inches below ground surface. Unintentional contact or movement, of obscured MEC could result in unintentional detonation from exposure to heat, shock or friction	•Ensure MDAS and MPPEH holding or processing areas have locations inspected for underground utilities and identified prior to start of work • Daily briefing of activities to be conducted Perform MEC surface search and removal of Surface MEC Perform subsurface search, mark anomalies, and avoid selection of areas with anomalies for placement of MDAS or MPPEH containers and do process MPPEH in areas suspected of subsurface MEC.
	Striking overhead utilities	•Locate and take appropriate precautions with required distances from power lines •Lower mast and secure during travel of forklifts or boom trucks during loading of MDAS for off-site disposition

	Physical environmental hazards	•Use of appropriate personal protective equipment (PPE) where required. Safety boots, hard hats, safety glasses and hearing protection are mandatory. Respirators, when chemical hazards exist. No loose-fitting clothing, rings, watches, etc.; long hair to be restrained close to the head.
	Dermal or inhalation exposure to contaminants	•Investigate history of area; determine nature and degree of contaminants that could be present •Conduct air monitoring for potential hazardous atmospheres as described in the project's written safety plan. •Use respirators and other PPE as prescribed in the project's written safety plan
Processing of MPPEH	MPPEH could result in unintentional detonation from exposure to heat, shock or friction	Processing of MPPEH shall be restricted to UXO Technicians (III and or II's) Processing of MPPEH shall be restricted to the minimal amount of personnel for the minimal amount of time. MPPEH may be processed manually for inspections MPEH may be opened by explosive venting IAW applicable ESS, ESP or site specific instruction , MR SOP 009 Demolition and applicable AHA MPPEH shall not be processed mechanically unless augmented by an ESS or ESP or specific work plan instructions and AHA MPPEH shall be processed, certified and verified to result in a determination of MDAS

Job Step	**Potential Hazard**	**Controls**
Site Setup (Continued)	Fire /Explosion	• No smoking or open flames around MPPEH
	Struck by vehicles	•Follow traffic control plan •Wear high-visibility warning vests
	Construction Equipment travel	•Ensure stable ground and adequate footing for machinery. Adequate ground preparation to support loads and accommodate waste materials. • Construction equipment travel will be conducted with equipment secured in its lowered position, as applicable •Use alarm or spotter when reversing equipment

19.0 PROCESS SUPERVISOR’S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the processes described within 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 workers statement for this process. I will ensure the SOP is the most recent revision. If a major change to the SOP is necessary, I will ensure that the processes are stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards arise, I will stop activities, until hazards have been controlled, reduced, or eliminated to an acceptable risk level.

SOP MRP 0003 PROCEDURE SUPERVISOR ACKNOWLEDGEMENT

UXO Supervisor’s Name (print):	Supervisor’s Signature	Organization	Date

200 PERSONNEL STATEMENT

I have read this SOP and I have received adequate demonstration of the procedure, training to perform the process and procedure according to requirements, procedure, and guidance identified below. I agree to follow this SOP, unless I identify a hazard, work condition, or compliance issue not addressed within this SOP or encounter a situation, condition, or issue that, I cannot perform according to the SOP. If such a stoppage occurs, I will immediately notify the SUXOS, UXO Technician III, or II. Should the situation, condition, or compliance remain unresolved for greater than 24-hours, I shall contact the Munitions Response Safety Officer (251) 962-2963.

SOP MRP – 0003 - PERSONNEL STATEMENT ACKNOWLEDGEMENT

Personnel Name (print):	Personnel Signature	Organization	Date

Attachment 3-4
Explosives Site Plan

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Explosives Site Plan

Munitions and Explosives of Concern RCRA Facility Investigation:

FTRU-001-R-01 Anti-Tank/Rocket Grenade Range
FTRU-003-R-01 Infiltration/Grenade Range

Fort Rucker, Alabama

Contract No. W91ZLK-05-D-0014
Contract Task Order No. 0001

Prepared for:

U.S. Army Environmental Command

Prepared by:

CH2MHILL

Northpark 400
1000 Abernathy Road
Suite 1600
Atlanta, GA 30328

August 2010

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Amendments

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Acronyms and Abbreviations

DDESB	Department of Defense Explosives Safety Board
DGM	Digital Geophysical Mapping
ECP	Entry Control Point
EM	Engineering Manual
EM CX	Environmental and Munitions Center of Expertise
EOD	Explosives Ordnance Disposal
ESQD	Explosives Safety Quantity Distance
HEAT	High Explosive Anti-Tank
HFD	Hazardous Fragmentation Distance
MD	Munitions Debris
MDAS	Material Documented as Safe
MEC	Munitions and Explosives of Concern
MFD-H	Maximum Fragmentation Distance – Horizontal
MFD-V	Maximum Fragmentation Distance – Vertical
MGFD	Munition with the Greatest Fragmentation Distance
MPPEH	Material Potentially Presenting an Explosive Hazard
MRS	Munitions Response Site
MSD	Minimum Separation Distance
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SUXOS	Senior Unexploded Ordnance Supervisor
TM	Technical Manual
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
UXO	Unexploded Ordnance
UXOSO	Unexploded Ordnance Safety Officer

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1. **Site:**
   a. Name: Fort Rucker, FTRU-001-R-01: Anti-Tank/Rocket Grenade Range and FTRU-003-R-01: Infiltration/Grenade Range
   b. State: Alabama

2. **Anticipated Date:**
   a. Start: November 2010

3. Purpose:

This Explosives Site Plan is submitted to support the munitions response services provided by CH2M HILL during the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Fort Rucker, Alabama. The plan addresses the following Munitions Response Sites (MRSs): the Anti-Tank/Rocket Grenade Range and the Infiltration/Grenade Range.

4. Site Background and Current Conditions:

a. Fort Rucker is located in southeast Alabama, approximately 3 miles southwest of Ozark, Alabama and 1/2 mile north of Daleville, Alabama. Most of the installation property lies in Dale County, but a portion lies in Coffee County. Fort Rucker is bordered to the north and west by agricultural land, to the south by the cities of Daleville and Enterprise, and to the east by the city of Ozark. Figure 1 (provided in Appendix A) illustrates the location of Fort Rucker.

b. Fort Rucker encompasses nearly 98 square miles of land. It contains airfields, stage fields, tactical sites, leased land for rotary-wing pads, and fixed-wing airstrips. Fort Rucker is primarily used for helicopter and tactical maneuver training.

c. ***Anti-Tank/Rocket Grenade Range***

The Anti-Tank/Rocket Grenade Range, also known as FTRU-001-R-01, covers approximately 52 acres. Most of the site (39 of the 52 acres) consists of a well-maintained golf course. The remaining acreage is wooded. This site was historically used as an anti-tank rocket and grenade range.

During the 2005 site inspection by Malcolm Pirnie, four munitions debris (MD) items were discovered on the Anti-Tank/Rocket Grenade Range. The MD consisted of a fragment from a practice rifle grenade, a fragment of an expended 2.36-inch rocket, and fragments from two expended M28 3.5-inch rockets.

The location of the Anti-Tank/Rocket Grenade Range on Fort Rucker is illustrated in Figure 2, Appendix A.

d. ***Infiltration/Grenade Range***

The Infiltration/Grenade Range, also known as FTRU-003-R-01, is adjacent to but not contiguous with the Anti-Tank/Rocket Grenade Range. The site consists of approximately 44 acres in the non-operational range. Fort Rucker's equestrian center and golf course driving range comprise most of the site (34 acres), while the remaining 10 acres are wooded.

The site was used historically as an infiltration and grenade range. In 2003, two Explosives Ordnance Disposal (EOD) responses occurred. During each EOD response, one rifle grenade was destroyed (Malcolm Pirnie, 2005). No additional information on the rifle grenade items destroyed is available. Because no additional information is available on these rifle grenades, the worst-case grenade selected with the greatest fragmentation is the M31 Rifle Grenade High Explosive Anti-Tank (HEAT) [1].

The location of the Infiltration/Grenade Range on Fort Rucker is illustrated in Figure 2, Appendix A.

5. Executing Agencies:

a. U.S. Army Environmental Command

b. U.S. Army Corps of Engineers (USACE), Engineering and Support Center, Huntsville (USAESCH)

6. Scope of Investigative Action:

A Munitions and Explosives of Concern (MEC)/Material Potentially Presenting an Explosive Hazard (MPPEH) surface and subsurface investigative action is required for this RFI. These tasks are described below:

a. Surface Clearance

Unexploded Ordnance (UXO) Technicians will perform a MEC/MPPEH surface clearance over transects to ensure the safety of Digital Geophysical Mapping (DGM) crews, remove metallic debris (minimum size of 2 inches by 2 inches in length in any direction) that would impede DGM subsurface target detection, and document surface MEC-related finds by location. DGM transects for each MRS are identified and depicted in Figures 3 and 4, Appendix A.

b. Intrusive Investigation

UXO teams (UXO Technicians III, II, and I) will intrusively investigate DGM transect-identified anomalies, document the excavation, and record anomaly characterization results for each anomaly investigation. Handheld all-metals detectors will be used to predict proximity to the DGM anomaly. Hand excavation will occur within 12 inches of an anomaly and commence to the side of an anomaly. Operational metals detectors will be checked daily over a small metallic item (1/2″ x 4″ section of pipe) at a test location to ensure proper functioning and operation.

Each UXO team will consist of at least one UXO Technician III and two qualified UXO Technicians II or higher. A UXO Technician I may also support investigation teams.

Before intrusive operations begin, the following Fort Rucker organizations will be contacted: Directorate of Plans, Training, Mobilization and Security Airspace; Directorate of Family and Morale, Welfare and Recreation; the Fort Rucker Golf Course; and the Fort Rucker Equestrian Center. Scheduling efforts will be made to perform intrusive operations during low-use periods.

---

[1] TM 43-0001-29, Army Ammunition Data Sheets for Grenades (1977), Appendix C.

7. Safety Criteria:

a. The Munition with the Greatest Fragmentation Distance (MGFD) is identified for each MRS based on a review of available records. The MGFD for the Anti-Tank/Rocket Grenade Range is the 3.5-inch M28A2 Rocket[2]. The MGFD for the Infiltration/Grenade Range is the M31 Rifle Grenade. Figures 3 and 4 illustrate the Explosives Safety Quantity Distances (ESQDs) for the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range, respectively. Department of Defense Explosives Safety Board (DDESB) Fragmentation Data Sheets for each respective MRS MGFD are presented in Appendix B.

   If MEC with a greater fragmentation distance than the selected MGFD is encountered, the minimum separation distance (MSD) will be adjusted in accordance with DDESB Technical Paper 16 (Revision 3), *Methodologies for Calculating Primary Fragment Characteristics* and the DDESB Fragmentation Database, operations will continue, and an amendment to this plan will be submitted for approval.

   Sandbag mitigation is the preferred engineering control (if required) for intentional detonations. Sandbag mitigations shall be in accordance with HNC-ED-CS-S-98-7, *The Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions* and Environmental and Munitions Center of Expertise (EM CX) Safety Advisory: *Use of Jet Perforator During Intentional Detonation While Using Sandbag Mitigation for Engineering Controls*, dated 12 July 2010 (Note: a copy of these guidances will be available onsite). The implementation of sandbag mitigation during an intentional detonation will reduce the maximum fragmentation distance - horizontal (MFD-H) to 200 feet (Table 7-1). Figures 3 and 4 illustrate this reduction in MFD-H at each MRS. If an additional reduction of the MFD is required, the Buried Explosion Module (see DDESB Technical Paper 16) will be used.

b. See Appendix B for the DDESB Fragmentation Data Sheets.

c. See Table 7-1 for MSDs. Because Fort Rucker conducts aviation operations, the Fort Rucker Directorate of Plans, Training, Mobilization and Security Airspace will be contacted prior to an intentional detonation to enable a 24-hour Notice to Airmen to be posted. See Table 7-2 for vertical fragmentation distances for intentional detonations.

d. Any occupied buildings or public roadways within the Hazardous Fragmentation Distance (HFD) will be evacuated and/or blocked to prevent non-essential personnel from entering during intrusive operations. Entry control points (ECPs) have been established, as illustrated on Figures 3 and 4. If a roadway cannot be blocked, spotters will be used to alert the Senior UXO Supervisor (SUXOS) to cease intrusive operations when non-essential personnel approach/enter HFD areas. Work shall be suspended until non-essential personnel depart the HFD area. At the Anti-Tank/Rocket Grenade Range, horses stabled within the equestrian center will be removed from their stalls and withdrawn to beyond the HFD (235 ft).

---

[2] TM 43-0001-30, Army Ammunition Data Sheets for Grenades (1981), Appendix C.

e. In the event of an intentional detonation, all personnel and the public will withdraw outside the MFD, as listed in Tables 7-1 and 7-2, respectively. Horses stabled within the equestrian center on the Anti-Tank/Rocket Grenade Range will be removed from their stalls and withdrawn to beyond MFD-H.

TABLE 7-1
Minimum Separation Distances

MRS Name or other Designator	MEC[2]	Minimum Separation Distances (feet)[1]					
		For Unintentional Detonations			For Intentional Detonations		
		Team Separation Distance (K40)	HFD	To Sides and Rear Using OFB	Without Engineering Controls (MFD)	Using Sandbag Mitigation	Using Water Mitigation
Anti Tank/Rocket Grenade Range	3.5 inch M28A2 Rocket	56	235	N/A	1420	200	N/A
Infiltration/ Grenade Range	M31 Rifle Grenade	39	57	N/A	392	200	N/A

Notes:

1. See Appendix B for fragmentation data review sheets for documentation of the MSD.
2. Denotes MGFD within the area indicated.

TABLE 7-2
Vertical Fragmentation Distances

MRS Name or Other Designator	MEC[2]	Vertical Fragmentation Distance (MFD-V)[1]
Anti-Tank/Rocket Grenade Range	3.5 inch M28A2 Rocket	1128 feet
Infiltration/Grenade Range	M31 Rifle Grenade	323 feet

Note:

1. See Appendix B for fragmentation data review sheets.
2. Denotes MGFD within the area indicated.

8. Methods of Disposal:

a. Explosives operations will comply with procedures outlined in Technical Manual (TM) 60A-1-1-31, *EOD Disposal Procedures*, and Engineering Manual (EM) 385-1-97, *Explosives Safety and Health Requirements Manual*. Demolition operations will be performed daily or the items will be properly secured and guarded until operations can be conducted. Consolidated detonations and collection points will not be used.

b. Commercial explosives will be delivered to the project location on a "just-in-time" basis.

c. The MSDs for intentional detonations in each MRS are identified in Table 7-1 and illustrated in Figures 3 and 4.

d. All recovered MEC determined unacceptable-to-move will be blown-in-place by controlled detonation with engineering controls (i.e., sandbag mitigation or the Buried Explosion Module). MEC determined acceptable-to-move by the SUXOS and UXO Safety Officer (UXOSO) may be moved within the MRS for the purpose of conducting disposal operations away from any inhabited buildings, structures, or roadways.

e. Visual MPPEH inspection shall occur within the MRS, at the location where the MPPEH item is encountered. MPPEH and MD will be inspected, certified, verified and disposed of in accordance with DOD Instruction 4140.62, *Management and Disposition of Material Potentially Presenting an Explosive Hazard*, and EM 1110-1-4009, *Military Munitions Response Actions* and Errata Sheet No. 2. This inspection will be certified and verified on DD Form 1348-1 as follows:

> *"This certifies and verifies that the Material Documented as Safe (MDAS) listed has been 100 percent properly inspected and, to the best of our knowledge and belief, is free of explosive hazards."*

9. Figures: See Appendix A.

10. Fragmentation Calculation Sheets: See Appendix B.

11. Technical Manual Army Ammunition Data Sheets: See Appendix C.

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APPENDIX A

Figures

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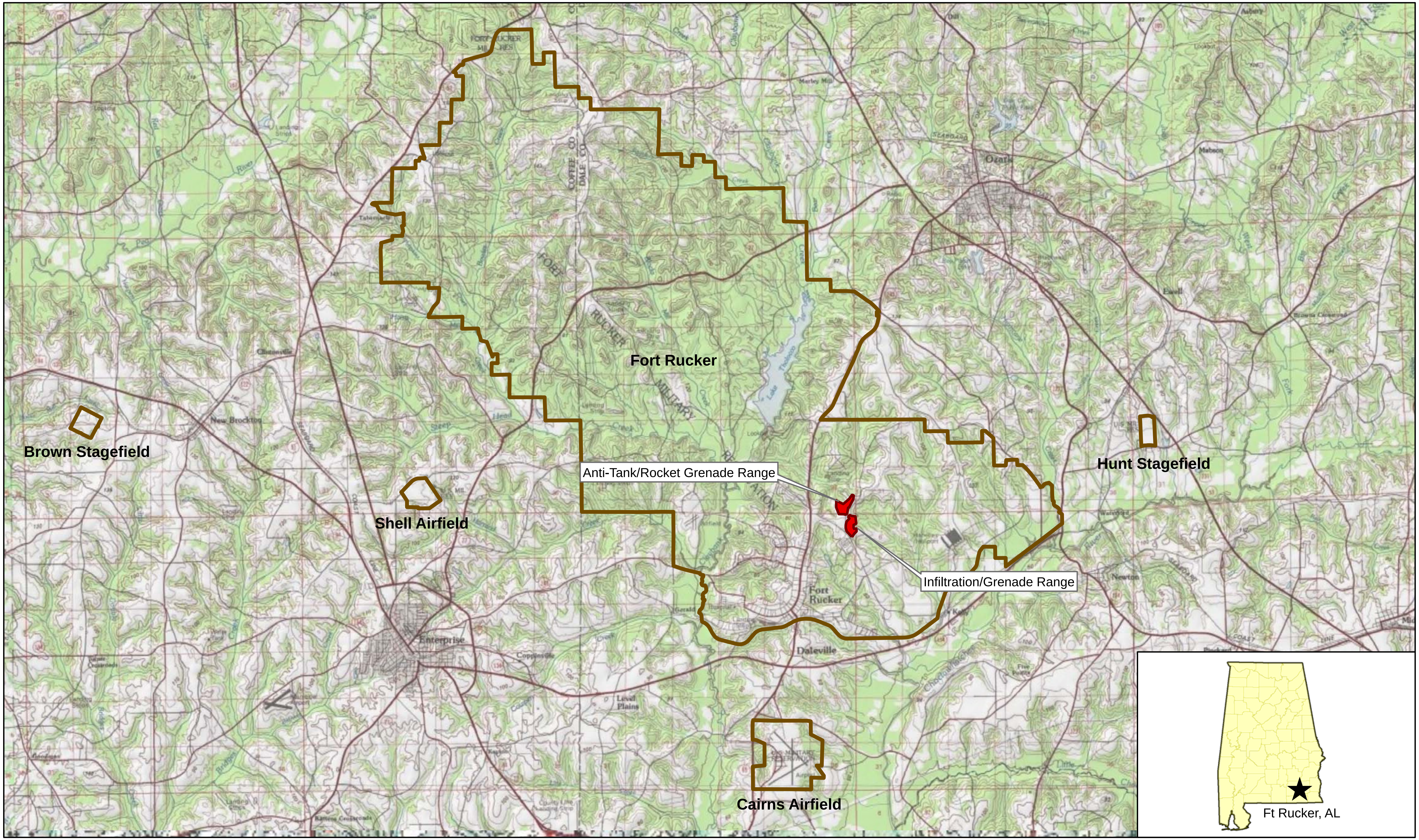

☐ Installation Boundary
🟥 Munitions Response Site Boundary
NGS USA Topographic Maps

FIGURE 1
General Location Map
Explosives Site Plan
Fort Rucker, Alabama

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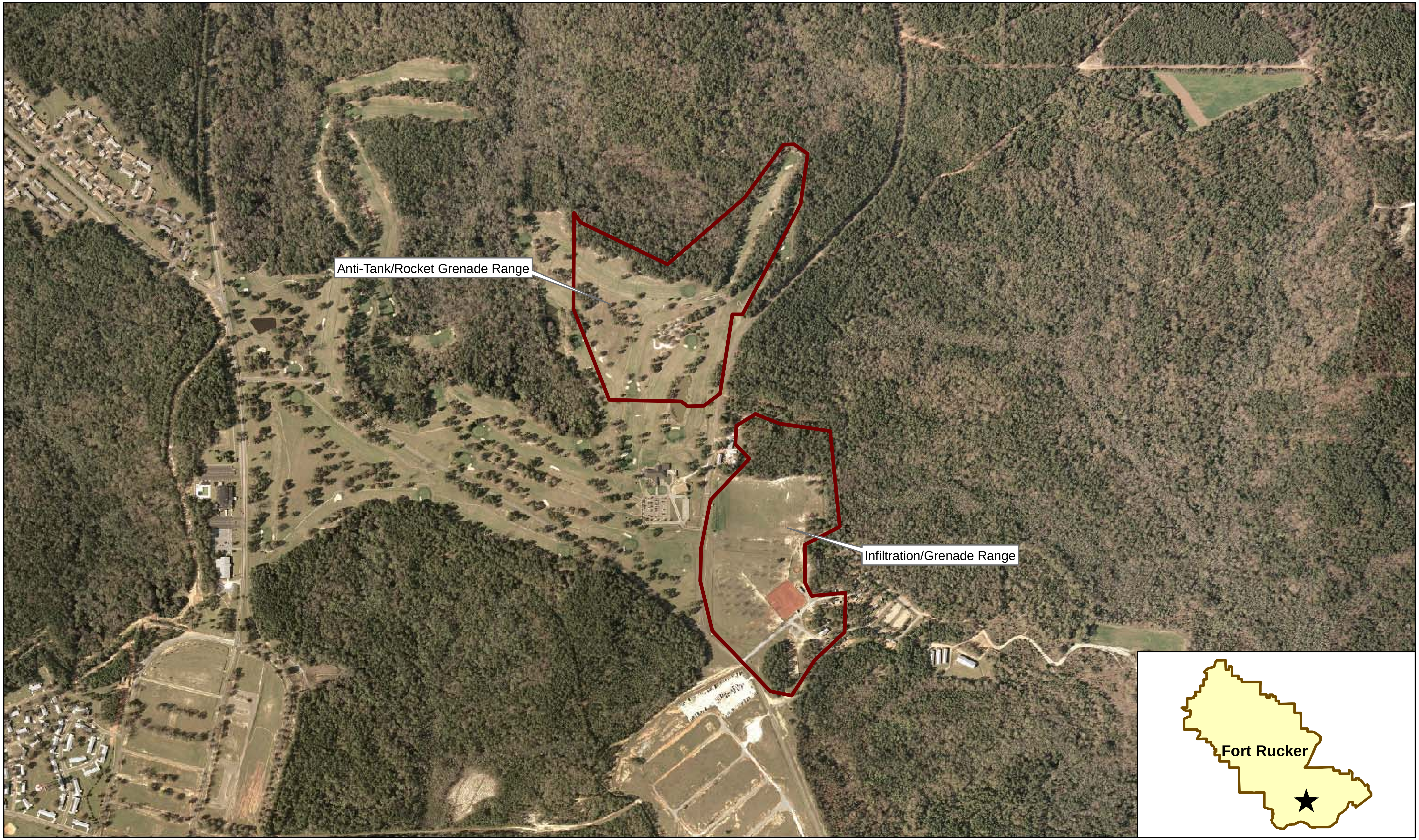

FIGURE 2
Munitions Response Sites
Explosives Site Plan
Fort Rucker, Alabama

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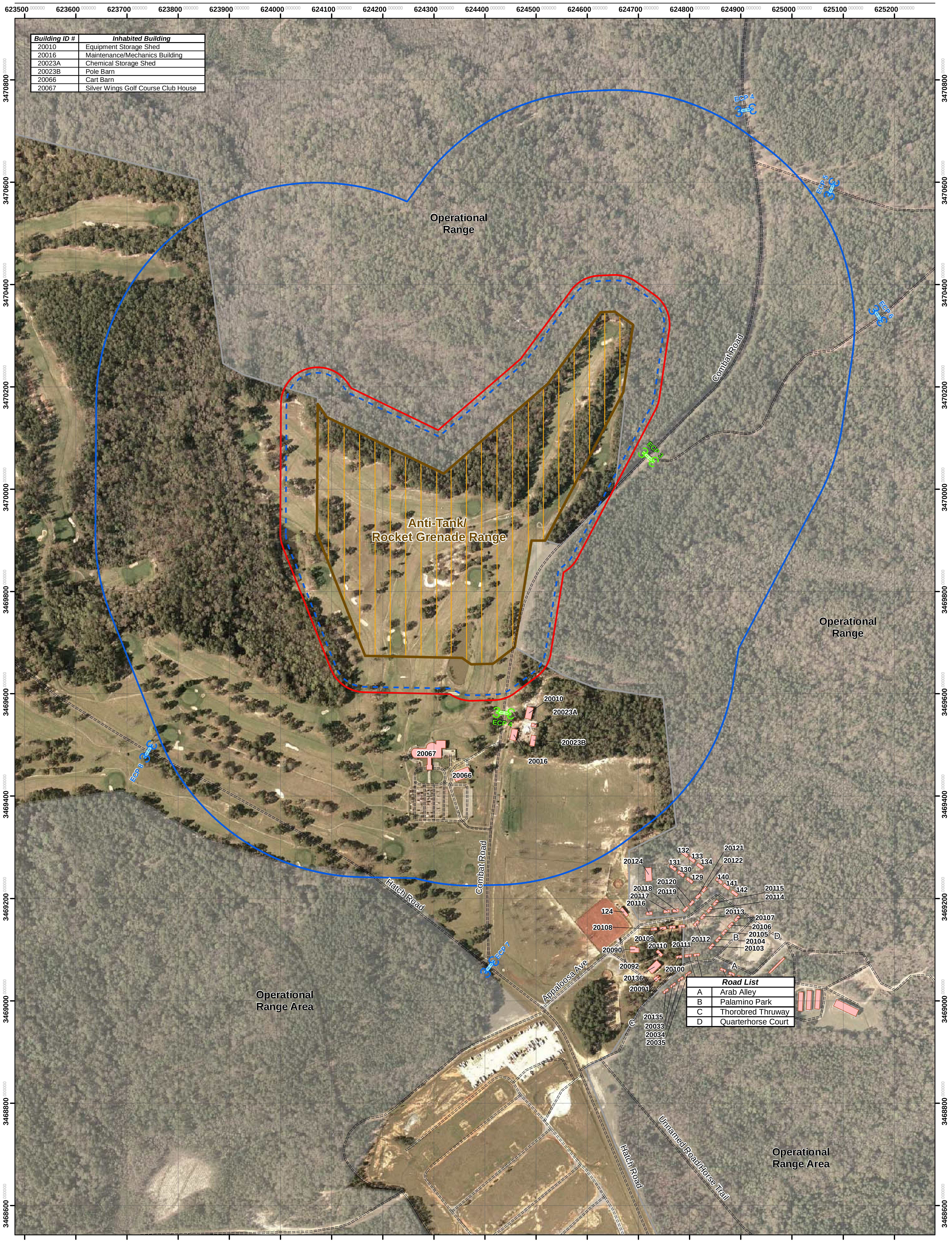

Building ID #	Inhabited Building
20010	Equipment Storage Shed
20016	Maintenance/Mechanics Building
20023A	Chemical Storage Shed
20023B	Pole Barn
20066	Cart Barn
20067	Silver Wings Golf Course Club House

Road List	
A	Arab Alley
B	Palamino Park
C	Thorobred Thruway
D	Quarterhorse Court

- HFD: 235 ft
- MFD-H: 1420 ft
- MFD-H with Sandbag Mitigation: 200 ft
- Road
- DGM Transects
- MFD-H Entry Control Point (ECP)
- HFD and MFD-H with Sandbag Mitigation ECP
- Existing Structure
- Operational Range
- Munitions Response Site Boundary

1 inch = 400 feet

FIGURE 3
Anti-Tank/Rocket Grenade Range ESQDs for MGFD (3.5" M28A2 Rocket)

Explosives Site Plan
Fort Rucker, Alabama

\\GALILEO\PROJ\USACE\FT_RUCKER\MAPFILES\FIGURE_3-ANTITANKROCKETGRENADERANGE-20100803.MXD SSMITH21 8/3/2010 16:58:12

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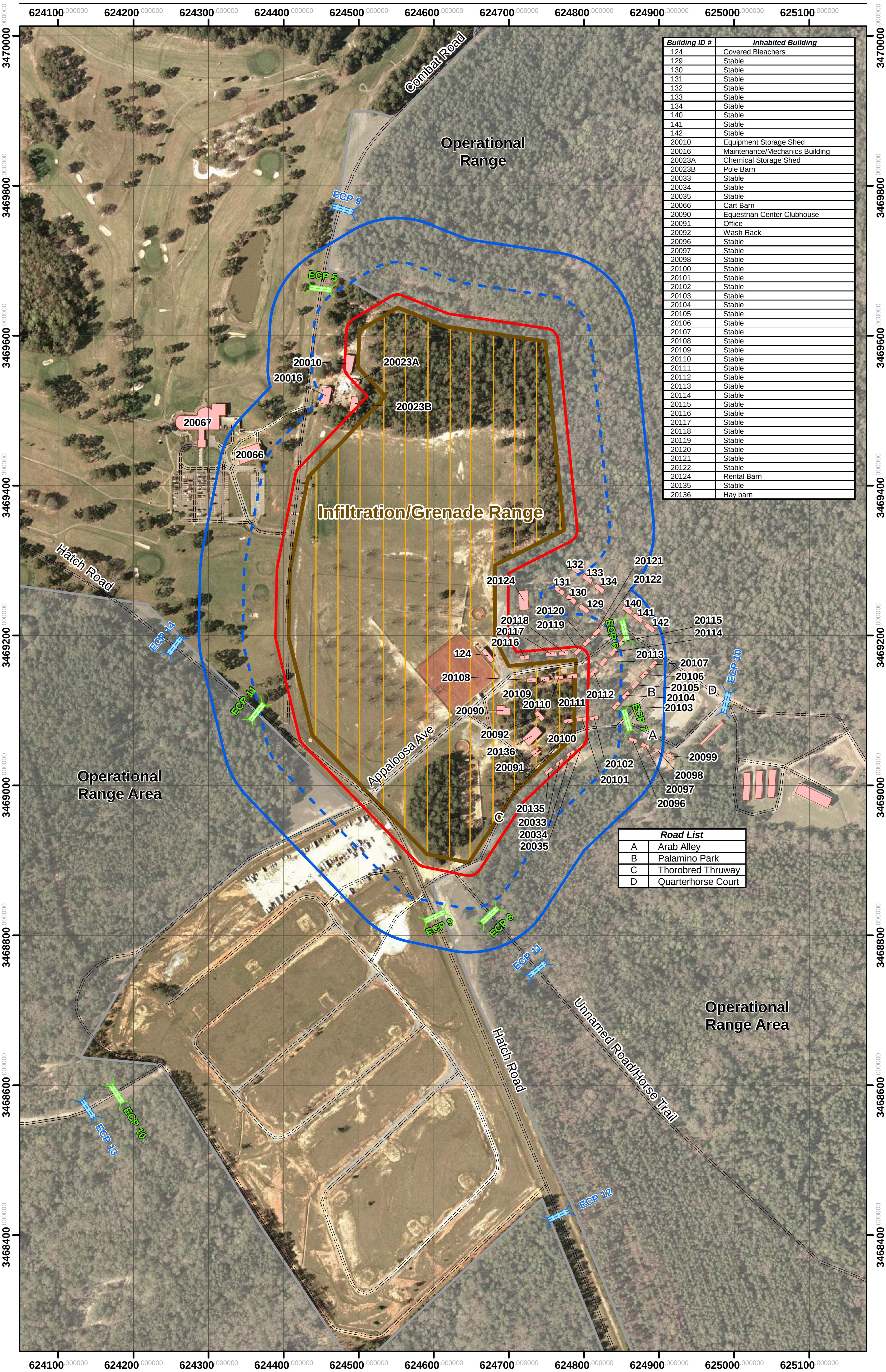

Building ID #	Inhabited Building
124	Covered Bleachers
129	Stable
130	Stable
131	Stable
132	Stable
133	Stable
134	Stable
140	Stable
141	Stable
142	Stable
20010	Equipment Storage Shed
20016	Maintenance/Mechanics Building
20023A	Chemical Storage Shed
20023B	Pole Barn
20033	Stable
20034	Stable
20035	Stable
20066	Cart Barn
20090	Equestrian Center Clubhouse
20091	Office
20092	Wash Rack
20096	Stable
20097	Stable
20098	Stable
20100	Stable
20101	Stable
20102	Stable
20103	Stable
20104	Stable
20105	Stable
20106	Stable
20107	Stable
20108	Stable
20109	Stable
20110	Stable
20111	Stable
20112	Stable
20113	Stable
20114	Stable
20115	Stable
20116	Stable
20117	Stable
20118	Stable
20119	Stable
20120	Stable
20121	Stable
20122	Stable
20124	Rental Barn
20135	Stable
20136	Hay barn

Road List	
A	Arab Alley
B	Palamino Park
C	Thorobred Thruway
D	Quarterhorse Court

🟥 HFD: 57 ft	=== Road
🟦 MFD-H: 392 ft	DGM Transects
MFD-H with Sandbag Mitigation: 200 ft	Existing Structure
MFD-H Entry Control Point (ECP)	Munitions Response Site Boundary
HFD and MFD-H with Sandbag Mitigation ECP	Operational Range

N

0 100 200 400
Feet
1 inch = 400 feet

FIGURE 4
Infiltration/Grenade Range ESQDs for MGFD (M31 Rifle Grenade)

Explosives Site Plan

Fort Rucker, Alabama

\\GALILEO\PROJ\USACE\FT_RUCKER\MAPFILES\FIGURE_4-INFILTRATIONGRENADERANGE-20100803.MXD SSMITH21 8/3/2010 17:00:32

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APPENDIX B

Fragmentation Data Sheets

MGFD by Area	
Anti-Tank/Rocket Grenade Range	3.5 inch M28A2 Rocket
Infiltration/Grenade Range	M31 Rifle Grenade

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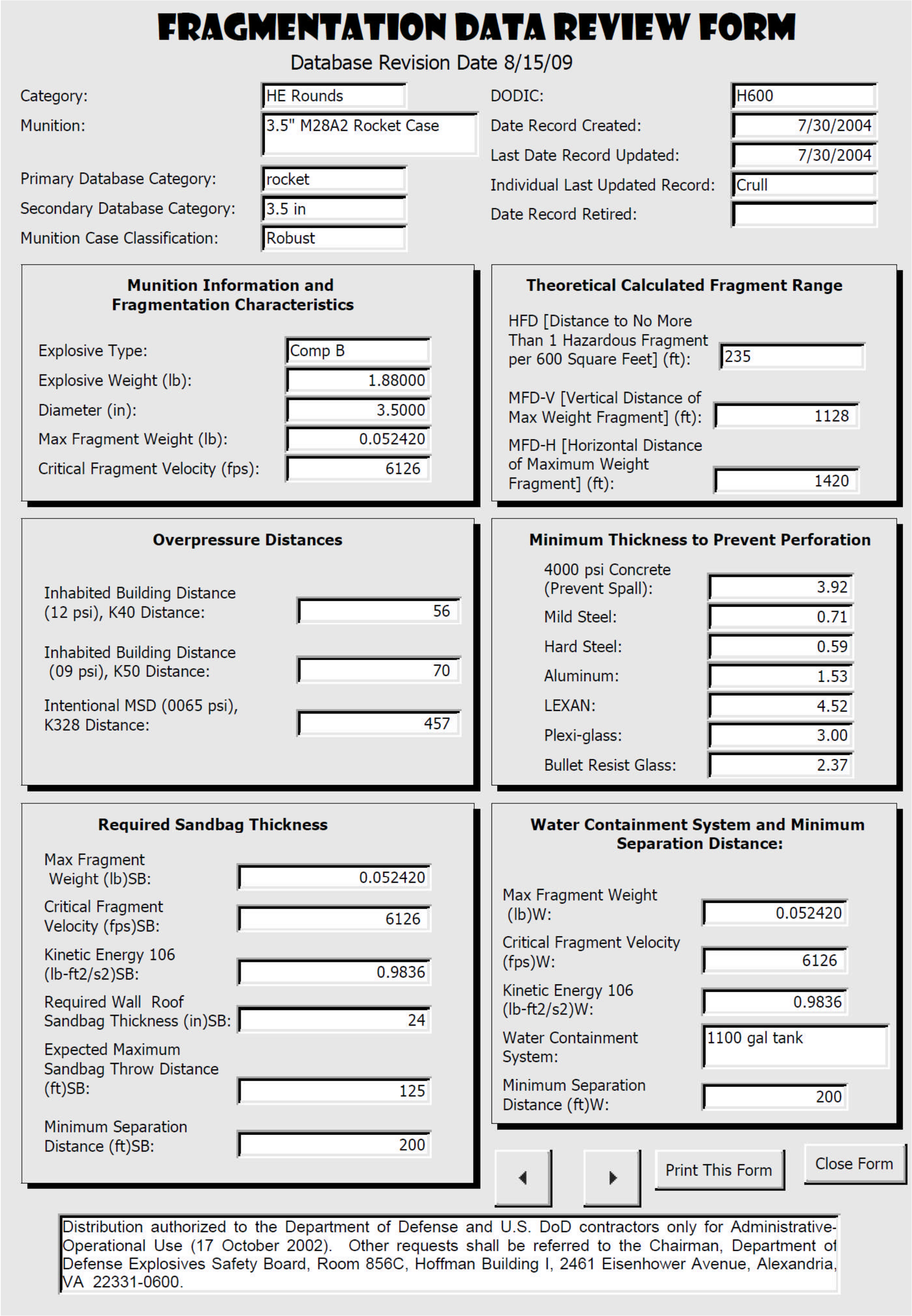


FRAGMENTATION DATA REVIEW FORM

Database Revision Date 8/15/09

Category: HE Rounds
Munition: 3.5" M28A2 Rocket Case
Primary Database Category: rocket
Secondary Database Category: 3.5 in
Munition Case Classification: Robust

DODIC: H600
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: 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 [Distance to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft): 235
MFD-V [Vertical Distance of Max Weight Fragment] (ft): 1128
MFD-H [Horizontal Distance 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

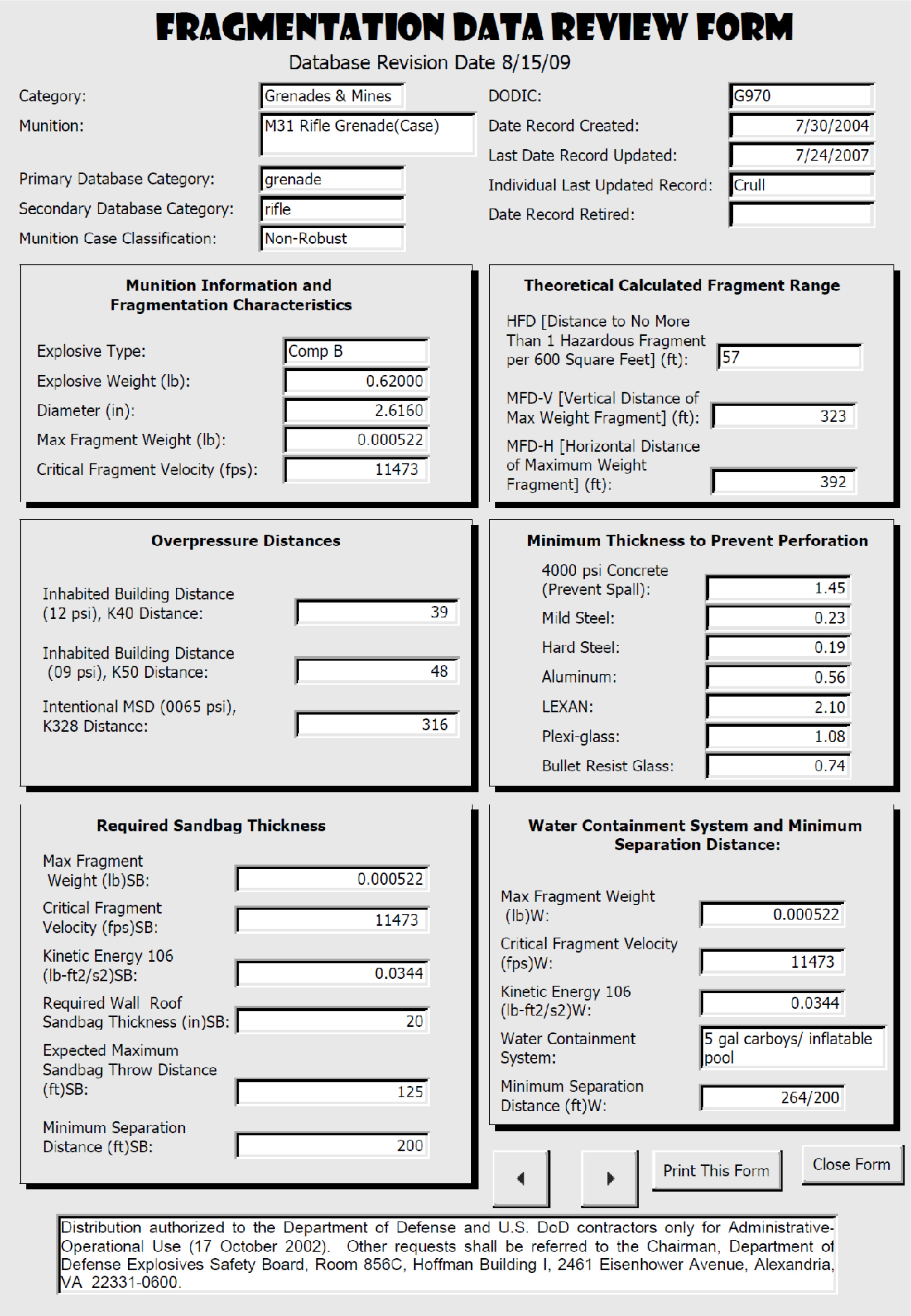
Required Sandbag Thickness

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

Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (17 October 2002). Other requests shall be referred to the Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building I, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.



FRAGMENTATION DATA REVIEW FORM

Database Revision Date 8/15/09

Category: Grenades & Mines

Munition: M31 Rifle Grenade(Case)

Primary Database Category: grenade

Secondary Database Category: rifle

Munition Case Classification: Non-Robust

DODIC: G970

Date Record Created: 7/30/2004

Last Date Record Updated: 7/24/2007

Individual Last Updated Record: Crull

Date Record Retired:

Munition Information and Fragmentation Characteristics

Explosive Type: Comp B

Explosive Weight (lb): 0.62000

Diameter (in): 2.6160

Max Fragment Weight (lb): 0.000522

Critical Fragment Velocity (fps): 11473

Theoretical Calculated Fragment Range

HFD [Distance to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft): 57

MFD-V [Vertical Distance of Max Weight Fragment] (ft): 323

MFD-H [Horizontal Distance of Maximum Weight Fragment] (ft): 392

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance: 39

Inhabited Building Distance (09 psi), K50 Distance: 48

Intentional MSD (0065 psi), K328 Distance: 316

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall): 1.45

Mild Steel: 0.23

Hard Steel: 0.19

Aluminum: 0.56

LEXAN: 2.10

Plexi-glass: 1.08

Bullet Resist Glass: 0.74

Required Sandbag Thickness

Max Fragment Weight (lb)SB: 0.000522

Critical Fragment Velocity (fps)SB: 11473

Kinetic Energy 106 (lb-ft2/s2)SB: 0.0344

Required Wall Roof Sandbag Thickness (in)SB: 20

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: 0.000522

Critical Fragment Velocity (fps)W: 11473

Kinetic Energy 106 (lb-ft2/s2)W: 0.0344

Water Containment System: 5 gal carboys/ inflatable pool

Minimum Separation Distance (ft)W: 264/200

Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (17 October 2002). Other requests shall be referred to the Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building I, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.

APPENDIX C

Technical Manual Army Ammunition Data Sheets

MGFD by MRS	
Anti-Tank/Rocket Grenade Range	3.5 inch M28A2 Rocket
Infiltration/Grenade Range	M31 Rifle Grenade

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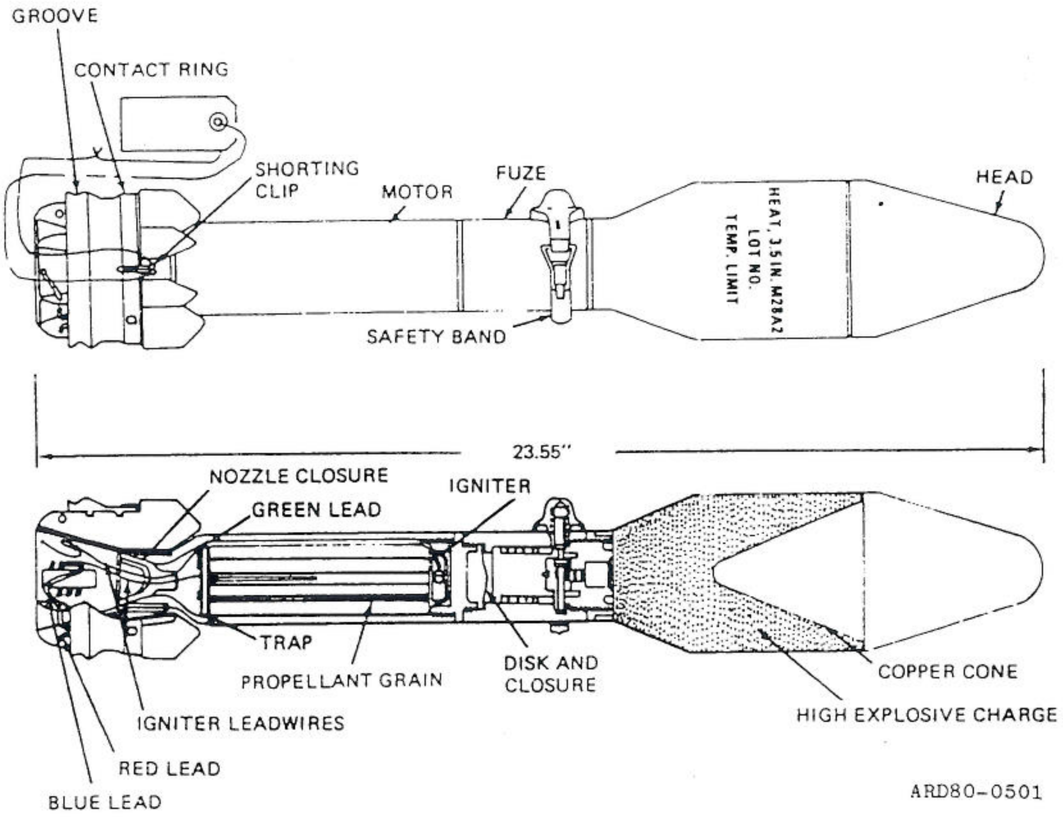
ROCKET, HIGH-EXPLOSIVE, 3.5-INCH: AT, M28A2



Type Classification:

STD (LCC-B) OTCM 36841 Jul 58

Use:

The M28A2 HEAT rocket is used primarily against armored targets, tanks and secondary targets, such as gun emplacements, pillboxes and personnel. It is capable of penetrating heavy armor at angles of impact greater than 30°. In an antipersonnel role, it has a fragmentation area 10 yd wide and 20 yd deep.

Description:

a. The warhead is cylindrical and tapered. The forward end, called the ogive, is thin metal and hollow. The rear end, threaded internally to receive the fuze which is encircled by a safety band. The warhead contains a copper cone whose apex faces aft and acts to shape the high explosive charge Composition B (Comp B).

b. The base detonating (BD) rocket fuze M404A2 consists of a body which contains the functioning parts; a safety band, a detonator and a booster pellet. The fuze body and safety band are olive drab. The fuze mechanism consists of an activating plunger, a setback spring, a setback sleeve, a firing pin assembly, a detent spring, an ejection pin and an ejection spring. The spring-loaded ejection pin passes through the fuze body.

c. The motor assembly consists of a tube which houses the propellant and igniter. The fin assembly is securely attached to this tube. The front end of the tube is assembled to the base of the fuze. The rear end forms a nozzle. The cylindrical motor cavity is divided into four sections by two spacer plates which support the grains of propellant powder.

d. Each grain of propellant is 5-in. long and approximately 3/8-in. in diameter. Three grains are placed in each of the four sections formed by the spacer plates. Each lot of propellant is adjusted at the time of manufacture to give standard velocity. The igniter ignites the propellant.

e. The igniter consists of a short, cylindrical plastic case containing a small black powder charge and an electrical squib. It is assembled in the forward end of the motor on top of the propellant, spacer plates. The leads of the electrical squib, running parallel to the grains of propellant, pass from the igniter through the nozzle into the expansion cone. A green lead (ground) wire is connected to the aluminum support ring of the contact ring assembly. A red lead (positive) wire is attached to a pin which is insulated from the support ring, but is in contact with the copper contact band. These connections are positioned 180° apart. Blue lead is used for test purpose only.

f. The fin assembly consists of six aluminum alloy fins and a contact ring assembly. The contact ring assembly, which encircles the fins, consists of three rings. The aluminum support ring, which is innermost, is separated from the copper contact ring by a plastic insulating ring. The fins are spot welded to the expansion cone, and the expansion cone is press fitted to the rear of the motor tube. The M24 and the M66 off-route mines utilizing M28A2 HEAT rockets are described in TM 43-0001-36.

Differences between Models:

The BD rocket fuze M404A1 is similar to BD rocket fuze M404A2. The M404A1 differs principally in minor design changes of the functioning parts and the shape of the safety band.

Functioning:

a. When the safety band is removed, the ejection pin moves outward approximately 3/8 of an inch but still prevents all parts of the fuze mechanism from moving. When the rocket is in the firing chamber, the ejection pin is partially depressed by the chamber, thereby freeing the setback sleeve so it can move to the rear when the rocket is fired. The fuze is still safe, since the ejection pin prevents movement of the actuating sleeve and firing pin.

b. If it becomes necessary to remove the rocket from the launcher, the ejection pin will move outward and re-engage the setback sleeve. This returns the fuze to its original safe condition.

c. When the rocket is fired, the force of inertia causes the setback sleeve to move rearward. It is held in its rearward position by the lockpin. When the rocket leaves the muzzle of the launcher, the ejection pin is thrown clear of the fuze by the ejection pin spring. The fuze is then fully armed.

d. During flight, the firing pin lever and firing pin spring prevent the firing pin from striking the detonator. The creep spring retards the forward movement of the plunger and actuating sleeve. The action of the creep spring prevents the fuze from firing should the rocket strike light objects such as thin brush or undergrowth.

e. Upon impact with a more resistant object, the plunger and actuating sleeve move forward until the sleeve hits the firing pin lever. This causes the firing pin to strike and detonate the warhead.

Tabulated Data:

Rocket:	
Model	M28A2
Type	Service
Diameter	3. 5 in.
Length (max)	23. 55 in.
Weight	9. 00 lb
Performance:	
Operating temperature limits	-20° to +120°F (-28. 6 to +48. 4C)
Muzzle velocity (at 70°F) (approx)	325 ft/sec (99 mps)
Warhead:	
Type	HEAT
Body	Steel
Color	Olive drab w/yellow markings
Diameter	3. 5 in.
Length	10. 5 in.
Weight	4. 47 lb
High-explosive train:	
Detonator	M41
Booster (tetryl)	0. 17 oz (4.81 g)
Filler (warhead)	
Type	Comp B
Weight (approx)	1. 88 lb (.854 kg)
Fuze:	
Model	M404A1 or M404A2
Type	Base detonating
Diameter	2. 0 in.
Length:	
Overall	3. 48 in.
To shoulder (max)	2. 94 in.
Weight	1. 16 lb
Arming distance	10 ft (3.05 m)
Motor:	
Diameter (at fins)	3. 5 in.
Length	10. 41
Weight	3. 30 lb
Thrust	6,000 - 10,000 lb

Propelling initiating train:	
Igniter:	
Model	M20A1
Charge (black powder)	0. 13 ± 0. 007 (3. 5 ± . 2 g)
Electric squib	M2
Propelling charge:	
Propellant:	
Model	M7
Type	Solvent
Configuration	Monoperforated, cylindrical, extruded grains (12)
Weight	0. 44 lb (198 g)
Burning time:	
At -20°F	0. 05 sec
At +120°F	0. 02 sec

Launchers	M20, M20A1, M20A1B1, M20B1
Packing	1 per metal/fiber container, 3 containers per wooden box
Box:	
Weight (with contents)	53. 0 lb

Dimensions:
W/metal
container - - - 29-9/16 in. x
14-1/16 in. x
16-19/32 in.

W/fiber
container - - - 29-3/16 in. x
13-7/8 in. x
16-19/32 in.

Cube:
W/metal
container - - - - 1.6 ft^3
W/fiber
container - - - - 1.5 ft^3

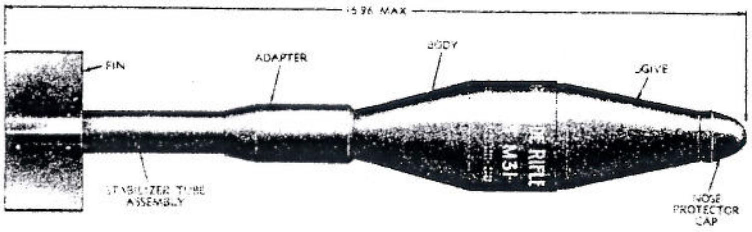
DODAC - - - - - - - 1340-H600

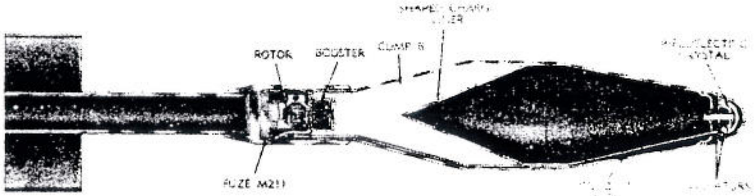
Shipping and storage data:
Storage class/
SCG - - - - - - - - 1.1E
DOT shipping
class - - - - - - - - A
DOT designation - ROCKET AMMUNITION WITH EXPLOSIVE PROJECTILES
Field storage - - Group E

Drawings:
Complete assy - - 9211744 (82-6-22
Loading assy
(head) - - - - - - - 82-16-36
Loading assy
(motor) - - - - - - 9225502 (82-16-35)
Packing (inner)- - 7549038
Packing (outer)- - 7549040

References:
TM 9-1340-222-34

GRENADE, RIFLE: HEAT, M31





TYPE CLASSIFICATION:

Std. LCC-A, MSR 6558

Use:

To defeat armored targets, against personnel, for screening, signaling or for incendiary effect against flammable targets.

Description:

a. The rifle grenade HEAT, M31 is a point-initiated, base-detonated (PIBD), high-explosive, anti-tank (HEAT) grenade. It employs a shaped charge to defeat armor plate or concrete, and will function against targets at all angles of obliquity up to 65°. The grenade uses a piezoelectric assembly which generates an electric current when crushed on impact with the target. This action initiates the explosive train. Only rifle grenades M31, which are assembled with modified nose assemblies, are authorized for use. The modified nose assemblies, are authorized for use. The modified nose assembly has a positive ground between the piezoelectric crystal and the metal nose protector cap.

b. Rifle grenade M31 consists of three basic parts: the cylindrical body with conical ogive and conical rear section; the fuze; and the stabilizer. The ogive contains a piezoelectric assembly in the nose. A lead wire (in conduit) connects this assembly to the fuze, in the base of the body. The body contains Comp B molded against a copper shaped charge liner. A booster is contained in the fuze at the base of the body.

c. Fuze M211 consists of a base, spring-driven detonator rotor and a cover. The detonator rotor contains an electric detonator. The base contains a setback leaf assembly. The cover contains a booster pellet. The aluminum stabilizer consists of a stabilizer tube, with an adapter at its forward end (for connection to the body), and a fin assembly at the other end. When assembled, the fuze is held within the adapter.

TABULATED DATA:

Model---------------M31
Type----------------HEAT
Weight (as issued)-1.56 lb.
Explosive charge
(Comp B)------------9.92 oz
Dimensions:
Diameter------------2.61 in.
Height--------------16.96 in.
Body----------------Steel
Fuze----------------M211
Type----------------PIBD
Color---------------Olive drab w/yellow markings

Federal Supply Code:

NSN------1330-00-541-9848
DODAC----1330-G970
See SC for complete packing data including NSN's pertaining to DODAC.

Unit of Issue:

Each
Packed: 1 per container; 10 containers per box with 20 Ctgs rifle grenade Cal. 30 M3.

Packing Data:

Packing box:
Weight-------------69.5 lb.
Dimensions---------18.5 in. X 8.375 in. X 20.875 in.
Cube---------------2.9 cu ft

Shipping and Storage Data:

Quantity distance
Class-------------7
Storage compatibility group------G
DOT shipping
Class-------------A
DOT designation---Rifle Grenades

Functioning:

An inertia-actuated setback leaf assembly prevents alinement of the detonator with the booster in the fuze until the rifle grenade is launched. Prior to arming, the detonating circuit within the fuze is grounded. Thus, current cannot pass through the detonating circuit, and current from an accidentally crushed or stressed crystal is short circuited to the body of the grenade. The detonating switch is contained within a small rotor which is locked into the short-circuit position by a set-back leaf assembly. When the grenade is launched, the set-back leaf assembly releases the rotor. The rotor turns 90°, opening the shorting switch and closing the firing switch. Upon launching, the grenade functions as follows:

a. Inertia setback causes the first of the three setback leaves in the setback leaf assembly to overcome the tension of its spring. This releases the second leaf.

b. The second leaf rotates, releasing the third leaf.

c. The third leaf rotates, releasing a rotor assembly containing the firing circuit.

d. The rotor assembly turns 90° to close the firing circuit, thus arming the grenade.

e. Upon impact with the target, the crystal is crushed and generates an electrical impulse.

f. The electrical impulse is conducted through a lead wire in the conduit to the electric fuze.

g. The electrical impulse passes through a resistance wire in the detonator, initiating the explosive train.

h. The detonator detonates the booster and, in turn, the shaped charge.

i. The principal explosive force of the shaped charge is directed forward to penetrate the target.

References:

TM 9-1330-200
TM 9-1330-200-12
TM 9-1330-200-34
FM 23-30

Drawings:

Assembly-------------82-0-195
Fuze-----------------82-2-54
Packing (inner)------7548996
Packing (outer)------7548997

AMENDMENT 1

Explosives Site Plan – Revised Minimum Separation Distances

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Explosives Site Plan
Amendment 1

FTRU-001-R-01 Anti-Tank/Rocket Grenade Range
FTRU-003-R-01 Infiltration/Grenade Range

Fort Rucker, Alabama

Contract W91ZLK-05-D-0014

Task Order No. 0001

December 2010

Prepared for

Army Environmental Command

Prepared by

CH2MHILL

Atlanta, Georgia

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1. **Purpose:** The purpose of this amendment is to revise the Explosives Site Plan for Fort Rucker, Alabama (FTRU-001-R01, Anti-Tank/Rocket Grenade Range and FTRU-003-R01, Infiltration/Grenade Range) in accordance with the Department of Defense Explosives Safety Board (DDESB) Fragmentation Data Forms dated 30 September 2010. All other stipulations of the original Explosives Site Plan remain in effect.

2. **Minimum Separation Distances:** Table 7-1 and Table 7-2 have been revised as follows:

TABLE 7-1
Minimum Separation Distances

MRS Name or other Designator	MEC[2]	Minimum Separation Distances (feet)[1]					
		For Unintentional Detonations			For Intentional Detonations		
		Team Separation Distance (K40)	HFD	To Sides and Rear Using OFB	Without Engineering Controls (MFD-H)	Using Sandbag Mitigation	Using Water Mitigation
Anti Tank/Rocket Grenade Range	3.5 inch M28A2 Rocket	~~56~~ ***52***	~~235~~ ***157***	N/A	~~1420~~ ***772***	200	N/A
Infiltration/ Grenade Range	M31 Rifle Grenade	~~39~~ ***36***	~~57~~ ***92***	N/A	~~392~~ ***500***	200	N/A

Notes:

1. See Appendix B for fragmentation data review forms (dated 30 Sept 2010) for documentation of the MSD.
2. Denotes MGFD within the area indicated.

TABLE 7-2
Vertical Fragmentation Distances

MRS Name or other Designator	MEC[2]	Vertical Fragmentation Distance (MFD-V)[1]
Anti-Tank/Rocket Grenade Range	3.5 inch M28A2 Rocket	~~1128 feet~~ ***628 feet***
Infiltration/Grenade Range	M31 Rifle Grenade	~~323 feet~~ ***409 feet***

Notes:

1. See Appendix B for fragmentation data review sheets dated 30 Sept 2010.
2. Denotes MGFD within the area indicated.

3. Figures: Figures 3 and 4 have been revised in accordance with the 30 September 2010 Fragmentation Review Forms. See Appendix A.

4. Fragmentation Calculation Sheets: See Appendix B.

APPENDIX A

Figures

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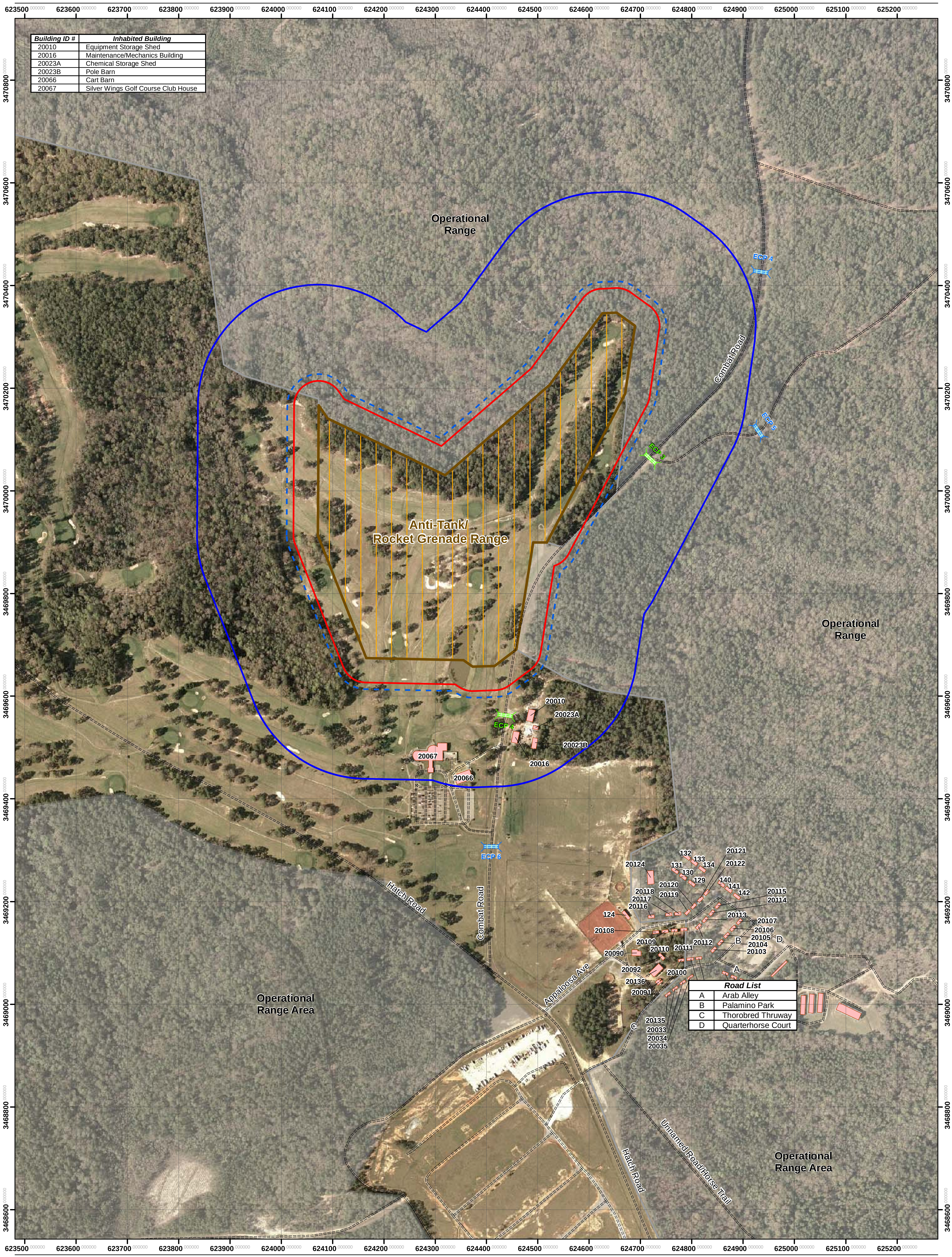

Building ID #	*Inhabited Building*
20010	Equipment Storage Shed
20016	Maintenance/Mechanics Building
20023A	Chemical Storage Shed
20023B	Pole Barn
20066	Cart Barn
20067	Silver Wings Golf Course Club House

Road List	
A	Arab Alley
B	Palamino Park
C	Thorobred Thruway
D	Quarterhorse Court

FIGURE 3
Anti-Tank/Rocket Grenade Range
ESQDs for MGFD (3.5" M28A2 Rocket)
Explosives Site Plan
Fort Rucker, Alabama

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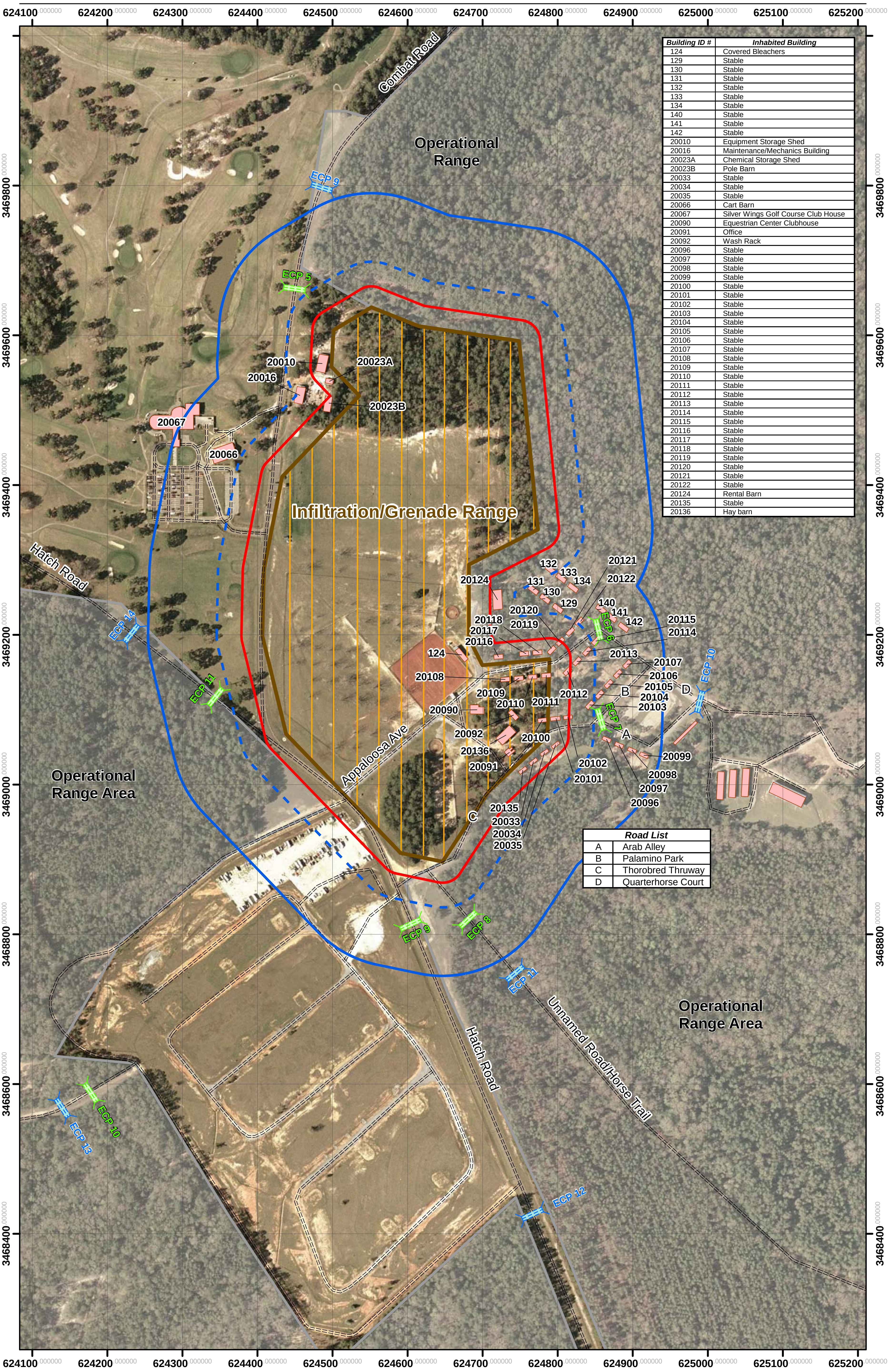
\\GALILEO\PROJ\USACE\FT_RUCKER\MAPFILES\FIGURE_3-ANTITANKROCKETGRENADERANGE-20101205.MXD SSMITH21 12/6/2010 08:18:16



Building ID #	Inhabited Building
124	Covered Bleachers
129	Stable
130	Stable
131	Stable
132	Stable
133	Stable
134	Stable
140	Stable
141	Stable
142	Stable
20010	Equipment Storage Shed
20016	Maintenance/Mechanics Building
20023A	Chemical Storage Shed
20023B	Pole Barn
20033	Stable
20034	Stable
20035	Stable
20066	Cart Barn
20067	Silver Wings Golf Course Club House
20090	Equestrian Center Clubhouse
20091	Office
20092	Wash Rack
20096	Stable
20097	Stable
20098	Stable
20099	Stable
20100	Stable
20101	Stable
20102	Stable
20103	Stable
20104	Stable
20105	Stable
20106	Stable
20107	Stable
20108	Stable
20109	Stable
20110	Stable
20111	Stable
20112	Stable
20113	Stable
20114	Stable
20115	Stable
20116	Stable
20117	Stable
20118	Stable
20119	Stable
20120	Stable
20121	Stable
20122	Stable
20124	Rental Barn
20135	Stable
20136	Hay barn

Road List	
A	Arab Alley
B	Palamino Park
C	Thorobred Thruway
D	Quarterhorse Court

HFD: 92 ft
MFD-H: 500 ft
MFD-H with Sandbag Mitigation: 200 ft
MFD-H Entry Control Point (ECP)
HFD and MFD-H with Sandbag Mitigation ECP
=== Road
DGM Transects
Existing Structure
Munitions Response Site Boundary
Operational Range

N
0 100 200 400
Feet
1 inch = 400 feet

FIGURE 4
Infiltration/Grenade Range
ESQDs for MGFD (M31 Rifle Grenade)
Explosives Site Plan
Fort Rucker, Alabama

\\GALILEO\PROJ\USACE\FT_RUCKER\MAPFILES\FIGURE_4-INFILTRATIONGRENADERANGE-20101205.MXD SSMITH21 12/6/2010 08:09:10

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APPENDIX B

Fragmentation Data Sheets

MGFD by Area	
Anti-Tank/Rocket Grenade Range	3.5 inch M28A2 Rocket
Infiltration/Grenade Range	M31 Rifle Grenade

Fragmentation Data Review Form

Database Revision Date 10/18/2011

Category: Grenades & Mines

DODIC: G970

Munition: M31 Rifle Grenade

Date Record Created: 7/24/2007

Record Created By: MC

Case Material: Steel, Mild

Last Date Record Updated: 9/14/2011

Fragmentation Method: Naturally Fragmenting

Individual Last Updated Record: SDH

Secondary Database Category: Rifle Grenade

Date Record Retired:

Munition Case Classification: Non-Robust

Munition Information and Fragmentation Characteristics

Explosive Type: Composition B

Explosive Weight (lb): 0.62

Diameter (in): 2.6160

Cylindrical Case Weight (lb): 0.27100

Maximum Fragment Weight (Intentional) (lb): 0.0013

Design Fragment Weight (95%) (Unintentional) (lb): 0.0002

Critical Fragment Velocity (fps): 9250

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft): 92

MFD-H [Maximum Fragment Distance, Horizontal] (ft): 500

MFD-V [Maximum Fragment Distance, Vertical] (ft): 409

Overpressure Distances

TNT Equivalent (Pressure): 1.16

TNT Equivalent Weight - Pressure (lbs): 0.719

Unbarricaded Intraline Distance (3.5 psi), K18 Distance: 16

Public Traffic Route Distance (2.3 psi); K24 Distance: 22

Inhabited Building Distance (1.2 psi), K40 Distance: 36

Intentional MSD (0.0655 psi), K328 Distance: 294

Required Sandbag Thickness

TNT Equivalent (Impulse): 1.14

TNT Equivalent Weight - Impulse (lbs): 0.707

Kinetic Energy 10^6 (lb-ft²/s²): 0.0654

Single Sandbag Mitigation

Required Wall & Roof Thickness (in): 20

Expected Max. Throw Distance (ft): 125

Minimum Separation Distance (ft): 200

Double Sandbag Mitigation

Required Wall & Roof Thickness (in): 48

Expected Max. Throw Distance (ft): 10

Minimum Separation Distance (ft): 12.5

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	3.69	1.65
Mild Steel:	0.60	0.28
Hard Steel:	0.50	0.23
Aluminum:	1.35	0.66
LEXAN:	3.81	2.39
Plexi-glass:	2.39	1.28
Bullet Resist Glass:	1.80	0.90

Water Containment System and Minimum Separation Distance:

TNT Equivalent (Impulse): 1.14

TNT Equivalent Weight - Impulse (lbs): 0.707

Kinetic Energy 106 (lb-ft²/s²): 0.0654

Minimum Separation Distance (ft): 264/200

Water Containment System: 5 gal carboys/ inflatable pool

Item Notes

Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (17 October 2002). Other requests shall be referred to the Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building I, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.

Fragmentation Data Review Form

Database Revision Date 10/18/2011

Category:	Grenades & Mines
Munition:	M31 Rifle Grenade
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Rifle Grenade
Munition Case Classification:	Non-Robust

DODIC:	G970
Date Record Created:	7/24/2007
Record Created By:	MC
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Composition B
Explosive Weight (lb):	0.62
Diameter (in):	2.6160
Cylindrical Case Weight (lb):	0.27100
Maximum Fragment Weight (Intentional) (lb):	0.0013
Design Fragment Weight (95%) (Unintentional) (lb):	0.0002
Critical Fragment Velocity (fps):	9250

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	92
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	500
MFD-V [Maximum Fragment Distance, Vertical] (ft):	409

Required Sandbag Thickness

TNT Equivalent (Impulse):	1.14
TNT Equivalent Weight - Impulse (lbs):	0.707
Kinetic Energy 10^6 (lb-ft²/s²):	0.0654

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	20
Expected Max. Throw Distance (ft):	125
Minimum Separation Distance (ft):	200

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	48
Expected Max. Throw Distance (ft):	10
Minimum Separation Distance (ft):	12.5

Overpressure Distances

TNT Equivalent (Pressure):	1.16
TNT Equivalent Weight - Pressure (lbs):	0.719
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	16
Public Traffic Route Distance (2.3 psi); K24 Distance:	22
Inhabited Building Distance (1.2 psi), K40 Distance:	36
Intentional MSD (0.0655 psi), K328 Distance:	294

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	3.69	1.65
Mild Steel:	0.60	0.28
Hard Steel:	0.50	0.23
Aluminum:	1.35	0.66
LEXAN:	3.81	2.39
Plexi-glass:	2.39	1.28
Bullet Resist Glass:	1.80	0.90

Water Containment System and Minimum Separation Distance:

TNT Equivalent (Impulse):	1.14
TNT Equivalent Weight - Impulse (lbs):	0.707
Kinetic Energy 106 (lb-ft²/s²):	0.0654
Minimum Separation Distance (ft):	264/200
Water Containment System:	5 gal carboys/ inflatable pool

Item Notes

Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (17 October 2002). Other requests shall be referred to the Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building I, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.

Fragmentation Data Review Form

Database Revision Date 10/18/2011

Category:	Surface-Launched HE Rounds
Munition:	3.5 in M28A2 Rocket
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Rocket
Munition Case Classification:	Robust

DODIC:	H600
Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Composition B
Explosive Weight (lb):	1.88
Diameter (in):	3.5000
Cylindrical Case Weight (lb):	1.00700
Maximum Fragment Weight (Intentional) (lb):	0.0054
Design Fragment Weight (95%) (Unintentional) (lb):	0.0007
Critical Fragment Velocity (fps):	9261

Required Sandbag Thickness

TNT Equivalent (Impulse):	1.14
TNT Equivalent Weight - Impulse (lbs):	2.143
Kinetic Energy 10^6 (lb-ft²/s²):	0.2307

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	20
Expected Max. Throw Distance (ft):	125
Minimum Separation Distance (ft):	200

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Containment System and Minimum Separation Distance:

TNT Equivalent (Impulse):	1.14
TNT Equivalent Weight - Impulse (lbs):	2.143
Kinetic Energy 106 (lb-ft²/s²):	0.2307
Minimum Separation Distance (ft):	264/200
Water Containment System:	5 gal carboys/ inflatable pool

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	157
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	772
MFD-V [Maximum Fragment Distance, Vertical] (ft):	628

Overpressure Distances

TNT Equivalent (Pressure):	1.16
TNT Equivalent Weight - Pressure (lbs):	2.181
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	23
Public Traffic Route Distance (2.3 psi); K24 Distance:	31
Inhabited Building Distance (1.2 psi), K40 Distance:	52
Intentional MSD (0.0655 psi), K328 Distance:	425

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	5.80	2.43
Mild Steel:	0.96	0.42
Hard Steel:	0.79	0.35
Aluminum:	2.08	0.96
LEXAN:	5.15	3.10
Plexi-glass:	3.56	1.81
Bullet Resist Glass:	2.82	1.33

Item Notes

Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (17 October 2002). Other requests shall be referred to the Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building I, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.

Attachment 3-5
Risk Assessment **P**rotocol

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Attachment 3-5

Risk Assessment Protocol

1.1 Human Health Assessment Approach

This subsection describes the procedures for the Human Health Risk Assessment (HHRA) that will be implemented for the evaluation of the MRS for potential risks to human receptors under current and future land use conditions. The results of these HHRAs will be the basis for developing site management options at each MRS and for screening corrective measures studies (CMSs). If the risks are within EPA (EPA, 1989) acceptable risk criteria, then a no further investigation and action (NFI/NFA) will be recommended for a site. The results of the risk assessment will be used to set site-specific remedial goal options for the medium, based on specific land use.

The risk assessment will follow the EPA, and EPA Region 4 guidance for HHRAs (EPA, 1989 and 2000). The basic methodology and assumptions that will be used in the HHRA are presented below. The site conceptual exposure evaluations are presented in Section 1 of the RFI Work Plan, which also discusses potential migration pathways, exposure media, and the potential receptors.

1.1.1 Site Background and History

The RFI report will include the physical characteristics of each of the MRSs (addressed in Section 1 of this work plan) in an introductory section. The pertinent information addressing the site operational and investigation history; its past, current and possible future uses; and the potential sources of contamination; regional land and water use patterns will be addressed as part of this section.

1.1.2 Source, Nature and Extent, Fate and Transport of Contamination

This subsection discusses the nature and extent of contamination at each of the MRSs. The Conceptual Site Model (CSM) portion will include two subsections–the first subsection includes a comprehensive evaluation of historical operations at each of the sites and surrounding areas. The second subsection will include, on the basis of the site history, the existing analytical data for the environmental media, potential sources, migration pathways, exposure routes, and receptors, as a conceptual site exposure model for each MRS.

This subsection will also examine the contamination migration potential through an environmental contaminant fate and transport evaluation. The factors that influence the fate and transport, including the site’s physical features, source characteristics, and extent of contamination in site media will be combined to form the basis of the contaminant fate and transport evaluation. A screening of site soil will be compared against EPA’s soil screening levels (SSLs) using a dilution attenuation factor (DAF) of 10. The site-specific subsections will describe the results of these comparisons, and provide recommendations for either further investigations or no further investigations, based on weight-of-evidence (WoE) factors that indicate whether the exceedence of an SSL indicates a leachability concern for a site.

1.1.3 Human Health Risk Assessment

The HHRA for the MRSs will document the methods that are followed and the results of the risk evaluation, and interprets how the results compare with EPA's guidance regarding acceptable risks and hazards for these MRS. The methodology that will be used for each risk assessment subsection is detailed below.

The HHRA subsection for each site will be organized as follows:

- Identification of contaminants of potential concern (COPCs)
- Exposure assessment
- Toxicity assessment
- Risk characterization
- Uncertainty assessment
- Summary of HHRA and recommendations

The general approach for each of the HHRA steps will be applied for the sites where initial surface soil or sediment screening indicates exceedance of EPA regional screening levels (RSLs) and soil screening levels (SSLs) (EPA 2009a). If these tables are updated by EPA by the time of RFI report preparation, latest screening level values will be used at that time.

A complete baseline risk assessment to determine potential risks to human receptors from exposure to site media will not be performed.

1.1.3.1 Identification of COPCs

The COPC identification step includes a comprehensive evaluation of the analytical data collected during the nature and extent definition for the MRSs. In addition, any surface water and sediment data available will be screened against RSL values for tap water, and soils, as a conservatively protective screening. If groundwater data are available for site, it will be evaluated for direct exposure. Groundwater data will be evaluated for potable use based screening for COPC selection.

Any data collected using field screening methods, such as XRF will be used to determine a correlation between XRF and offsite lab analysis of the same sample. If the data indicate a reliable and consistent correlation, an extrapolated concentration will be assigned to the XRF samples and these samples will be included in the risk assessment (i.e., lead). The composite samples collected for an area will be used combining with discrete samples to estimate site-wide statistical average concentrations for quantitative risk estimations, including COPC selection and also in the exposure assessment described below.

The data sets that will be used for the HHRA will be identified by the sampling effort and the sampling dates, and will be sorted by medium. Surface soil (0 to 2 foot bgs) and subsurface soil (2 foot to 10 ft bgs) for direct exposure pathways will be screened as separate data set. The COPCs will be selected by comparison to residential RSLs that will be used as the health protective screening levels for surface and subsurface soil as described further below.

Surface water and sediment analytical results will be evaluated from ponds and surface water bodies. Samples collected from the bottom of a ditch that does not contain standing water during most of the year will be treated as surface soil during the risk assessment. Whereas samples collected from underneath standing surface water will be treated as sediments.

Media Screening for COPC Identification: COPC identification is a screening process designed to focus the HHRA on the chemicals that might contribute significantly to overall risks. Only those analytes detected in at least one sample will be evaluated. A chemical will be identified as a COPC if the site's maximum concentration will be above both the background (lead only) and the screening criteria.

The screening criteria for soil are RSL values (EPA, 2009a) derived from standard exposure residential scenarios. The screening levels used for screening are identified below, according to each media:

- *Surface soil and dry ditch lining soils* collected from 0 to 2 feet below surface will be considered surface soil, and the results will be compared to the EPA RSLs, adjusted to an HI of 0.1 for noncarcinogenic chemicals. No adjustment will be made to the carcinogenicity end-point-based RSL values. These samples will also be evaluated against SSLs to assess potential for leaching to subsurface soil and groundwater.
- *Subsurface soil* samples from 2-feet to shallow water table depths will be collected if surface soils indicate there is a potential of contaminant leaching. Subsurface soil sample analytical results compared against the direct exposure-based residential RSL values similar to the criteria used for surface soil screening. The subsurface soil data sets will also be screened against the leachability criteria, SSL with a DAF=10 values (EPA, 2009a).

1.1.3.2 Exposure Assessment

The exposure scenarios evaluated will represent any current or potential future scenarios, because most of the exposure assumptions are based on conservative input factors for the dose estimations. Thus, most, if not all, exposure scenarios represent future hypothetical exposure assumptions, because current exposures are minimal or are not occurring at the site. Presence of a human receptor at a site under current land use will be evaluated using conservative exposure assumptions for exposure quantitation for the receptor. The exposure assumptions will be described, along with a list of the exposure factors selected for intake estimations, the calculated exposure point concentrations (EPCs) for each COPC, and the estimated dose or intake rates for each of the COPCs. A preliminary list of exposure factors is included in Table 1 of this attachement.

Exposure is the contact rate of a receptor with a chemical or physical agent. An exposure assessment estimates the type and magnitude of the potential exposure of a receptor to the COPCs found at or migrating from a site (EPA, 1989). The site-specific subsections presented in Section 1 of this report discuss the physical setting associated with each site.

The future land use based receptors evaluated will be assumed to be uniform for all sites. Most of the exposure scenarios are hypothetical, because future site activities are unknown. Thus, the exposure assumptions are either the available default values or are conservatively selected based on assumed receptor behavior.

The receptors and exposure factors assumed for the MRSs sites are based on EPA and EPA Region 4. Any additional site-specific exposure scenarios identified during RFI preparation will be included at that time.

Default industrial and residential land use scenarios will be evaluated for each of the sites during the HHRA. The exposure factors primarily are based on a reasonable maximum exposure (RME) assumption. The intent of the RME assumption is to estimate the highest exposure level that reasonably could be expected to occur (EPA, 1989; 1991).

The RME assumptions will be developed by EPA to represent an upper-bound estimate for the plausible exposures. In keeping with the EPA guidance (1991), the variables chosen for a baseline RME scenario for the intake rate, exposure frequency (EF), and exposure duration (ED) are generally upper-bounds. Other variables, such as body weight (BW) and exposed skin surface area are generally central tendency, or average values. In the case of contact rates consisting of multiple components–such as dermal contact with soil or water that consists of a dermal absorption factor (ABS) and soil-to-skin adherence factor (AF) for soil, and a permeability coefficient and exposure time for water–only one variable, ABS or permeability coefficient, needs to be an upper-bound. The conservatism built into the individual variables ensures that the entire estimate for the contact rate will be more than sufficiently conservative.

Quantification of Exposure Point Concentrations. The EPCs for the COPCs identified in various environmental media, including surface and subsurface soil, surface water, sediment, and groundwater, will be estimated using EPA's ProUCL tool (EPA, 2009b).

Quantification of Chemical Intake. The intake estimates will be calculated using the equations provided in the EPA *RAGS* guidance (EPA, 2001). The dermal contact and exposure areas will be based on the latest EPA guidance (EPA, 2004a).

1.1.3.3 Toxicity Evaluation

This subsection lists the quantitative cancer and toxicity factors provided by EPA for the site COPCs. Route-to-route extrapolation for the derivation of dermal toxicity values following EPA guidance will be performed.

Sources of Toxicity Information Used in the Risk Assessment. Toxicity values generally will be chosen using the following hierarchy:

- EPA's online Integrated Risk Information System (IRIS) database (EPA, 2010),which contains toxicity values that have undergone the most rigorous Agency review
- EPA's Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
- The latest version of the annual Health Effects Assessment Summary Tables (HEAST) (EPA, 1997)

All toxicity values, regardless of their source, will be evaluated for appropriateness for use in risk assessment. The use of surrogate chemicals also will be considered if the chemical structure, adverse effects, and toxic potency of the surrogate and chemical of interest are judged to be sufficiently similar.

Detailed toxicity profiles will not be provided for chemicals that have toxicity values in the primary databases. A table with all toxicity criteria will be provided as part of the HHRA.

1.1.3.4 Risk Characterization

Risk characterization is a combination of the results of the exposure assessment and toxicity assessment to yield a quantitative expression of risk for the exposed receptors. This quantitative expression is the probability of developing cancer, or a nonprobabilistic comparison of an estimated dose with a reference dose for effects. Quantitative estimates are developed for individual chemicals, exposure pathways, and exposure media for each receptor. The risk characterization will be used to guide risk management decisions.

Generally, the risk characterization follows the methodology prescribed by EPA (1989), as modified by more recent information and guidance. EPA methods are, appropriately, designed to be health-protective and tend to overestimate, rather than to underestimate, risk. The risk results generally are conservative, because risk characterization involves the multiplication of the conservatisms built into the estimation of source-term and EPCs, the exposure (intake) estimates, and the toxicity dose-response assessments.

Up to this point, the term risk has been used generically to mean the potential for the occurrence of adverse effects, either cancer or noncancer, to arise from exposure to chemicals. However, at this point in the discussion, it is helpful to define terms more precisely. Therefore, in this subsection of the document, the term risk will be used to describe the potential for the occurrence of cancer. The potential for the occurrence of effects will be termed hazard. Although some chemicals induce both cancer and effects, the risks or hazards for each endpoint are calculated separately.

1.1.3.5 Lead in Soils

The lead detected in site soils will be evaluated by comparing maximum concentrations against residential protection based screening value of 400 mg/kg. The sites with average lead concentrations above the health protective criteria will be identified as part of the list of COC for a site or an area. Site specific discussions on lead will be included in the respective risk characterization subsections.

1.1.3.6 Cancer Risk

The risk from exposure to potential chemical carcinogens will be estimated as the probability of an individual developing cancer over a lifetime, and is called the excess lifetime cancer risk (ELCR). In the low-dose range, which would be expected for most environmental exposures, cancer risk is estimated by the following linear equation (EPA, 1989):

$$\text{ELCR} = (\text{chronic daily intake [CDI]})\ (\text{SF})$$

where:

ELCR = excess lifetime cancer risk, a unitless expression of the probability of developing cancer, adjusted for background incidence, calculated
CDI = chronic daily intake, averaged over 70 years (mg/kg-day)
SF = cancer slope factor $(\text{mg/kg-day})^{-1}$

If the resulting risk is greater than 1E-2, an alternative equation recommended by EPA is used (EPA, 1989):

$$\text{ELCR} = 1 - e^{[(\text{CDI})(\text{SF})]}$$

where:

ELCR = excess lifetime cancer risk, a unitless expression of the probability of developing cancer, adjusted for background incidence, calculated

$-e^{(CDI)SF)}$= the exponential of the negative of the risk

Risks from different chemicals and media to the same receptor are added to estimate the total ELCR.

1.1.3.7 Non-Cancer Effects of Chemicals

The hazards associated with the noncarcinogenic effects of chemicals are evaluated by comparing an exposure level or intake with an RfD. The HQ, defined as the ratio of intake to RfD, is estimated as (EPA, 1989):

$$HQ = I / RfD$$

where:

HQ = hazard quotient (unitless, calculated)
I = intake of chemical averaged over subchronic or chronic exposure period (mg/kg-day)
RfD = reference dose (mg/kg-day)

Chemical hazards generally are evaluated using chronic RfD values. This approach is different than the probabilistic approach used to evaluate cancer risks. An HQ of unity indicates that the estimated intake equals the RfD. If the HQ is greater than unity, there may be a concern regarding potential adverse health effects.

$$HI = I_1 / RfD_1 + I_2 / RfD_2 + \ldots I_i / RfD_i$$

An HI can be estimated for exposure to a given chemical in a given source medium when multiple pathways are involved by summing the pathway-specific HQs, as follows:

$$HI_{(chem)} = HQ_{(pathway\ 1)} + HQ_{(pathway\ 2)} + \ldots HQ_{(pathway\ i)}$$

where:

$HI_{(chem)}$ = total hazard index for a given chemical in a given source medium across pathways (unitless, calculated)
$HQ_{(pathway\ i)}$ = hazard quotient for a given chemical in a given source medium for pathway i

The total HI for a given receptor across chemicals and across media is summed in the same manner. Calculating a total HI as the sum of the HQ values is based on the assumption that the potential for effects is additive. EPA (1989), however, acknowledges that the assumption of additivity probably is appropriate only for chemicals that include adverse effects by the same mechanism. Therefore, if the total HI for a receptor exceeds l.0, the HI values for each target organ are estimated.

The cumulative risks and HIs are then compared against the acceptable risk ranges and target HI value. For the purposes of regulatory decision-making, EPA recommends an acceptable risk range of 1E-4 to 1E-6 (1 to 100 in a million). The SCDHEC recommends an acceptable risk value of 1E-6 as point of departure risk and an HI of 1 or less (same as EPA) for risk management decisions. Typically, results falling within or below these acceptable risk criteria are considered a reasonable basis for NFA. An HI value above 1 will be further evaluated if any individual target organ HIs exceeds a value of 1. Typically, unless the cumulative HI to a target organ exceeds an HI of 1, it is not considered an exceedance. Inorganic chemicals common to background soils will be thoroughly evaluated before considering such a COPC as a final chemical of concern (COC) for CMS recommendation. A site-specific remedial goal options (RGOs) will be prepared for COCs at each site and for each medium that indicate risks above acceptable limits. The conservative nature of the analysis and the uncertainty inherent in the risk assessment will be considered when interpreting the results.

1.1.3.8 Uncertainty Analysis

This subsection briefly introduces an evaluation of the uncertainties inherent in the risk assessment process. Uncertainty is a factor in each step of the exposure and toxicity assessments presented in the preceding subsections. Uncertainties associated with earlier stages of the process become magnified when they are linked together with other uncertainties in the latter stages of the process. Such uncertainty includes the variations in sample analytical results, the values of variables used as inputs to a given model, the accuracy with which the model itself represents the actual environmental processes, the manner in which the exposure scenarios are developed, and the high-to-low dose and interspecies extrapolations for dose-response relationships.

The results of the risk assessment reflect the accumulated variances of the individual measured values used to develop it. A different kind of uncertainty stems from data gaps; when additional information is needed to complete the database for the assessment. Often, the data gap is significant, such as the absence of information regarding the effects of human exposure to a chemical or the biological mechanism of action of an agent (EPA, 2008; EPA, 1997).

The uncertainty analysis will be limited to a qualitative discussion of the sources of uncertainty and their effects on the risk and hazard estimates.

1.2 Ecological Risk Assessment Approach and Methodologies

This subsection describes the procedures that will be implemented to assess ecological risks at the MRSs. If the results of the assessment indicate no significant risk to populations of ecological receptors, no further action will be recommended. If the results indicate the potential for significant risk, further study or consideration of corrective action will be recommended.

The ERA for each site will prepared in accordance with the following guidance:

- Ecological Risk Assessment Guidance for Superfund (RAGS): Process for Designing and Conducting Ecological Risk Assessments (EPA, 1997b)
- Region 4 Ecological Risk Assessment Bulletins – Supplement to RAGS (EPA, 2001).

The ERA will address three steps of the EPA 8-step ERA process. The screening-level assessment will address Step 1 (screening-level problem formulation and effects evaluation) and Step 2 (screening-level exposure estimate and risk calculation). If needed, the assessments will continue to the baseline ERA, with preparation of Step 3 (problem formulation). Each of these steps are addressed in this section.

1.2.1 Step 1 – Screening-Level Problem Formulation and Effects Evaluation

The development of the problem formulation involves preparing summaries of the following components: environmental setting and contaminants at the site, contaminant fate and transport, ecotoxicity and potential receptors, and complete exposure pathways. Together, these components form the screening-level problem formulation.

The screening value set for soil will be developed using EPA Region 4 Ecological Screening Values (EPA, 2001) and EPA Ecological Soil Screening Levels (EcoSSL) (EPA, 2009c). The screening value set for surface water will be the lowest available freshwater screening values from the Region 4 ESV set and the EPA National Recommended Water Quality Criteria set (NRWQC; EPA, 2009d). For sediment, EPA Region 4 values will be used.

1.2.2 Step 2 – Screening-Level Exposure Estimate and Risk Calculation

For the screening-level assessment, the exposure concentration will be the maximum concentration detected at each MRS. For each medium, maximum concentrations will be compared to ESVs. If the site concentration is greater than the screening value, the result is a hazard quotient (HQ) over 1 and there is a potential for a risk. Constituents with HQs over 1 and constituents with no ESV will be carried to Step 3.

1.2.3 Step 3 – Baseline Problem Formulation

The first part of Step 3 is refinement of the list of constituents carried to the baseline ERA. This will involve consideration of background, supplemental ecological benchmarks, frequency of detection, average exposure concentration, and the potential for risk via the food chain. For bioaccumulative constituents, food chain modeling will be conducted for a representative set of wildlife receptors. Receptors will be selected after the site visit is conducted. HQs will be calculated; estimated exposure will be divided by a toxicity reference value (TRV) obtained from the literature. No and lowest observed effects levels will be selected as TRVs so that a range of risk can be calculated.

The weight of evidence will be used to characterize risks and determine an assessment outcome. Possible outcomes are as follows:

- There is no significant risk
- There is significant risk that warrants consideration of corrective action
- There is not enough information.

If there are no significant risks, no further action will be recommended. If there is a risk that warrants consideration of corrective action, the risk will be defined spatially, to the extent possible, and risk thresholds will be developed. In some cases, additional information is required to define nature and extent at a finer level or refine risk estimates using site specific information (e.g., toxicity tests or tissue analyses). If collection of additional information is recommended, a revised problem formulation will be prepared which will define the issues that require consideration as the process moves forward. With each outcome, the ERA will also include a description of the assessment uncertainties.

1.3 REFERENCES:

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U.S. Environmental Protection Agency. 1997a. *Health Effects Assessment Summary Tables* (HEAST).

U.S. Environmental Protection Agency. 1997b. *Ecological Risk Assessment Guidance for Superfund (RAGS): Process for Designing and Conducting Ecological Risk Assessments.*

U.S. Environmental Protection Agency. 1991. *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors.* Interim Final, Office of Solid Will bete and Emergency Response, Office of Solid Will bete and Emergency Response (OWSWER) Directive: 9285.6-03.

U.S. Environmental Protection Agency. 1989. *EPA Risk Assessment Guidance for Superfund (RAGS): Volume 1. Human Health Evaluation Manual, Part A.* Office of Emergency and Remedial Response. EPA/540/1-89/002.

TABLE 1
Proposed Exposure Factors
Fort Rucker, Alabama

Pathway Variable	Units	Construction Worker	Trespasser	Adult Resident	Child Resident	Commercial Worker	Groundskeeper	Sportsman
General Parameters Used in All Intake Models								
Exposure frequency - except game consumption (EF)	days/year	250 [b]	52 [c]	350 [b]	350 [d]	250 [b]	225 [a]	52 [c]
Exposure duration (ED)	years	1 [c]	10 [d]	24 [b]	6 [d]	25 [b]	25 [b]	30 [b]
Body weight (BW)	kilograms	70 [b]	45 [d]	70 [b]	15 [d]	70 [b]	70 [b]	70 [b]
Averaging time - noncancer (ATn) [e]	days	365	3,650	8760	2,190	9,125	9,125	10,950
Averaging time - cancer (ATc) [f]	days	25,550	25,550	25,550	25,550	25,550	25,550	25,550
Inhalation of VOCs and Resuspended Dust from Soil								
Outdoor inhalation rate (IR_o)	m^3/hour	2.5 [b]	1.6 [g,j]	0.83 [d]	0.63 [d]	2.5 [b]	2.5 [b]	2.1 [g]
Exposure time for outdoor inhalation (ET_o)	hours/day	8 [b]	4 [c,j]	24 [c]	24 [c]	8 [b]	8 [b]	8 [c]
Fraction exposed to contaminated medium (FI_o)	unitless	1 [c]	1 [c]	1 [c]	1 [c]	1 [c]	1 [c]	1 [c]
Indoor Inhalation								
Indoor inhalation rate (IR_i)	m^3/hour	NA	NA	0.83 [d]	0.63 [d]	2.5 [b]	NA	NA
Exposure time for indoor inhalation (ET_i)	hours/day	NA	NA	24 [c]	24 [c]	8 [b]	NA	NA
Incidental Ingestion of Soil								
Incidental ingestion rate (IR_s)	mg/day	330 [a]	100 [b]	100 [b]	200 [d]	100 [b]	100 [b]	100 [b]
Fraction exposed to contaminated medium (FI_s)	unitless	1 [c]	0.38 or 0.25 [c]	1 [c]	1 [c]	1 [c]	1 [c]	0.5 or 0.25 [c]
Dermal Contact with Soil								
Body surface area exposed (SA)	cm^2	3,300 [a]	3,700 [c,h]	5,700 [h]	2,800 [h]	3,300 [h]	3,300 [a]	5,000 [c,h]
Soil-to-skin adherence factor (AF)	mg/cm^2	0.3 [g,j]	0.2 [a]	0.07 [h]	0.2 [h]	0.2 [h]	0.2 [a,h]	0.2 [h]
Dermal absorption factor (ABS)	unitless	csv	csv	csv	csv	csv	csv	csv
Event frequency (EV)	events/day	1 [c]	1 [c]	1 [c]	1 [c]	1 [c]	1 [c]	1 [c]
Fraction exposed to contaminated medium (FI)	unitless	1 [c]	0.38 or 0.25 [c]	1 [c]	1 [c]	1 [c]	1 [c]	0.5 or 0.25 [c]
Incidental Ingestion of Sediment								
Incidental ingestion rate (IR_s)	mg/day	NA	100 [b]	NA	NA	NA	NA	100 [b]
Fraction exposed to contaminated medium (FI_s)	unitless	NA	0.125 [c]	NA	NA	NA	NA	0.25 [c]
Dermal Contact with Sediment								
Body surface area exposed (SA)	cm^2	NA	3,700 [c,h]	NA	NA	NA	NA	5,000 [h]
Soil-to-skin adherence factor (AF)	mg/cm^2	NA	0.2 [h]	NA	NA	NA	NA	0.2 [h]
Dermal absorption factor (ABS)	unitless	NA	csv	NA	NA	NA	NA	csv
Event frequency (EV)	events/day	NA	1 [c]	NA	NA	NA	NA	1 [c]
Fraction exposed to contaminated medium (FI)	unitless	NA	0.125 [c]	NA	NA	NA	NA	0.25 [c]
Dermal Contact with Surface Water								
Body surface area exposed (SA)	cm^2	NA	4,000 [h]	NA	NA	NA	NA	4,100 [h]
Permeability coefficient (K_p)	cm/hour	NA	csv	NA	NA	NA	NA	csv
Exposure time (ET_w)	hour/day	NA	2 [c]	NA	NA	NA	NA	4 [c]
Event frequency (EV)	events/day	NA	1 [c]	NA	NA	NA	NA	1 [c]
Fraction exposed to contaminated medium (FI)	unitless	NA	1 [c]	NA	NA	NA	NA	1 [c]

TABLE 1
Proposed Exposure Factors
Fort Rucker, Alabama

Pathway Variable	Units	Construction Worker	Trespasser	Adult Resident	Child Resident	Commercial Worker	Groundskeeper	Sportsman
Drinking Water Ingestion of Potable Groundwater								
Drinking water ingestion rate (IR_w)	L/day	2 [a]	NA	2 [b]	1 [d]	1 [b]	1 [b]	NA
Fraction exposed to contaminated medium (FI_w)	unitless	1 [c]	NA	1 [c]	1 [c]	1 [c]	NA	NA
Dermal Contact with Potable Groundwater								
Body surface area exposed (SA)	cm^2	4,100 [c,h]	NA	18,000 [h]	6,600 [h]	4,100 [h]	4,100 [c,h]	NA
Permeability coefficient (K_p)	cm/hour	csv	NA	csv	csv	csv	csv	NA
Exposure time (ET_w)	hour/day	1 [c]	NA	0.58 [n]	1 [n]	NA	1 [c]	NA
Event frequency (EV)	events/day	1 [c]	NA	1 [c]	1 [c]	1 [c]	1 [c]	NA
Fraction exposed to contaminated medium (FI)	unitless	1 [c]	NA	1 [c]	1 [c]	1 [c]	1 [c]	NA

Notes:
Notes:
Not all pathways and exposure factors are applicable all sites, site-specific scenarios will be developed during RFI

[a] EPA, 2002, *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*, Office of Solid Waste and Emergency Response, OSWER 9355.4-24. December.

[b] EPA, 1991, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors,* Interim Final, Office of Solid Waste and Emergency Response, OSWER Directive : 9285.6-03.

[c] Assumed; professional judgment

[d] EPA, 2000, *Region 4 Human Health Risk Assessment Bulletins - Supplement to RAGS, Interim*, Waste Management Division, Atlanta, GA, on line.

[e] Calculated as the product of ED (years) x 365 days/year.

[f] Calculated as the product of 70 years (assumed human lifetime [EPA, 1989, Risk Assessment Guidance for Super-fund, Volume I, Human Health Evaluation Manual (Part A), Interim Final, Office of Emergency and Remedial Response, Washington, DC., EPA/540/1-89/002.]) x 365 days/year.

[g] EPA, 1997, *Exposure Factors Handbook*, Office of Health and Environmental Assessment, Washington, DC, EPA/600/P-95/002F.

[h] EPA, 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final,* Office of Emergency and Remedial Response, Washington, DC, EPA/540/R/99/005. July.

[l] ABS is 0.01 for organics and 0.001 for inorganics.

NA = Not available or not applicable
cm/hour = centimeter per hour
cm^2 = square centimeter
csv = chemical-specific value
L/day = liter per day
kg/day = kilogram per day
m^3/hour = cubic meters per hour
mg/cm^2 = milligram per square centimeter
mg/day = milligram per day

Attachment 5-1
ERRG Explosives Authorization Letter and Endorsed Copy of ATF&E License

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

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

In accordance with the provisions of Title XI, Organized Crime Control Act of 1970, and the regulations issued thereunder (27 CFR Part 555)you may engage in the activity specified in this license/permit within the limitations of Chapter 40, Title 18, United States Code and the regulations issued thereunder, until the expiration date shown. See "WARNING" and "NOTICES" on back.

DIRECT ATF CORRESPONDENCE TO

Christopher R. Reeves
Chief, Federal Explosives Licensing Center (FELC)
Bureau of Alcohol, Tobacco, Firearms and Explosives
244 Needy Road
Martinsburg, West Virginia 25405
Telephone: 1-877-283-3352 Fax: 1-304-616-4401

LICENSE/PERMIT NUMBER **9-CA-013-33-3J-01233**

EXPIRATION DATE **September 1, 2013**

NAME
ENGINEERING REMEDIATION RESOURCES GROUP, INC

Premises Address CHANGES? You must notify the FELC at least 10 days before the mov
4585 PACHECO BLVD, SUITE 200
MARTINEZ, CA 94553-

TYPE OF LICENSE OR PERMIT
33-USER OF HIGH EXPLOSIVES

CHIEF, FEDERAL EXPLOSIVES LICENSING CENTER (FELC) Christopher R. Reeves
Christopher R. Reeves

PURCHASING CERTIFICATION

I certify that this is a true copy of a license/permit issued to me to engage in the activity specified.

(SIGNATURE OF LICENSEE/PERMITTEE)

The licensee/permittee named herein shall use a reproduction of this license/permit to assist a transferor of explosives to verify the identity and status of the licensee/permittee as provided in 27 CFR Part 555. The signature on each reproduction must be an ORIGINAL signature.

Mailing Address CHANGES? You must notify the FELC at least 10 days before the change

ENGINEERING REMEDIATION RESOURCES GROUP, INC
4585 PACHECO BLVD, SUITE 200
MARTINEZ, CA 94553-

ATF F 5400.14/5400.15, Part 1 (8/89)

U.S. Department of Justice
Bureau of Alcohol, Tobacco, Firearms and Explosives
Federal Explosives Licensing Center (FELC)
www.atf.gov

Federal Explosives Licensing Center
244 Needy Road
Martinsburg, West Virginia 25405
telephone: (877)283-3352 fax: (304)616-4401

08/23/2010

NOTICE OF CLEARANCE

RECD AUG 27 2010

for individuals transporting, shipping, receiving, or possessing explosive materials.

ISSUED TO: ENGINEERING REMEDIATION RESOURCES GROUP, INC
NOTICE DATE: 08/23/2010

Federal Explosives license/permit no.: 9-CA-013-33-3J-01233
Expiration Date: September 1, 2013
Explosives License/Permit Type: 33-USER OF HIGH EXPLOSIVES

EXPIRATION DATE: This Notice expires when superseded by a newer Notice which will list all current responsible persons and employee possessors, or when the license or permit expires - whichever comes first.

❶ WARNING. Only those individuals listed below as RESPONSIBLE PERSONS and EMPLOYEE POSSESSORS with a background clearance status of "CLEARED" or "PENDING" are authorized to transport, ship, receive, or possess explosive materials in the course of employment with you.

❷ "DENIED" STATUS. If an employee possessor has a background clearance status of "DENIED", you MUST take immediate steps to remove the employee from a position requiring the transporting, shipping, receiving, or possessing of explosive materials. Also, if the employee has been listed as a person authorized to accept delivery of explosive materials, you MUST remove the employee from such list and immediately, and in no event later than the second business day after such change, notify distributors of such change, as stated in 27 CFR 555.33(a).

❸ CHANGE IN RESPONSIBLE PERSONS. You MUST report any change in responsible persons to the Chief, Federal Explosives Licensing Center, within 30 days of the change and new responsible persons MUST include "appropriate identifying information" as defined in 27 CFR 555.11. Fingerprints and photos are NOT required, however they will be required upon renewal of the license or permit.

❹ CHANGE OF EMPLOYEES. You MUST report any change of employee/possessors to the Chief, FELC, within 30 days. Reports relating to newly hired employees must be submitted on ATF Form 5400.28 for EACH employee.

Premises Address: 4585 PACHECO BLVD, SUITE 200
MARTINEZ, CA 94553

Mailing Address:
ENGINEERING REMEDIATION RESOURCES GROUP, INC
4585 PACHECO BLVD, SUITE 200
MARTINEZ, CA 94553

This 'Notice of Clearance' is provided to you as required by 18 U.S.C. 843(h) and MUST be retained as part of your permanent records and be made available for examination or inspection by ATF officers as required by 27 CFR 555.121. If you receive a Notice subsequent to this Notice, this Notice will no longer be valid.

In accordance with 27 CFR 555.33, Background Checks and Clearances, and 27 CFR 555.57, Change of Control, Change in Responsible Persons, and Change of Employees, ATF's Federal Explosives Licensing Center (FELC) has conducted background checks on the individual(s) you identified as a responsible person(s) and an employee/possessor(s) on your application, or reported after the issuance of your license/permit.

The following is a SUMMARY of the results of the background checks conducted on the individuals you reported as responsible persons and employee/possessors. ATF will be notifying ALL individuals listed on this document of their respective status by separate letter mailed to their residence address.

PLEASE BE ADVISED THAT IT IS UNLAWFUL FOR ANY PERSON REFLECTING A STATUS OF "DENIED" TO TRANSPORT, SHIP, RECEIVE, OR POSSESS EXPLOSIVE MATERIALS.

Please carefully review this Notice to ensure that all the information is accurate. If this Notice is incorrect, please return the Notice to the Chief, FELC, with a statement showing the nature of the error(s). The Chief, FELC, shall correct the error, and return a corrected Notice.

Number of RESPONSIBLE PERSON(S) : 2
Number of EMPLOYEE POSSESSOR(S): 4

LAST NAME, First Name, Middle Name	Clearance Status
RESPONSIBLE PERSONS:	2
0001 COTA, FRANCISO MODESTO	Cleared
0002 RANDALL, RANDY ROY	Cleared
EMPLOYEE POSSESSORS:	4
0001 BIRD, JOE LLOYD	Cleared
0002 FIERRO, LUIS ENRIQUE	Cleared
0003 PENA, GERMAN GERMAN	Cleared

continued

LAST NAME, First Name, Middle Name	Clearance Status
0004 WILLIAMS, DAVID ORLIN	Cleared

9-CA-013-33-3J-01233 expiration date: September 1, 2013 ENGINEERING REMEDIATION RESOURCES GROUP, INC OF , 4585 PACHECO BLVD, SUITE 200, MARTINEZ, CA 94553

Bureau of Alcohol, Tobacco, Firearms and Explosives
Federal Explosives Licensing Center (FELC)
www.atf.gov

Federal Explosives Licensing Center
244 Needy Road
Martinsburg, West Virginia 25405
telephone: (877)283-3352 fax: (304)616-4401

08/24/2010

NOTICE OF CLEARANCE

RECD AUG 27 2010

for individuals transporting, shipping, receiving, or possessing explosive materials.

ISSUED TO: ENGINEERING REMEDIATION RESOURCES GROUP, INC

NOTICE DATE: 08/24/2010

Federal Explosives license/permit no.: 9-CA-013-33-3J-01233
Expiration Date: September 1, 2013
Explosives License/Permit Type: 33-USER OF HIGH EXPLOSIVES

EXPIRATION DATE: This Notice expires when superseded by a newer Notice which will list all current responsible persons and employee possessors, or when the license or permit expires - whichever comes first.

❶ WARNING. Only those individuals listed below as RESPONSIBLE PERSONS and EMPLOYEE POSSESSORS with a background clearance status of "CLEARED" or "PENDING" are authorized to transport, ship, receive, or possess explosive materials in the course of employment with you.

❷ "DENIED" STATUS. If an employee possessor has a background clearance status of "DENIED", you MUST take immediate steps to remove the employee from a position requiring the transporting, shipping, receiving, or possessing of explosive materials. Also, if the employee has been listed as a person authorized to accept delivery of explosive materials, you MUST remove the employee from such list and immediately, and in no event later than the second business day after such change, notify distributors of such change, as stated in 27 CFR 555.33(a).

❸ CHANGE IN RESPONSIBLE PERSONS. You MUST report any change in responsible persons to the Chief, Federal Explosives Licensing Center, within 30 days of the change and new responsible persons MUST include "appropriate identifying information" as defined in 27 CFR 555.11. Fingerprints and photos are NOT required, however they will be required upon renewal of the license or permit.

❹ CHANGE OF EMPLOYEES. You MUST report any change of employee/possessors to the Chief, FELC, within 30 days. Reports relating to newly hired employees must be submitted on ATF Form 5400.28 for EACH employee.

Premises Address: 4585 PACHECO BLVD, SUITE 200
MARTINEZ, CA 94553

Mailing Address:

ENGINEERING REMEDIATION RESOURCES GROUP, INC
4585 PACHECO BLVD, SUITE 200
MARTINEZ, CA 94553

This 'Notice of Clearance' is provided to you as required by 18 U.S.C. 843(h) and MUST be retained as part of your permanent records and be made available for examination or inspection by ATF officers as required by 27 CFR 555.121. If you receive a Notice subsequent to this Notice, this Notice will no longer be valid.

In accordance with 27 CFR 555.33, Background Checks and Clearances, and 27 CFR 555.57, Change of Control, Change in Responsible Persons, and Change of Employees, ATF's Federal Explosives Licensing Center (FELC) has conducted background checks on the individual(s) you identified as a responsible person(s) and an employee/possessor(s) on your application, or reported after the issuance of your license/permit.

The following is a SUMMARY of the results of the background checks conducted on the individuals you reported as responsible persons and employee/possessors. ATF will be notifying ALL individuals listed on this document of their respective status by separate letter mailed to their residence address.

PLEASE BE ADVISED THAT IT IS UNLAWFUL FOR ANY PERSON REFLECTING A STATUS OF "DENIED" TO TRANSPORT, SHIP, RECEIVE, OR POSSESS EXPLOSIVE MATERIALS.

Please carefully review this Notice to ensure that all the information is accurate. If this Notice is incorrect, please return the Notice to the Chief, FELC, with a statement showing the nature of the error(s). The Chief, FELC, shall correct the error, and return a corrected Notice.

Number of RESPONSIBLE PERSON(S) : 2
Number of EMPLOYEE POSSESSOR(S): 4

LAST NAME, First Name, Middle Name	Clearance Status
RESPONSIBLE PERSONS:	2
0001 COTA, FRANCISCO MODESTO	Cleared
0002 RANDALL, RANDY ROY	Cleared
EMPLOYEE POSSESSORS:	4
0001 BIRD, JOE LLOYD	Cleared
0002 FIERRO, LUIS ENRIQUE	Cleared
0003 PENA, GERMAN GERMAN	Cleared

continued

LAST NAME, First Name, Middle Name	Clearance Status
0004 WILLIAMS, DAVID ORLIN	Cleared

9-CA-013-33-3J-01233 expiration date: September 1, 2013 ENGINEERING REMEDIATION RESOURCES GROUP, INC OF , 4585 PACHECO BLVD, SUITE 200, MARTINEZ, CA 94553

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Attachment 5-2
Procurement/Purchase Request Form

To be provided in final document.

Attachment 5-3
Operational Procedures and Guidelines for Demolition

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MEC Disposal Operations

Procedure No: UXO-008
Revision No: 0
Date of Revision: 12/10/2009
Review Date: 00/00/00

1. PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide the minimum procedures and safety and health requirements applicable to the conduct of demolition/disposal operations on sites contaminated with munitions and explosives of concern (MEC).

2. SCOPE

This SOP applies to all site personnel, including contractor and subcontractor personnel, involved in the conduct of MEC demolition/disposal operations on a UXO contaminated site. This SOP is not intended to contain all of the requirements needed to ensure complete compliance, and should be used in conjunction with project plans and applicable federal, state and local regulations. This SOP is generic in form and will address all demolition/disposal procedures. For site specific details refer to site specific Work Plan and Explosives Safety Submission (ESS).

3. REGULATORY REFERENCES

Applicable sections and paragraphs in the documents listed below will be used as references for the conduct of UXO demolition/disposal operations:

- OSHA General Industry Standards, 29 CFR 1910
- OSHA Construction Standards, 29 CFR 1926
- USACE Safety Concepts and Basic Considerations for Unexploded Ordnance
- USACE EM 385-1-1, Safety and Health Requirements Manual
- USACE EP 385-1-95a, Basic Concepts and Considerations for Munitions and Explosives of Concern (MEC) Response Action Operations
- DoD 4145.26-M, Contractor's Safety Manual for Ammunition and Explosives
- DoD 4160.21-M, Defense Reutilization and Marketing Manual
- DoD 6055.9-STD, DoD Ammunition and Explosives Safety Standards
- AR 385-64, Ammunition and Explosive Safety
- AR 385-10, Army Safety Program
- DA PAM 385-64, Ammunition and Explosives Safety Standards
- TM 9-1300-206, Ammunition and Explosive Standards
- TM 9-1300-200, Ammunition General

- TM 9-1300-214, Military Explosives
- TM 60A-1-1-31, EOD Disposal Procedures
- AR 190-11, Physical Security of Arms, Ammunition and Explosives
- ATF 5400.7, Alcohol Tobacco and Firearms Explosives Laws and Regulations
- Applicable sections of DOT, 49 CFR Parts 100 to 199

4. RESPONSIBILITIES

4.1. PROJECT MANAGER

The Project Manager (PM) shall be responsible for ensuring the availability of the resources needed to implement this SOP, and shall also ensure that this SOP is incorporated in plans, procedures and training for sites where this SOP is to be implemented.

4.2. SENIOR UXO SUPERVISOR

The Senior UXO Supervisor (SUXOS) will be responsible for ensuring adequate safety measures and housekeeping are taken during all phases of site operations, to include demolition activities, and shall visit site demolition locations as deemed necessary to ensure that demolition operations are carried out in a safe, clean, efficient and economical manner.

4.3. DEMOLITION SUPERVISOR

Prior to initiation of demolition operations, the SUXOS shall designate an experienced and trained UXO Supervisor to act as the Demolition Supervisor (DS). The demolition activities shall then be conducted under the direct control of the DS, who will have the responsibility of supervising all demolition operations within the area. The DS shall be responsible for training all on-site UXO personnel regarding the nature of the materials handled, the hazards involved and the precautions necessary. The DS will also ensure that the Daily Operational Log, Ordnance Accountability Log, Demolition Records and inventory records are properly filled and accurately depict the demolition events and demolition material consumption for each day's operations. The DS shall be present during all demolition operations or designate a competent, qualified person to be in charge during any absences.

4.4. UXO SAFETY OFFICER

The UXO Safety Officer (UXOSO) for the site is responsible for ensuring that all demolition operations are being conducted in a safe and healthful manner, and is required to be present during all MEC demolition operations. The only exception to this rule is when the project site has multiple sites conducting various types of UXO investigation and remediation operations being conducted concurrently with periods where there may be continuous demolition operations throughout the day. In that event a demolition team UXOSO will be designated. This individual will report to the UXOSO and assume the UXOSO's responsibilities at the demolition range. In this situation, the UXOSO will conduct periodic safety audits of the demolition team and assist the demolition team UXOSO in the performance of his duties.

4.5. UXO QUALITY CONTROL SPECIALIST

The UXO Quality Control Specialist (UXOQC) is responsible for ensuring the completeness of demolition operations and for weekly inspection of the Ordnance Accountability Log, the Daily Operational Log, the ERRG Demolition Shot Record and the inventory of MEC and demolition material. The UXOQC, assisted by demolition team personnel, will inspect each demolition pit and an area of up to 250 feet in radius after each demolition shot to ensure there are no kick-outs, hazardous MEC components or other hazardous items. In addition, the pit will be checked with a magnetometer and large metal fragments four inches or greater and any hazardous debris will be removed on a per use basis. Any MEC discovered during the QC check will be properly stored for destruction at a later date. Extreme caution must be exercised when handling MEC which has been exposed to the forces of detonation.

5. GENERAL OPERATIONAL AND SAFETY PROCEDURES

All personnel, including contractor and subcontractor personnel, involved in operations on MEC contaminated sites shall be familiar with the potential safety and health hazards associated with the conduct of demolition/disposal operations, and with the work practices and control techniques used to reduce or eliminate these hazards. During demolition operations, general safety provisions listed below shall be followed by all demolition personnel, at all times. Non-compliance with the general safety provisions listed may result in disciplinary actions, to include termination of employment:

- All safety regulations applicable to demolition range activities and demolition and MEC materials involved shall be complied with.
- Demolition of any kind is prohibited without the express permission from the client
- The use of sandbags for mitigation of fragmentation and blast effects due to intentional detonation of munitions will be required for all demolition shots conducted in accordance with (IAW) HNC-ED-CS-98-7. The quantity of MEC to be destroyed will be kept to a minimum to reduce noise travel into residential areas.
- In the event of an electrical storm, or heavy snow or dust storms, immediate action will be taken to cease all demolition range operations and evacuate the area.
- In the event of a fire or unplanned explosion, if possible, put out the fire, if unable to do so, notify the fire department and evacuate the area. If injuries are involved, remove victims from danger, administer first aid and seek medical attention.
- The DS is responsible for reporting all injuries and accidents which occur to the UXOSO.
- Employees will not tamper with any safety devices or protective equipment

- Any defect or unusual condition noted that is not covered by this attachment will be reported immediately to the DS or UXOSO.
- Methods of demolition shall be conducted IAW this procedure and approved changes thereto.
- Fire prevention procedures for disposal operations contained in para. 5.1 will be enforced during all demolition operations.
- Adequate first aid equipment shall be provided at all times
- All personnel engaged in the destruction of MEC shall wear under and outer garments made of natural fiber, close-weave clothes, such as cotton. Synthetic material such as nylon is not authorized unless treated with anti-static material.
- Care will be taken to minimize exposure to the smallest number of personnel, for the shortest time, to the least amount of hazard, consistent with safe and efficient operations.
- Work locations will be maintained in a neat and orderly condition
- All hand tools shall be maintained in a good state of repair
- Each heavy equipment and/or vehicle operator will have in his possession a valid operator's permit, i.e., state driver's license.
- Equipment and other lifting devices designed and used for lifting will have the load rating and date of next inspection marked on them. The load rating will not be exceeded and the equipment will not be used without a current inspection date.
- Leather or leather-palmed gloves will be worn when handling wooden boxes, or MEC
- Lifting and carrying require care. Improper methods cause unnecessary strains observe the following precautions before attempting to lift or carry:
  - When lifting, keep your arms and back as straight as possible, bend your knees and lift with your leg muscles; and
  - Be sure you have good footing and hold, and lift with a smooth, even motion
- The demolition range shall be provided with telephone and/or radio communication
- Motor vehicles and material handling equipment (MHE) used for transporting MEC or demolition materials must meet the following requirements:
  - Exhaust systems shall be kept in good mechanical repair at all times
  - Lighting systems shall be an integral part of the vehicle
  - One Class ABC rated, portable fire extinguisher shall, if possible, be mounted on the vehicle outside of the cab, on the driver's side, and one Class ABC fire extinguisher shall be mounted inside the cab.
  - Wheels of carriers must be chocked and brakes set during loading and unloading.
  - No demolition material or MEC shall be loaded into or unloaded from, motor vehicles while their motors are running.
- Motor vehicles and MHE used to transport demolition material and MEC shall be inspected prior to use to determine that:

  - Fire extinguishers are filled and in good working order
  - Electrical wiring is in good condition and properly attached
  - Fuel tank and piping are secure and not leaking
  - Brakes, steering and safety equipment are in good condition
  - The exhaust system is not exposed to accumulations of grease, oil, gasoline, or other fuels, and has ample clearance from fuel lines and other combustible materials.

- Employees are required to wear leather or rubber gloves when handling demolition materials. The type of glove worn is dependent on the type of demolition material.
- An observer will be stationed at a location where there is a good view of the air and surface approaches to the demolition range before material is detonated. It shall be the responsibility of the observer to order the DS to suspend firing if any aircraft, vehicles or personnel are sighted approaching the general demolition area.
- Two-way radios shall not be operated at the disposal site while the pit is primed or during the priming process. The charts shown in Tables 1 and 2 shall be used for determining the safe distances from transmitter antennas.
- No Demolition operation will be left unattended during the active portion of the operation (i.e., during the burn or once any explosives or MEC are brought to the range).
- No demolition activities will be conducted if there is less than a 2,000 foot ceiling or if wind velocity is in excess of 10 mph.
- Demolition shots must be fired during daylight hours (i.e., between 30 minutes after sunrise and 30 minutes before sunset).
- No more than two persons shall ride in a truck transporting demolition material or MEC, and no person shall be allowed to ride in the trailer/bed.
- Vehicles shall not be refueled when carrying demolition material or MEC, and must be 100 feet from magazines or trailers containing such items before refueling.
- All explosive vehicles will be cleaned of visible explosive and other contamination before releasing the vehicles for other tasks.
- Prior to conducting any other task, personnel shall wash their face and hands after handling demolition material or MEC.
- Disposal sites shall be spaced at least 50 feet apart, with no more than 10 pits prepared for a series of shots at any one time.

5.1. FIRE PREVENTION FOR DISPOSAL OPERATIONS

During the high fire seasons at the sites, the following procedures will be adhered to on each disposal shot conducted:

- MEC that is moved for disposal will be taken to a location that will provide the most protection from fires and provide the easiest access by fire fighting vehicles if required.

- For UXO that cannot be moved, measures will be taken to carefully plan fire suppression accesses and procedures prior to detonating shots. All disposal and safety personnel will be fully briefed on fire suppression procedures.
- Immediately after the detonation, all safety personnel will report status of the disposal site and presence/absence of fires.
- If fire or smoke in the vegetation surrounding the site is present, the demolition team will proceed immediately to the site with field fire suppression equipment and attempt to suppress any fires present.
- If a fire becomes uncontrollable, emergency notifications to local fire agencies will be made and all field workers will stand by to assist as necessary.

The fire prevention goals are to plan effectively for all potential fire suppression obstacles, effectively mitigate the disposal shot and surrounding vegetation with water, ensure prevailing winds are not going to take potential smoke towards populated areas, ensure that adequate fire suppression equipment is on site, and keep vigilant communications with the local Fire Department during all disposal operations (refer to work plan for contact numbers).

6. SPECIAL REQUIREMENTS FOR DEMOLITION ACTIVITIES

The following safety and operational requirements shall be followed during demolition range operations. Any deviations from this procedure shall be allowed only after receipt of written approval from the ERRG MEC Operations Manager and the client. Failure to adhere to the requirements and procedures listed in the paragraphs below could result in serious injury or death, therefore complete compliance with these required procedures will be strictly enforced.

6.1. GENERAL REQUIREMENTS

The general disposal operations requirements listed below shall be followed at all times:

- Material awaiting destruction shall be stored at not less than intra-line distance, based on the largest quantity involved, from adjacent explosive materials and from explosives being destroyed. The material shall be protected against accidental ignition or explosion from fragments, grass fires, burning embers or detonating impulses originating in materials being destroyed.
- MEC or bulk explosives to be destroyed by detonation should be detonated in a pit not less than three feet deep and covered with earth which protrudes not less than two feet above existing ground level. The components should be placed on their sides or in a position to expose the largest area to the influence of the demolition material. The demolition material should be placed in intimate contact with the item to be detonated and held in place by tape or earth packed over the demolition materials. The total quantity to be destroyed below ground at one time shall be kept at a minimum.
- Detonations will be counted to ensure detonation of all pits. After each series of detonations, a search shall be made of the surrounding area for unexploded UXO and MEC. Items such as lumps of explosives or unfuzed ammunition may be picked up and prepared for the next shot.

Fuzed ammunition or items which may have internally damaged components will be detonated in place, if possible.

- Prevailing weather condition information will be obtained from the U.S. Weather Service and the data logged in the Demolition Shot Log before each shot or round of shots.
- All shots shall be dual primed
- A minimum of 30 seconds will be maintained between each detonation
- After each detonation and at the end of each day's operations, surface exposed scrap metal, casings, fragments, and related items shall be recovered from the demolition range and disposed of in accordance with munition debris procedures, as well as all applicable environmental regulations. All collected scrap metal will be 100% inspected for absence of explosive materials by UXO personnel and certified by the SUXOS.
- When operated in accordance with the conditions of this procedure the demolition range should not present a noise problem to the surrounding community. However, if a noise complaint is received, the name, address and phone number of the complainant should be recorded and reported to the SUXOS, who in turn, will report it to the ERRG MEC Operations Manager.
- Prior to and after each shot, the Demolition Shot Record is to be filled out by the DS with all applicable information. This record will be kept with the MEC Accountability Log and reflect each shot.

6.2. PREPARATION SEQUENCE (FOR A NONEL FIRING SYSTEM)

6.2.1. ASSEMBLING THE NONEL FIRING SYSTEM

- Test and maintain control of the NONEL firing device
- Lay out the NONEL shock tube
- Protect the NONEL detonator
- Prime the charge(s)
- Connect the firing device to the shock tube

6.2.2. TESTING AND MAINTAINING CONTROL OF THE NONEL FIRING DEVICE

The NONEL firing device will be tested each day prior to use as specified in the manufacturer's instruction. The supervisor in charge of the demolition operation is responsible for maintaining control of the NONEL firing device at all times.

6.2.3. LAYING OUT THE NONEL SHOCK TUBE

Care will be taken to prevent kinks or sharp bends in the shock tube. Control of the firing position will be maintained from this point on. This control will ensure that no one tampers with the shock tube or fires the charge prematurely. Personnel will not walk on or step over the shock tube.

6.2.4. PROTECTING THE NONEL DETONATOR

The NONEL detonator will be protected at all times prior to priming the charge(s).

6.2.5. PRIMING THE CHARGES/RETURNING TO THE FIRING POINT

ERRG will use commercially available explosives to detonate UXO. The NONEL detonator will be connected to the detonating cord trunk line or ring main system. Detonating cord trunk and branch lines will be used to link multiple shots.

6.2.6. INITIATING THE NONEL FIRING SYSTEM

The NONEL firing device will not be connected until all personnel are accounted for and the perimeter security is verified. The supervisor in charge of the demolition operation will give the order to fire the charge(s) only after all personnel are accounted for and the perimeter security is verified.

6.3. ELECTRIC DETONATOR USE

The following requirements are necessary when using electric detonators and blasting circuits:

- Electric detonators and electric blasting circuits may be energized to dangerous levels from outside sources such as static electricity, induced electric currents and radio communication equipment. Safety precautions will be taken to reduce the possibility of a premature detonation of the electric detonator and explosive charges of which they form a part. Radios will not be operated while the pit is primed or during the priming process.
- The shunt shall not be removed from the leg wires of the detonator until the continuity check of the detonator.
- When uncoiling or straightening the detonator leg wires, keep the explosive end of the detonator pointing away from the body and away from other personnel. When straightening the leg wires, do not hold the detonator itself; rather hold the detonator leg wires approximately one inch from the detonator body. Straighten the leg wires by hand, do not throw or wave the wires through the air to loosen them.
- Prior to use, the detonators shall be tested for continuity. To conduct the test, place the detonators in a pre-bored hole in the ground or place them in a sand bag and walk facing away from the detonators and stretch the wires to their full length, or to 50 feet, whichever is less, being sure to not pull the detonators from the hole or sandbag. With the leg wires stretched to their full length, test the continuity of the detonators one at a time by un-shunting the leg wires and attaching them to the galvanometer and checking for continuity. After the test, re-shunt the wires by twisting the two ends together. Repeat this process for each detonator until all detonators have been tested. This process shall be accomplished at least 50 feet from any MEC or demolition materials and out of the demolition range personnel and vehicle traffic flow pattern. In addition, all personnel on the demolition range shall be alerted prior to the test being conducted.

NOTE: When testing the detonator, prior to connecting the detonator to the firing circuit, the leg wires of the detonator must be shunted by twisting the bare ends of the wires together immediately after testing. The wires shall remain short circuited until time to connect them to the firing line.

- At the power source end of the blasting circuit, the ends of the wires shall be shorted or twisted together (shunted) at all times, except when actually testing the circuit or firing the charge. The connection between the detonator and the circuit firing wires must not be made unless the power end of the firing wires are shorted and grounded or the firing panel is off and locked.

- The firing line will be checked using pre-arranged hand signals or through the use of two-way radios if the demolition pit is not visible from the firing point. If radios are used, communication shall be accomplished a minimum of 25 feet from the demolition pit and detonators. The firing line will be checked for electrical continuity in both the open and closed positions, and will be closed/ shunted prior to connecting the detonator leg wires.
- MEC to be detonated/vented shall be placed in the demolition pit and the demolition material placed/attached in such a manner as to ensure the total detonation/venting of the MEC. Once the MEC and demolition material are in place and the shot has been tamped, the detonators will be connected to the demolition material. Prior to handling any detonators that are connected to the firing line, personnel shall ensure that they are grounded. The detonators will then be carried to the demolition pit with the end of the detonators pointed away from the individual. The detonators are then connected to the detonation cord, Non-El, etc., ensuring that the detonator is not covered with tamping material to allow for ease of recovery/investigation in the event of a miss-fire.
- Prior to making connections to the blasting machine, the entire firing circuit shall be tested with a galvanometer for electrical continuity and ohm resistance to ensure the blasting machine has the capacity to initiate the shot.
- The individual assigned to make the connections at the blasting machine or panel will not complete the circuit at the blasting machine or panel and will not give the signal for detonation until satisfied that all personnel in the vicinity have been evacuated to a safe distance. When in use, the blasting machine or its actuating device shall be in the blaster's possession at all times. When using the panel, the switch must be locked in the open position until ready to fire, and the single key must be in the blaster's possession.
- Prior to initiating a demolition shot(s), a warning will be given, the type and duration of such will be determined by the prevailing conditions at the demolition range. At a minimum, this should be an audible signal using a siren, air horn or megaphone which is sounded for duration of one minute, five minutes prior to the shot and again one minute prior to the shot.

6.4. DETONATING CORD USE

The following procedures are required when using detonating cord (det cord):

- Det cord should be cut using approved crimpers and only the amount required should be removed from inventory.
- When cutting det cord, the task should be performed outside the magazine
- For ease of inventory control, only remove det cord in one foot increments
- Det cord should not be placed in clothing pockets or around the neck, arm or waist, and should be transported to the demolition location in either an approved "day box" or a cloth satchel, depending upon the magazine location and proximity to the demolition area.
- Det cord should be placed at least 25 feet away from detonators and demolition materials until ready for use. To ensure consistent safe handling, each classification of demolition material shall be separated by at least 25 feet until ready for use.
- When ready to "tie in" either the det cord to demolition materials, or det cord to detonator, the det cord will be connected to the demolition material and secured to the MEC. The cord is then

strung out of the hole and secured in place with soil, being sure to leave a one foot tail exposed outside the hole.

- Once the hole is filled, make a loop in the det cord that is large enough to accommodate the det cord detonator, place the detonator in the loop and secured it with tape. The explosive end of the detonator will face down the det cord toward the demolition material or parallel to the main line.
- In all cases, ensure there is sufficient det cord extending out of the hole to allow for ease of detonator attachment and detonator inspection/replacement should a misfire occur.
- If the det cord detonators are electric, they will be checked, tied in to the firing line and shunted prior to being taped to the loop. If the det cord detonators are non-electric, the time/safety fuse will be prepared with the igniter in place prior to taping the detonators to the det cord loop. If the det cord detonators are Non-El, simply tape the detonators into the loop as described above.
- In the event that a time/safety fuse is used, and an igniter is not available and a field expedient initiation system is used (i.e., matches), do not split the safety fuse until the detonator is taped into the det cord loop.

6.5. TIME/SAFETY FUSE USE

The following procedures are required when using a time/safety fuse:

- Prior to each daily use, the burn rate for the time/safety fuse must be tested to ensure the accurate determination of the length of time/safety fuse needed to achieve the minimum burn time of five minutes needed to conduct demolition operations.
- To ensure both ends of the time/safety fuse are moisture free, use approved crimpers to cut 6 inches off the end of the time/safety fuse roll and place the 6-inch piece in the time/safety fuse container.
- If quantity allows, accurately measure and cut off a three foot long piece of the time/safety fuse from the roll.
- Take the three foot section out of the magazine and attach a fuse igniter
- In a safe location, removed from demolition materials and MEC, ignite the time/safety fuse, measure the burn time from the point of initiation to the "spit" at the end, and record the burn time in the DS's Log
- To measure the burn time, use a watch with a second hand or chronograph
- To calculate the burn rate in seconds per foot, divide the total burn time (in seconds) by the length (in feet) of the test fuse.
- Whenever using time/safety fuse for demolition operations, the minimum amount of fuse to be used for each shot will be the amount needed to permit a minimum burn time of five minutes.

6.6. PERFORATOR USE

The following procedures are required when using perforators:

- Only remove from inventory the number of perforators required to perform the task

- Transport perforators in an approved "day box", cloth satchel or plastic container, depending upon magazine location and proximity to the demolition operations.
- Keep perforators stored at the demolition site at least 25 feet away from detonators and demolition materials until ready for use.
- When ready to use, place the det cord through the slot on the perforator and knot the det cord, ensuring the cord fits securely and has good continuity with the perforator.
- Once the det cord is secure, place the perforator in the desired location and secure it in place.
- Proceed from this point as described in para 6.3

6.7. USE OF TWO-COMPONENT EXPLOSIVES

The following procedures are required when using two-component explosives as demolition material:

- Only remove from inventory the amount of two-component required to perform the task
- When transporting the solid and liquid, they need only be placed apart in the bed of a truck.
- Do not mix the solid and liquid components until certain that it will be used, since the resulting mixture is classified as a Class 1.1 explosive by Department of Transportation.
- When mixing the solid and liquids components, follow the manufacturer's instructions, while being sure to wear rubber gloves and goggles. Mix components in an area away from other demolition materials, the MEC, and if possible, sheltered from the wind.

- Once the components have been mixed, it is essential that the lid to the solid bottle is put on securely as soon as possible after mixing to prevent evaporation of the liquid.
- Attach the det cord as recommended by the manufacturer, place the assembled unit in the desired location in the hole and secure the unit.
- Proceed from this point as described in para 6.3

7. METEOROLOGICAL CONDITIONS

In order to control the effects of demolition operations and to ensure the safety of site personnel, the following meteorological limitations and requirements shall apply to demolition operations:

- Demolition operations will not be conducted during electrical storms or thunderstorms
- No demolition operations shall be conducted if the surface wind speed is greater than 10 miles per hour.
- Demolition operations will not be conducted during periods of visibility of less than one mile caused by, but not limited to, dense fog, blowing snow, rain, sand or dust storms.
- Demolition shall not be carried out on extremely cloudy days which are defined as: overcast (more than 80% cloud cover) with a ceiling of less than 2,000 feet.
- Demolition operations will not be conducted during any atmospheric inversion condition (low or high altitude).

- Demolition operations will not be conducted during periods of local air quality advisories
- Demolition operations will not be initiated until 30 minutes after sunrise, and will be secured at least 30 minutes prior to sunset.

8. PRE-DEMOLITION/DISPOSAL PROCEDURES

8.1. PRE-DEMO/DISPOSAL OPERATIONS

The DS will brief all personnel involved in range operations in the following areas:

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

8.2. PRE-DEMO/DISPOSAL SAFETY BRIEFING

The SSO will conduct a safety brief for all personnel involved in range operations in the following areas:

- Care and handling of explosive materials
- Personal hygiene
- Two man rule and approved exceptions
- Potential trip/fall hazards
- Horse play on the range
- Stay alert for any explosive hazards on the range
- Location of emergency shelter (if available)
- Parking area for vehicles (vehicles must be positioned for immediate depar¬ture, with the keys in the ignition).
- Location of range emergency vehicle (keep engine running)
- Wind direction (to assess potential toxic fumes)
- Location of first aid kit and fire extinguisher

- Route to nearest hospital or emergency aid station
- Type of communications in event of an emergency
- Storage location of demolition materials and MEC awaiting disposal
- Exclusion Zone/Site Control

8.3. TASK ASSIGNMENTS

Individuals with assigned tasks will report the completion of the task to the DS. The types of tasks which may be required are:

- Contact local Police, Fire personnel, and FAA as required
- Contact hospital/emergency response personnel if applicable
- Secure all access roads to the range area
- Visually check range for any unauthorized personnel
- Check firing wire for continuity and shunt
- Prepare designated pits as required
- Check continuity of detonators
- Check time/safety fuse and its burn rate
- Designate a technician to maintain custody of blasting machine, fuse igniters or Non-El initiator.
- Secure detonators in a safe location
- Place MEC in pit and place charge in desired location

8.4. PREPARING EXPLOSIVE CHARGE FOR INITIATION

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

- Ensure firing wire is shunted
- Connect detonator to the firing wire
- Isolate or insulate all connections
- Place demolition charge on MEC
- Prime the demolition charge
- Depart to firing point (if using non electric firing system, obtain head count, pull igniters and depart to designated safe area).
- Obtain a head count
- Give one minute warning signal, using a bullhorn or siren, five minutes prior to detonation, and again at one minute prior to detonation.
- Yell "fire in the hole" three times (or an equivalent warning) and take cover
- If using electric firing system connect firing wires to blasting machine and initiate charge

- Remove firing wires from blasting machine and shunt
- Remain in designated safe area until DS announces "All Clear". This will occur after a post-shot waiting period of 5-minutes and the DS has and inspected the pit(s).

9. 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 below listed procedures:

- After the "All Clear" signal, check pit for low orders, kick outs, and fires
- Mag pit and remove any large fragmentation
- Back fill hole as necessary
- Police up all equipment
- Notify police, fire, etc. that the operation is complete

10. 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 shall be followed.

10.1. 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 connections to the blasting machine and make a second attempt to initiate charge.
- If unsuccessful, disconnect and connect to another blasting machine (if available) and attempt to initiate charge.
- If unsuccessful, commence a 30 minute wait period
- After the maximum delay predicted for any part of the shot has passes, 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 and prime the charge without disturbing the original detonator (replacement detonator must have been checked for continuity as outlined in para 6.2, after disconnecting the defective detonator).
- Follow normal procedures for effecting initiation of the charge

10.2. NON-ELECTRIC MISFIRES

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

- If charge fails to detonate at the determined time, initiate a 60 minute wait period plus the time of the safety fuse, i.e., 5 minute safety fuse plus 60 minutes for a total of 65 minute wait period.
- After the wait period has expired, a designated technician will proceed down range to inspect the firing system. A safety observer must watch from a protected area.
- Prime the shot with a new non electric firing system and install a new fuse igniter
- Follow normal procedures for initiation of the charge

10.3. NON-EL MISFIRE

The use of a shock tube for blast initiation can present misfires which require the following actions:

- If charge fails to detonate, it could be the result of the shock tube not firing. Visually inspect the shock tube, if it is not discolored (i.e., slightly black), it has not fired.
- If it has not fired, cut a one foot piece off the end of the tube, re-insert the tube in the firing device and attempt to fire again.
- If the device still does not fire, wait 30 minutes and proceed down range to replace the shock tube per instructions outlined below.
- If the tube is slightly black, then a "Black Tube" misfire has occurred, and the shock tube will have to be replaced. When replacing the shock tube, be sure to remove the tube with the detonator in place. Without removing the detonator from the end of the tube, repackage the defective tube and return it to the supplier for credit.

10.4. DETONATING CORD MISFIRE

Det cord will be used to tie in multiple demolition shots and to ensure that electric detonators are not buried. Since det cord initiation will be either electrical or non-electrical, the procedures presented in paragraphs 10.1, 10.2, or 10.3, as appropriate to the type of detonator used, will be used to clear a det cord misfire. In addition, 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 para 6.0.
- If the initiator detonated and the cord did not, inspect the cord to ensure it is det cord and not time fuze. Also, check to ensure there is PETN in the cord at the connection to the initiator.
- At this point, it may be necessary to uncover the det cord and replace it. If this is required, it must be accomplished carefully to ensure that the demolition charge and the MEC item are not disturbed.

10.5. PERFORATOR MISFIRE

The use of perforators is both cost effective and considerably safer than the use of C-4 and many other demolition materials. If the perforator is not initiated properly, it could malfunction. Since the perforator is covered with tamping material, det cord is used as the initiator. Therefore, in the event of a misfire, the procedures presented in para 10.4 will be followed, along with the items presented below.

- If everything went but the perforator, one of four things has occurred:
  1. Det cord grain size was insufficient to initiate the perforator
  2. The det cord was dislodged from the perforator when placing tamping materials
  3. The perforator was defective
  4. The perforator was moved during the placement of tamping materials
- Check to ensure the grain size of the det cord is sufficient, with 80 grain size or greater being the recommended size.
- If the det cord connection to the perforator was the problem, ensure that the next connection is secure (use duct tape if necessary).
- If it is evident that the perforator was moved, then ensure it is properly secured for the next shot.
- If cord size and connection are sufficient, replace the perforator, leaving the defective one on the shot

11. RECORD KEEPING REQUIREMENT

To document the demolition operations procedures and the completeness of the demolition of MEC, the following record keeping requirements shall be met:

- ERRG will obtain and maintain all required permits
- The DS will ensure the accurate completion of the logs, and the SUXOS will monitor the entries in the log for completeness, accuracy and compliance with meteorological conditions.
- The DS shall enter the appropriate data on the Ordnance Accoun¬tability Log and the Demolition Shot Record, to reflect the MEC destroyed, and shall complete the appropriate information on the Explosives Accountability Log (a.k.a. the Magazine Data Card) which indicates the demolition materials used to destroy the MEC.
- The quantities of MEC recovered must also be the quantities of MEC destroyed or disposed of as scrap.
- ERRG will retain a permanent file of all Demolition Records, including permits, Magazine Data Cards, training records, inspector reports, waste manifests if applicable, and operating logs.
- Copies of ATF License and any state or local permits must be on hand.

12. SAFETY AND PPE REQUIREMENTS

The following safety measures and personal protective equipment shall be used in preventing or reducing exposure to the hazards associated with MEC demolition/disposal operations. These requirements will be implemented unless superseded by site specific requirements stated in the SSHP.

- Steel-toed safety boots will not be worn by personnel conducting demolition/disposal operations, unless a toe crush hazard exists, in which case personnel will wear boots with plastic or fiber toed safety toes.
- Unless a serious head, eye or face hazard exists, UXO personnel will not be required to wear hard hats, safety glasses or face shields when conducting operations involving the handling of demolition explosives or MEC.
- In the event that a serious head, eye or face hazard does exist, UXO personnel will wear the required PPE, but positive means shall be required to secure the PPE and prevent it from falling and causing an accidental detonation.

13. AUDIT CRITERIA

The following items related to demolition/disposal operations on a MEC contaminated site will be available for review on site:

- The Demolition Shot Record
- The Site Daily Operational and Safety Logs
- The MEC Operations Daily/Weekly Report
- The Safety Training Attendance Forms, for the initial site hazard training
- The Safety Training Attendance Forms, for the Daily Tailgate Safety Briefings
- The Daily Safety Inspection and Audit Log
- MEC Accountability Record

1. MINIMUM SAFE DISTANCE FROM TRANSMITTER ANTENNAS

Average or Peak Transmitter Power in Watts	Minimum Distance to Transmitter in Meters / Feet
0 - 5	7.5 / 25
6 - 30	30 / 98.4
31 - 50	50 / 164.1
51 - 100	110 / 360
101 - 250	160 / 525
251 - 500	230 / 755
501 - 1,000	305 / 1,000

Average or Peak Transmitter Power in Watts	Minimum Distance to Transmitter in Meters / Feet
1,001 - 3,000	480 / 1,575
3,001 - 5,000	610 / 2,001
5,001 - 20,000	915 / 3,002
20,001 - 50,000	1,530 / 5,020
50,001 - 100,000	3,050 / 10,007
100,001 - 400,000	6,100 / 20,014
400,001 - 1,600,000	12,200 / 40,028
1,600,001 - 6,400,000	24,400 / 80,056

Note: When the transmission is a pulsed or pulsed continuous wave type and its pulse width is less than 10 microseconds, the power column indicates average power. For all other transmissions, including those with pulse widths greater than 10 microseconds, the power column indicates peak power.

2. MINIMUM SAFE SEPARATION FORMULAS

Unknown (Worst Case)	Without Metal Pack		With Metal Pack	
	Frequency	Formula	Frequency	Formula
Use Table 120D-1-1	☐2.3 KHz	$D = 0.093 \times (PG)^{0.5}$	☐73 KHz	$D = 0.093 \times (PG)^{0.5}$
	2.3 KHz - 0.45 MHz	$D = 39.7 \times F \times (PG)^{0.5}$	73 KHz - 0.45 MHz	$D = 126 \times F \times (PG)^{0.5}$
	0.45 MHz - 400 MHz	$D = 18 \times (PG)^{0.5}$	0.45 MHz - 400 MHz	$D = 0.6 \times (PG)^{0.5}$
	400 MHz - 75 GHz	$D = (7137 / F) \times (PG)^{0.5}$	400 MHz - 2.4 GHz	$D = (226 / F) \times (PG)^{0.5}$
	>75 GHz	$D = 0.093 \times (PG)^{0.5}$	>2.4 GHz	$D = 0.093 \times (PG)^{0.5}$

Notes:

D = Safe distance to the transmitter in feet (multiply feet by 0.305 to obtain meters)

P = Output power of the transmitter in watts

G = Numerical gain of transmitter antenna

F = Frequency in MHz (divide KHz by 1,000 to obtain MHz, and multiply GHz by 1,000 to obtain MHz)

To properly use this table, the following assumptions are made:

- The no-fire current of the EED is 10 mA.
- At least 10 dB below the no-fire current in EED is considered to be safe.

- The metal pack provides at least 30 dB of shielding.
- Non-metal packs provide no shielding.
- A 1 volt/meter field intensity is considered to be safe.
- At no time should personnel or munitions be exposed to more tha

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Attachment 5-4

Explosive End User Certificate

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Explosive End User Certificate

Instructions

Assemble all Explosive End User Certificate (EEUC) forms and the associated documents, letters, certificates, notices, and other relevant information for the project associated with the purchase, use, storage and transportation of explosives and attach copies by date in chronological order:

a. Purchase Order - provided to the vender with a copy of our ATF&E Explosives License/Permit

b. Authorization Letter for Responsible Persons and Possessor of Explosives – provided to the vendor on ERRG letterhead to receive vendor shipments

c. Notification of explosive shipment - Provided to the ERRG Responsible Person(s) and or Employee Possessor – identifying the explosive shipment vendor, vendor shipping date, carrier, project site name, receiving date, receiving telephone number, and receiving site address of explosive materials delivered by the carrier.

d. Magazine inspection notice, permit, fire marshal acceptance.

e. Responsible Person and or Employee Possessor receives explosive shipment and preserves for file all manifests, bill of landing, shipping papers, forms, packing lists, hazardous materials shipping documents and Material Safety Data Sheets (MSDS).

f. Carrier Hazardous Materials Shipping Declaration

g. Magazine Data Cards

h. Magazine Initial Physical Inventory

i. Magazine close-out inventory

j. Explosive End User Certificate

   - EEUC Destruction
   - EEUC Transfer/return

For EEUC forms that have sections that are not applicable enter the letters N/A.

For projects that do not have a transfer/return, complete one form and complete each block with the letters N/A, within the signature block of the certifier insert the following statement.

> ***"From: mm/dd/yyyy (project start date) through mm/dd/yyyy (reporting date) – no explosive materials were transferred or returned to any other person or organization."***

Within the date block enter the current date

Within the forms block enter 1 of 1

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Explosive Materials End User Certificate

Explosive Disposition Record

Date:	
TO:	ERRG ATF&E Licensee -
COPIES:	ERRG Safety Officer; Operations Manager;
FROM: Organization: Project Manager:	
Client Organization:	
Project Name:	
Project Site:	
Project Number:	
Project Location: Address:	

Acquisition Source/Vendor/ supplier: Address: City: State: Zip: Tel:	

This memorandum is to certify that the explosive items listed below were purchased, used, destroyed and/or returned as required by 27CFR 555 and in accordance with ERRG and project specific policies. Instructions: complete one (1) end user certificate for each separate explosive lot/"Date Shift Code" as applicable to destruction/transfer/return.

Example-Explosive End User Certificate (EEUC)

Disposition/Destruction

ATF&E Licensee

(Form 2006)

Type of Explosive Materials	Product Description	Lot Number or Date Shift Code	Issue: Each, Feet, Case, Block, Sheet, Lbs, Roll, Charge, Round, etc:	Unit	Net Explosive Weight	Unit Quantity	Total Number of Explosive Units Consumed
Manufacture: Atlas Powder **Manufacture Mark**: "ATPD" **Product Name:** TNT 2,4,6 Trinitrotoluene	Circular charge, pale yellow, cast booster, double primer hole, 3in diameter 6in length	ATPD01-22-000-3c	Each	1	.8oz	100	100

DOT Hazard Class: 1 – Explosive	**UNO #:** 1356	**EX #:** 12345678910	**DOT Hazard Div:** 1.1	**Remarks:** Explosive were used to destroy military munitions identified in CDC Shot Log entries #1through 25 (MM/DD/YYYY) or Explosives were excess to project needs and destroyed do to termination of explosive storage and

				security.

Certifying Person/Title: Boomer B. Bang, SUXOS, Print Name (above): Organization: ///////////// I declare under the penalties of perjury that this “Explosive End User Certificate”, including the documents submitted in support thereof, has been examined by me and, to the best of my knowledge and belief, is true, correct, and complete'. Signature:	Verifying Witness: I, M, Cool, UXO Tech II Print Name (above): Organization: ////////////// I declare under the penalties of perjury that this “Explosive End User Certificate”, including the documents submitted in support thereof, has been examined by me and, to the best of my knowledge and belief, is true, correct, and complete'. Signature:	Date: MM/DD/YYYY EEUC Forms: Form _1_ of_7_ Forms

Explosive End User Certificate (EEUC)

DISPOSITION/TRANSFER/RETURN

ATF&E Licensee

(Form 2006)

Type of Explosive Materials	**Product Description**	**Lot Number or Date Shift Code**	**Issue:** Each, Feet, Case, Block, Sheet, Lbs, Roll, Charge, Round, etc:	**Unit**	**Net Explosive Weight**	**Unit** *Quant*	**Total Number of Units Transferred/ Returned**
Manufacture: Atlas Powder **Manufacture Mark**: “ATPD” **Product Name:** TNT 2,4,6 Trinitrotoluene	Circular charge, pale yellow, cast booster double, primer hole, 3in diameter 6in length	ATPD01-22-000-3c	Each	1	.8oz	33	33

DOT Hazard Class:	**UNO #:**	**EX #**	**D**	**Remarks:**

1 – Explosive	1356	12345678910	OTHazardDiv: 1.1	Explosives were excess to project needs and returned to distributor.

Certifying Employee Possessor/Title/Org: Boomer B. Bang, SUXOS/ERRG Print Name (above): Employee #: 654321 I declare under the penalties of perjury that this "Explosive End User Certificate", including the documents submitted in support thereof, has been examined by me and, to the best of my knowledge and belief, is true, correct, and complete'. Signature:	Acceptance of Transfer Distributor: Jack Middleman Vendor Print Name (above): Organization: We Sell Explosives Inc Address: 321 Boom Road Nitro WV I declare under the penalties of perjury that this "Explosive End User Certificate", including the documents submitted in support thereof, has been examined by me and, to the best of my knowledge and belief, is true, correct, and complete'. Signature:	Date: MM/DD/YYYY EEUC Forms: Form _1_ of_7_ FormS

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Explosive End User Certificate (EEUC)

Disposition/Destruction

ATF&E Licensee

(Form 2006)

Type of Explosive Materials	**Product Description**	**Lot Number or Date Shift Code**	**Issue: Each, Feet, Case, Block, Sheet, Lbs, Roll, Charge, Round, etc:**	**Unit**	**Net Explosive Weight**	**Unit Quantity**	**Total Number of Explosive Units Consumed**
Manufacture: **Manufacture Mark**: **Product Name:**							

DOT Hazard Class:	**UNO #:**	**EX #:**	**DOT Hazard Div:**	**Remarks:**

Certifying Person/Title: Print Name (above): Organization:	Verifying Witness: Print Name (above):	Date:

I declare under the penalties of perjury that this “Explosive End User Certificate”, including the documents submitted in support thereof, has been examined by me and, to the best of my knowledge and belief, is true, correct, and complete'. Signature:	Organization: I declare under the penalties of perjury that this “Explosive End User Certificate”, including the documents submitted in support thereof, has been examined by me and, to the best of my knowledge and belief, is true, correct, and complete'. Signature:	EEUC Forms: Form __ of__ Forms

Explosive End User Certificate (EEUC)

DISPOSITION/TRANSFER/RETURN

ATF&E Licensee

(Form 2006)

Type of Explosive Materials	Product Description	Lot Number or Date Shift Code	Issue: Each, Feet, Case, Block, Sheet, Lbs, Roll, Charge, Round, etc:	Unit	Net Explosive Weight	Unit *Quantit*	Total Number of Units Transferred/ Returned
Manufacture: **Manufacture Mark**: **Product Name:**							

DOT Hazard Class:	**UNO #:**	**EX #**	**DOT Hazard Div:**	**Remarks:**

Certifying Employee Possessor/Title/Org: Print Name (above): Employee #: I declare under the penalties of perjury that this “Explosive End User Certificate”, including the documents submitted in support thereof, has been examined by me and, to the best of my knowledge and belief, is true, correct, and complete'. Signature:	Acceptance of Transfer Distributor: Print Name (above): Organization: Address: I declare under the penalties of perjury that this “Explosive End User Certificate”, including the documents submitted in support thereof, has been examined by me and, to the best of my knowledge and belief, is true, correct, and complete'. Signature:	Date:

Attachment 5-5
Explosives Material Safety Data Sheets

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Material Safety Data Sheet

Dyno Nobel Inc.
2650 Decker Lake Boulevard, Suite 300
Salt Lake City, Utah 84119
Phone: 801-364-4800 Fax: 801-321-6703
E-Mail: dnna.hse@am.dynonobel.com

FOR 24 HOUR EMERGENCY, CALL **CHEMTREC (USA)** **800-424-9300**
CANUTEC (CANADA) **613-996-6666**

MSDS # 1122
Date 01/22/09

Supercedes
MSDS # 1122 08/13/08

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s):

- NONEL® MS
- NONEL® MS ARCTIC
- NONEL® LP
- NONEL® SL
- NONEL® TD
- NONEL® MS CONNECTOR
- NONEL® TWINPLEX™
- NONEL® STARTER
- NONEL® EZ DET®
- NONEL® EZTL™
- NONEL® EZ DRIFTER ®

Product Class: NONEL® Non-electric Delay Detonators

Product Appearance & Odor: Aluminum cylindrical shell with varying length and diameter of attached colored plastic tubing. The detonator may be enclosed in a plastic housing, and an assembly may contain two detonators. Odorless.

DOT Hazard Shipping Description: UN0029 Detonators, non-electric 1.1B II
-or- UN0360 Detonator assemblies, non-electric 1.1B II
-or- UN0361 Detonator assemblies, non-electric 1.4B II

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

		Occupational Exposure Limits	
Ingredients	**CAS#**	**OSHA PEL-TWA**	**ACGIH TLV-TWA**
Pentaerythritol Tetranitrate (PETN)	78-11-5	None[1]	None[2]
Lead Azide	13424-46-9	0.05 mg (Pb)/m^3	0.05 mg (Pb)/m^3
Lead	7439-92-1	0.05 mg (Pb)/m^3	0.05 mg (Pb)/m^3
Silicon	7440-21-3	15 mg / m^3 (total dust) 5 mg / m^3 (respirable fraction)	10 mg / m^3
Selenium	7782-49-2	0.2 mg/m^3	0.2 mg/m^3
Red Lead (Lead tetroxide)	1314-41-6	0.05 mg (Pb)/m^3	0.05 mg (Pb)/m^3
Titanium dioxide	13463-67-7	15 mg/m^3	10 mg/m^3
Barium Chromate	10294-40-3	1 mg (CrO_3)/10m^3 (ceiling) 0.5 mg (Ba)/m^3	0.01 mg (Cr)/m^3 0.5 mg (Ba)/m^3
Lead Chromate	7758-97-6	0.05 mg (Pb)/m^3 1 mg (CrO_3)/10m^3 (ceiling)	0.15 mg (Pb)/m^3 0.012 mg (Cr)/m^3
Barium Sulfate	7727-43-7	0.5 mg (Ba)/m^3	10 mg/m^3
Potassium Perchlorate[3]	7778-74-7	None[1]	None[2]
Silica (crystalline)	61790-53-2	See Note Below	0.05 mg/m^3 (resp frac)

Molybdenum	7439-98-7	None[1]	None[2]
Tungsten	7440-33-7	None[1]	5 mg/m^3 (TWA) 10 mg/m^3 (STEL)
Aluminum	7429-90-5	15 mg/m^3 (total dust) 5 mg/m^3 (respirable fraction)	5 mg/m^3
Antimony	7440-36-0	0.5 mg/m^3	0.5 mg/m^3
Cyclotetramethylene Tetranitramine (HMX)	2691-41-0	None[1]	None[2]

[1] Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m^3 ; respirable fraction, 5 mg/m^3 .

[2] Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m^3 ; respirable part., 3 mg/m^3 .
Note: The OSHA PEL for crystalline silica is calculated as follows:
Quartz, respirable: 10 mg/m$^{3\ e}$ / % SiO_2 + 2   Quartz, total dust: 30 mg/m^3 / % SiO_2 + 2

[3] Not all delay periods contain perchlorate. Those that do contain between from about 4 to a maximum of about 60 mg perchlorate per detonator.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable
Vapor Density: Not Applicable
Percent Volatile by Volume: Not Applicable
Evaporation Rate (Butyl Acetate = 1): Not Applicable
Vapor Pressure: Not Applicable
Density: Not Applicable
Solubility in Water: Not Applicable

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable
Flammable Limits: Not Applicable
Extinguishing Media: (See Special Fire Fighting Procedures section.)
Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe, distant location. Allow fire to burn unless it can be fought remotely or with fixed extinguishing systems (sprinklers).
Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

This is a packaged product that will not result in exposure to the explosive material under normal conditions of use. Exposure concerns are primarily with post-detonation reaction products, particularly heavy metal compounds.

Eyes: No exposure to chemical hazards anticipated with normal handling procedures. Particulates in the eye may cause irritation, redness, swelling, itching, pain and tearing.
Skin: No exposure to chemical hazards anticipated with normal handling procedures. Exposure to post-detonation reaction products may cause irritation.
Ingestion: No exposure to chemical hazards anticipated with normal handling procedures. Post-detonation reaction product residue is toxic by ingestion. Symptoms may include gastroenteritis with abdominal pain, nausea, vomiting and diarrhea. See systemic effects below.

Inhalation: Not a likely route of exposure. See systemic effects below.
Systemic or Other Effects: None anticipated with normal handling procedures. Repeated inhalation or ingestion of post-detonation reaction products may lead to systemic effects such as respiratory tract irritation, ringing of the ears, dizziness, elevated blood pressure, blurred vision and tremors. Heavy metal (lead) poisoning can occur.
Carcinogenicity: ACGIH classifies Lead as a "Suspected Human Carcinogen" and insoluble Chromium VI as "Confirmed Human Carcinogen". NTP, OSHA, and IARC consider components contained in this detonator carcinogenic.

Perchlorate: Perchlorate can potentially inhibit iodide uptake by the thyroid and result in a decrease in thyroid hormone. The National Academy of Sciences (NAS) has reviewed the toxicity of perchlorate and has concluded that even the most sensitive populations could ingest up to 0.7 microgram perchlorate per kilogram of body weight per day without adversely affecting health. The USEPA must establish a maximum contaminant level (MCL) for perchlorate in drinking water by 2007, and this study by NAS may result in a recommendation of about 20 ppb for the MCL.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.
Skin: Wash with soap and water.
Ingestion: Seek medical attention.
Inhalation: Not applicable.
Special Considerations: None

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact.
Conditions to Avoid: Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock. Do not attempt to disassemble.
Materials to Avoid (Incompatibility): Corrosives (acids and bases or alkalis).
Hazardous Decomposition Products: Carbon Monoxide (CO), Nitrous Oxides (NO_X), Sulfides, Chromates, Lead (Pb), Antimony (Sb) and various oxides and complex oxides of metals.
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate all personnel to a safe distant area and allow to burn or fight fire remotely. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. If loose explosive powder is spilled, such as from a broken detonator, only properly qualified and authorized personnel should be involved with handling and clean-up activities. Spilled explosive powder is extremely sensitive to initiation and may detonate. Follow applicable Federal, State, and local spill reporting requirements.

Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: None required for normal handling. Provide enhanced ventilation after use if in underground mines or other enclosed areas.

Respiratory Protection: None required for normal handling.

Protective Clothing: Cotton gloves are recommended.

Eye Protection: Safety glasses are recommended.

Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State, and local regulations. Only properly qualified and authorized personnel should handle and use explosives. Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock.

Precautions to be taken during use: Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death. Avoid breathing the fumes or gases from detonation of explosives. Detonation in confined or unventilated areas may result in exposure to hazardous fumes or oxygen deficiency.

Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

ECTION X - SPECIAL INFORMATION

These products contain the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	Max. lbs/1000 units
Lead	7439-92-1	39.4
	(Use Toxic Chemical Category Code)	
Lead Compounds	N420	2.0
Barium Compounds	N040	1.8
Chromium Compounds	N090	1.9

Range* of Section 313 Chemicals in each product

Product	lb Pb per 1000 detonators	lb Pb compounds per 1000 detonators	lb Ba compounds per 1000 detonators	lb Cr compounds per 1000 detonators
NONEL® MS	**0 - 27**	**0.3 – 1.5**	**0 – 0.9**	**0 – 0.9**
NONEL® LP	**0 - 30**	**0.3 – 2.0**	**0 - 1.8**	**0 - 1.9**
NONEL® SL	**7 - 27**	**0.3 – 1.5**	**0**	**0**
NONEL® TD	**0 - 18**	**0.3 – 0.7**	**0**	**0**
NONEL® MS Connector	**5 - 16**	**0.3 – 0.4**	**0**	**0**
NONEL® TWINPLEX™	**5 - 15**	**0.3 – 0.7**	**0**	**0**
NONEL® STARTER	**0**	**0.3**	**0**	**0**
NONEL® EZ DET®	**22 - 36**	**2.0**	**0**	**0**
NONEL® EZTL™	**5 - 15**	**0.5 – 0.7**	**0**	**0**
NONEL® EZ DRIFTER	**39.4**	**1.3**	**1.2**	**1.3**

*** The exact quantity and weight percent of Section 313 Chemicals in each delay period and tubing length for each product is available upon request.**

Disclaimer

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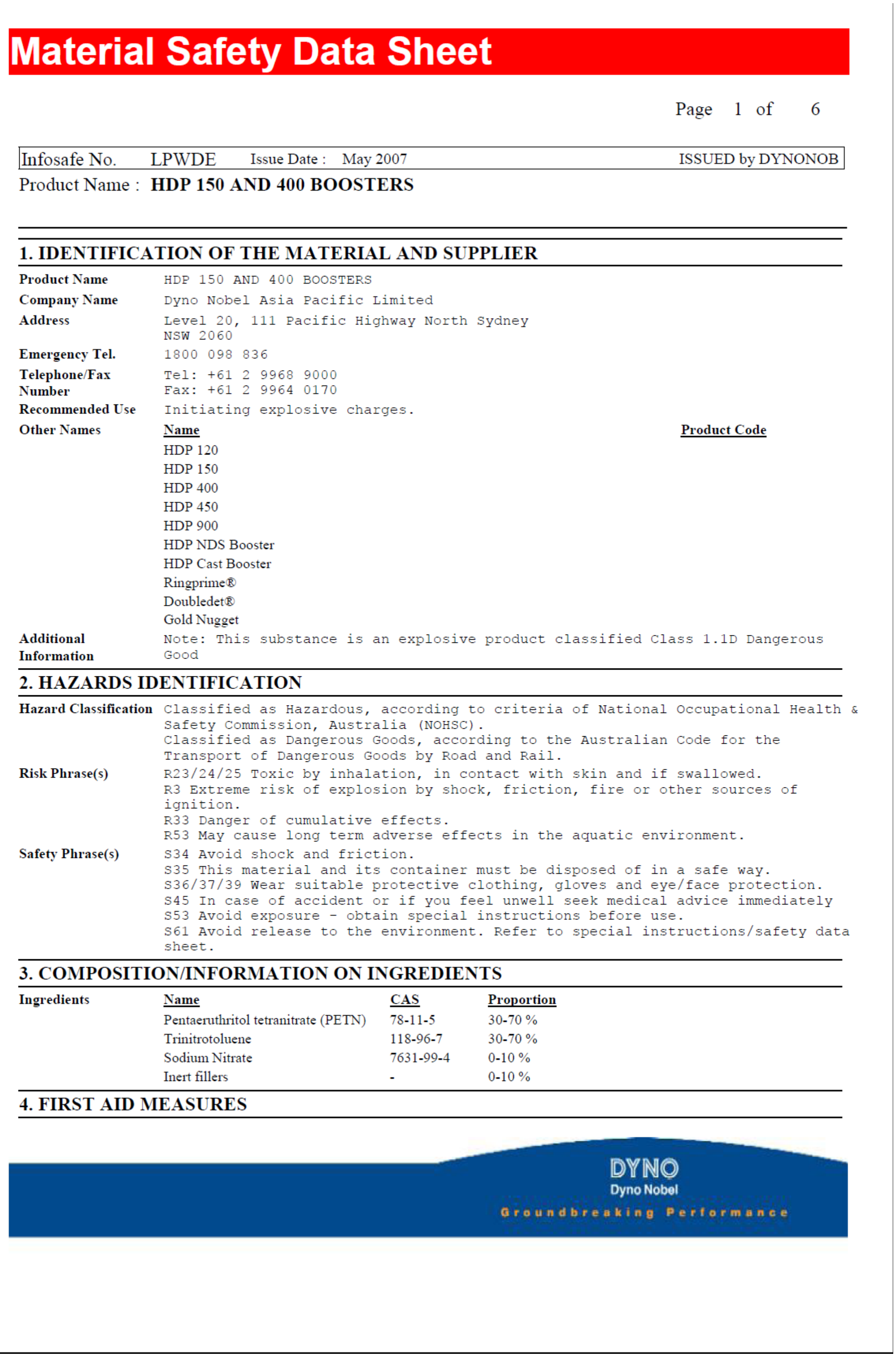


Material Safety Data Sheet

Infosafe No. LPWDE Issue Date : May 2007 ISSUED by DYNONOB

Product Name : **HDP 150 AND 400 BOOSTERS**

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name HDP 150 AND 400 BOOSTERS

Company Name Dyno Nobel Asia Pacific Limited

Address
Level 20, 111 Pacific Highway North Sydney
NSW 2060

Emergency Tel. 1800 098 836

Telephone/Fax Number
Tel: +61 2 9968 9000
Fax: +61 2 9964 0170

Recommended Use Initiating explosive charges.

Other Names

Name	Product Code
HDP 120	
HDP 150	
HDP 400	
HDP 450	
HDP 900	
HDP NDS Booster	
HDP Cast Booster	
Ringprime®	
Doubledet®	
Gold Nugget	

Additional Information Note: This substance is an explosive product classified Class 1.1D Dangerous Good

2. HAZARDS IDENTIFICATION

Hazard Classification Classified as Hazardous, according to criteria of National Occupational Health & Safety Commission, Australia (NOHSC).
Classified as Dangerous Goods, according to the Australian Code for the Transport of Dangerous Goods by Road and Rail.

Risk Phrase(s)
R23/24/25 Toxic by inhalation, in contact with skin and if swallowed.
R3 Extreme risk of explosion by shock, friction, fire or other sources of ignition.
R33 Danger of cumulative effects.
R53 May cause long term adverse effects in the aquatic environment.

Safety Phrase(s)
S34 Avoid shock and friction.
S35 This material and its container must be disposed of in a safe way.
S36/37/39 Wear suitable protective clothing, gloves and eye/face protection.
S45 In case of accident or if you feel unwell seek medical advice immediately
S53 Avoid exposure - obtain special instructions before use.
S61 Avoid release to the environment. Refer to special instructions/safety data sheet.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients

Name	CAS	Proportion
Pentaeruthritol tetranitrate (PETN)	78-11-5	30-70 %
Trinitrotoluene	118-96-7	30-70 %
Sodium Nitrate	7631-99-4	0-10 %
Inert fillers	-	0-10 %

4. FIRST AID MEASURES

DYNO
Dyno Nobel
Groundbreaking Performance

Inhalation	If inhaled, remove from contaminated area. Apply artificial respiration if not breathing. Seek immediate medical attention
Ingestion	Unlikely to occur due to the physical state of the product. However, if ingested, Do NOT induce vomiting. Wash out mouth with water. Seek immediate medical attention.
Skin	Immediately wash contaminated skin with plenty of soap and water. Remove contaminated clothing and wash before re-use. Can be absorbed through the skin with resultant toxic effects. Seek immediate medical advice.
Eye	If contact with the eye(s) occurs, wash with copious amounts of water holding eyelid(s) open. Take care not to rinse contaminated water into the non-affected eye. If symptoms persist seek medical attention.
First Aid Facilities	Eye wash fountain, safety shower and normal washroom facilities.
Advice to Doctor	Treat symptomatically.

5. FIRE FIGHTING MEASURES

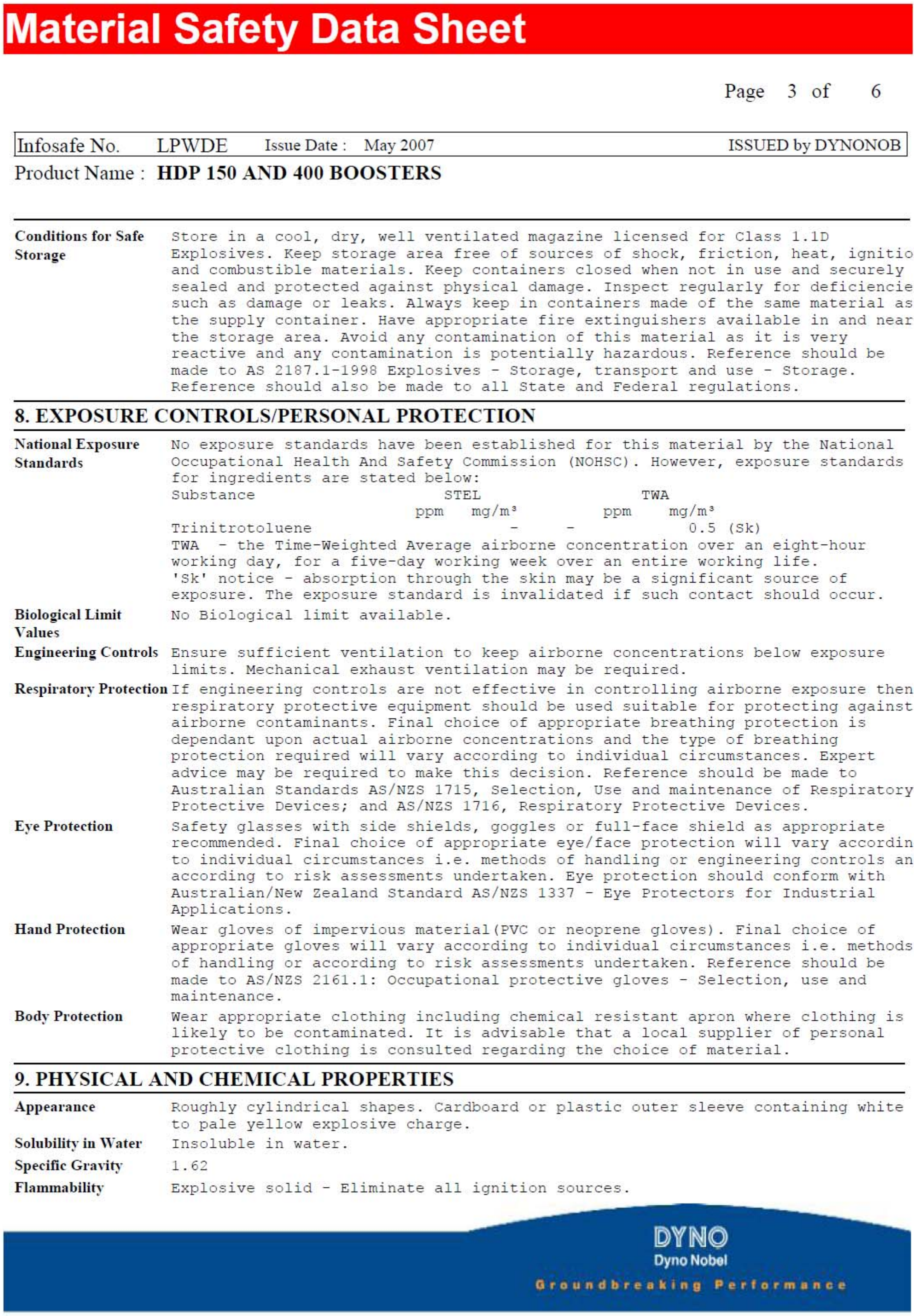
Suitable Extinguishing Media	DO NOT FIGHT FIRES. Immediately isolate area and evacuate personnel to a safe distance.
Hazards from Combustion Products	Under fire conditions this product will emit toxic and/or irritating fumes including carbon monoxide and carbon dioxide.
Special Protective Equipment for fire fighters	Fire fighters should wear full protective clothing and self-contained breathing apparatus (SCBA) operated in positive pressure mode. Use water spray to disperse vapours.
Specific Hazards	Will explode if suitably primed. Avoid extreme conditions of heat or shock. DO NOT FIGHT ANY FIRES. In the cases of a fire, if explosive is burning, immediately isolate area and evacuate personnel to a safe distance. Evacuate up wind as toxic fumes may be generated as the product decomposes.
Hazchem Code	E

6. ACCIDENTAL RELEASE MEASURES

Emergency Procedures	Shut off all possible ignition sources. Isolate and install signals for the area of spill. Contain the source and spread of the spill and ensure that the material does not enter any waterways or drains. Collect with anti-spark tools and place in clean, approved containers which are then labelled and sealed. Surplus or defective explosives must not be placed in any waterway, thrown away, discarded or placed with rubbish.

7. HANDLING AND STORAGE

Precautions for Safe Handling	Use smallest possible amounts in designated areas with adequate ventilation. Avoid sources of shock, friction, heat and ignition. Avoid contact with oxidising materials. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Label containers. Keep containers closed when not in use. Wear appropriate protective equipment to prevent inhalation, skin and eye contact. It is essential that all who come into contact with this material maintain high standards of personal hygiene ie. Washing hands prior to eating, drinking, smoking or using toilet facilities.



Material Safety Data Sheet

Conditions for Safe Storage Store in a cool, dry, well ventilated magazine licensed for Class 1.1D Explosives. Keep storage area free of sources of shock, friction, heat, ignition and combustible materials. Keep containers closed when not in use and securely sealed and protected against physical damage. Inspect regularly for deficiencies such as damage or leaks. Always keep in containers made of the same material as the supply container. Have appropriate fire extinguishers available in and near the storage area. Avoid any contamination of this material as it is very reactive and any contamination is potentially hazardous. Reference should be made to AS 2187.1-1998 Explosives - Storage, transport and use - Storage. Reference should also be made to all State and Federal regulations.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

National Exposure Standards No exposure standards have been established for this material by the National Occupational Health And Safety Commission (NOHSC). However, exposure standards for ingredients are stated below:

Substance	STEL		TWA	
	ppm	mg/m³	ppm	mg/m³
Trinitrotoluene	-	-		0.5 (Sk)

TWA - the Time-Weighted Average airborne concentration over an eight-hour working day, for a five-day working week over an entire working life.
'Sk' notice - absorption through the skin may be a significant source of exposure. The exposure standard is invalidated if such contact should occur.

Biological Limit Values No Biological limit available.

Engineering Controls Ensure sufficient ventilation to keep airborne concentrations below exposure limits. Mechanical exhaust ventilation may be required.

Respiratory Protection If engineering controls are not effective in controlling airborne exposure then respiratory protective equipment should be used suitable for protecting against airborne contaminants. Final choice of appropriate breathing protection is dependant upon actual airborne concentrations and the type of breathing protection required will vary according to individual circumstances. Expert advice may be required to make this decision. Reference should be made to Australian Standards AS/NZS 1715, Selection, Use and maintenance of Respiratory Protective Devices; and AS/NZS 1716, Respiratory Protective Devices.

Eye Protection Safety glasses with side shields, goggles or full-face shield as appropriate recommended. Final choice of appropriate eye/face protection will vary according to individual circumstances i.e. methods of handling or engineering controls and according to risk assessments undertaken. Eye protection should conform with Australian/New Zealand Standard AS/NZS 1337 - Eye Protectors for Industrial Applications.

Hand Protection Wear gloves of impervious material(PVC or neoprene gloves). Final choice of appropriate gloves will vary according to individual circumstances i.e. methods of handling or according to risk assessments undertaken. Reference should be made to AS/NZS 2161.1: Occupational protective gloves - Selection, use and maintenance.

Body Protection Wear appropriate clothing including chemical resistant apron where clothing is likely to be contaminated. It is advisable that a local supplier of personal protective clothing is consulted regarding the choice of material.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance Roughly cylindrical shapes. Cardboard or plastic outer sleeve containing white to pale yellow explosive charge.

Solubility in Water Insoluble in water.

Specific Gravity 1.62

Flammability Explosive solid - Eliminate all ignition sources.

10. STABILITY AND REACTIVITY

Stability and Reactivity	Detonation can occur from impact, friction and excessive heating.
Chemical Stability	Stable under normal conditions.
Conditions to Avoid	Avoid sources of heat and shock to the product.

11. TOXICOLOGICAL INFORMATION

Toxicology Information	NO LD50 data available for the actual product. Oral LD50 (rat) : 795 mg/kg (TNT). Oral LD50 (rat) : 35 500 mg/kg (PETN). For TNT, dermatitis, cyanosis, gastritis, liver damage and aplastic anaemia are commonly quoted effects of exposure. Other occasional effects include blood destruction, leucocytosis or leucopoenia, central nervous system effects, peripheral neuritis and muscular pain, cardiac muscular and menstrual irregularities and urinary and renal Cataracts in the eyes have been reported following chronic exposure. PETN is a vasodilatory agent therefore can cause lowering of blood pressure. Exposure to high doses of PETN may result in headaches, weakness and dizziness.
Inhalation	Toxic by inhalation. Inhalation of high concentrations of this product will result in headache, dizziness, mental depression, nausea, vomiting, narcosis, anaesthesia and coma.
Ingestion	Toxic if swallowed. Will cause irritation to the mouth, esophagus and stomach. Symptoms may include nausea, headaches, dizziness, vomiting, abdominal pains, chemical burns to the gastro-intestinal tract with resultant bleeding, and possible shock. Damage to the liver, kidney and renal failure may also occur.
Skin	Toxic if absorbed through the skin. Contact with liquid may cause blisters which appear after several hours with little or no pain. Skin resembles second degree burns. May cause toxic and allergic dermatitis.
Eye	Dust or particulate matter may be an eye irritant.
Chronic Effects	Prolonged or repeated skin contact may cause defatting leading to dermatitis. Evidence from human exposure data and animal tests is available to indicate that repeated or prolonged exposure to the TNT contained in this material (by any route) could result in liver, blood, bone marrow, eye kidney and nervous system disorders. The ingestion of alcohol may increase susceptibility of the effects of TNT.

12. ECOLOGICAL INFORMATION

Ecotoxicity	May cause long term adverse effects in the aquatic environment.
Persistence / Degradability	No data available for this specific product.
Mobility	No data available for this specific product.
Environ. Protection	Prevent this material entering waterways, drains and sewers.

13. DISPOSAL CONSIDERATIONS

Disposal Considerations

Destruction of explosives must be carried out by suitably qualified personnel. If necessary, the relevant statutory authorities must be notified.

In all circumstances, detonation is the preferred method disposal. Do not burn, ask Dyno Nobel for advice and assistance.

The residue from spills and the burning of explosives may be toxic to livestock and/or wildlife.

DETONATION:
The explosives to be destroyed must be placed in direct contact with fresh priming charge in a hole which is at least 0.6 m deep and then adequately stemmed. No detonators are to be inserted into
defective explosives. Personnel must be evacuated to a safe distance in accordance with relevant local regulations prior to initiation of the charge.

NOTE: Detonations in loose or stony ground may be expected to cause fly rock.

14. TRANSPORT INFORMATION

Transport Information

This material is classified as a Class 1 (Explosive) Dangerous Good according to The Australian Code for the Transport of Dangerous Goods by Road and Rail.
Dangerous goods of Class 1 (Explosive) are incompatible in a placard load with any of the following:

- Class 2.1, Flammable Gas
- Class 2.2, Non-flammable Non-toxic Gas
- Class 2.3, Toxic Gas
- Class 3, Flammable Liquid
- Class 4.1, Flammable Solid
- Class 4.2, Spontaneously Combustible Substance
- Class 4.3, Dangerous When Wet Substance
- Class 5.1, Oxidising Agent
- Class 5.2, Organic Peroxide
- Class 6, Toxic and Infectious Substances
- Class 7, Radioactive Substance
- Class 8, Corrosive
- Class 9 - Miscellaneous Dangerous Goods
- Fire risk substances

U.N. Number	0042
Proper Shipping Name	BOOSTERS
DG Class	1.1D
Hazchem Code	E
Packaging Method	E107
Packing Group	see 'Other information' (*)
EPG Number	EXP1
IERG Number	02
Other Information	(*) Unless specific provision to the contrary is made, the packagings used for explosives shall comply with at least the requirements for solids or liquids (as appropriate) of Packing Group II (medium danger). Further information related to packaging, IBCS and Unit loads for explosives can be obtained from Australian Explosives Code.

15. REGULATORY INFORMATION

Poisons Schedule	Not Scheduled
Hazard Category	Toxic,Explosive

16. OTHER INFORMATION

Date of preparation or last revision of MSDS	MSDS created: May 2007
Contact Person/Point	Dyno Nobel Asia Pacific Limited Mt Thorley Technical Centre Telephone: +61 2 6574 2500 Fax: +61 2 65 74 6849

DISCLAIMER: The information and suggestions above concern explosive products which should only be dealt with by persons having appropriate technical skills, training and licences. The results depend to a large degree on the conditions under which the products are stored, transported and used.
While Dyno Nobel Asia Pacific makes every effort to ensure the details contained in the data sheet are as current and accurate as possible the conditions under which its products are used are not within Dyno Nobel Asia Pacific Limited's control. Each user is responsible for being aware of the details in the data sheet and the product applications in the specific context of the intended use. Buyers and users assume all risk, responsibility and liability arising from the use of this product and the information in this data sheet. Dyno Nobel Asia Pacific Limited is not responsible for damages of any nature resulting from the use of its products or reliance upon the information. Dyno Nobel Asia Pacific Limited makes no express or implied warranties other than those implied mandatory by Commonwealth, State or Territory legislation.

...End Of MSDS...

Appendix A
Task Order Scope of Work

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FORT RUCKER

1.0 Background and Introduction

This requirement is for environmental remediation services for four (4) sites at the following installation: Fort Rucker, located near Dothan, Alabama. One site is being addressed under the Installation Restoration Program (IRP) and the other three under the Military Munitions Response Program (MMRP). The Department of Defense (DoD) established the MMRP under the Defense Environmental Restoration Program (DERP) to address unexploded ordnance (UXO), discarded military munitions (DMM), and munitions constituents (MC) located on current and former military installations.

The Contractor shall be responsible for conducting required environmental restoration services for which the United States Department of the Army (the “Army”) is statutorily responsible; addressing any and all unforeseen environmental, scheduling, and regulatory issues; and, assuming contractual liability and responsibility for the achievement of the performance objectives for the cleanup sites at Fort Rucker (the “Installation”) identified in this Task Order, including any sites with off-installation contamination for which the Army is responsible. Contractors should note that "unforeseen environmental issues" include unknown and/or varied concentrations of contaminants at cleanup sites (off-installation areas included) identified in this Task Order, but not unknown sites (e.g., sites not identified in this Task Order).

Fort Rucker is located in southeast Alabama approximately 20 miles northwest of the city of Daleville. It occupies 62,430 total acres with 57,885 acres at the main installation and 4,545 acres of satellite airfields, leases and easements. In 1973, Fort Rucker became the center for all US Army aviation flight training. Since then, its mission has been to maintain and operate facilities and provide services and material to support the helicopter pilot training for the Army. In addition to Fort Rucker's role as the Army's Aviation Center, it houses several tenant activities and directorates. Fort Rucker is the home for the Army Safety Center, the US Army Aviation Development Test Activity, the Aeromedical Center and Aeromedical Research Laboratory, and a Human Engineering Laboratory.

Under this Task Order, the contractor will perform munitions response actions for military munitions (MM) and munitions debris (MD). Activities may involve munitions and explosives of concern (MEC), which includes UXO, DMM, and MC if found in high enough concentrations to cause an explosive threat, non-explosive concentrations of MC and incidental contaminants not related to MM.

Remediation of the IRP site is being conducted under a Resource Conservation and Recovery Act (RCRA) Hazardous and Solid Waste Amendments (HSWA) Permit, with regulatory coordination, as appropriate, by the Alabama Department of Environmental Management (ADEM) and the United States Environmental Protection Agency (USEPA) Region IV. To perform munitions responses, the DoD primarily uses CERCLA. However, the State has identified the MMRP sites as Areas of Concern (AOC)s for corrective action under the installation’s RCRA Permit. The DoD has recently revised their Ammunition and Explosives Safety Standards (DoD 6055.09-STD) (Feb 08) and additionally this document must be adhered to in the investigation and remediation of sites with MEC.

Certain solid and hazardous wastes may be an issue at sites covered by this Task Order. Cleanup of wastes may be warranted if they present an imminent and substantial endangerment to the public health or welfare that results in an unacceptable risk. However, funding will not be provided for responses that are not in full compliance with CERCLA, RCRA, the Defense Environmental Restoration Program (DERP), and DoD and Army policy.

2.0 Types of Services Required

This task order includes the following types of services as authorized in Section C.3 of the basic contract:

☒ Site Characterization/Investigation

☒ Studies and Reports

☒ Support of Remedial Actions

☒ Remediation

☒ Monitoring

☒ MEC Support

3.0 Task Order Type

☐ Firm- Fixed Price (w/ insurance)

☒ Firm-Fixed Price (w/o insurance)

☐ Fixed Price with Award Fee

4.0 Performance Objectives and Standards

The Contractor shall be required to furnish all plant, labor, materials, and equipment necessary to meet the performance objectives and standards identified in Table 1 below. The status of the remediation efforts for each site can be found in the documents provided in Table 2 of this Performance Work Statement (PWS).

Table 1: Performance Requirements Summary.

Performance Objective	*Performance Standards*
Approved Project Management Plan (PMP) and Quality Assurance Surveillance Plan (QASP): • Draft PMP and QASP within 30 calendar days of Task Order award, • Final PMP within 30 calendar days of receipt of COR comments on the drafts.	Army approval through the Contracting Officer’s Representative (COR).

Performance Objective	*Performance Standards*
Achieve Record of Decision/ Decision Document (ROD/DD) at the following sites by October 30, 2010: • FTRU-001-R-01 – Anti-Tank/Rocket Grenade Range • FTRU-003-R-01 – Infiltration/Grenade Range • FTRU-004-R-01 - .22 Caliber Target Butt	Department of Defense Explosives Safety Board (DDESB) approval of contractor prepared Explosives Safety Submission (ESS) or Explosives Site Plan (ESP). Army approval through the COR and Regulator acceptance (e.g., receipt of documentation confirming acceptance of ROD/DD).
Achieve Remedy in Place (RIP) at the following sites by February 28, 2010: • AOC-S – PCE in GW near SWMU 8 Upon achievement of RIP, perform Remedial Action (Operations) (RA(O)) at the above sites for the duration of the Task Order or until achievement of Response Complete (RC), whichever comes first. Upon achievement of RC, perform any necessary Long-Term Management (LTM) at the above sites for the duration of the Task Order.	Compliance with the RCRA HSWA Permit #6210020776 and associated schedules. Army approval through the COR and Regulator approval (e.g., receipt of documentation confirming RIP/RC; RA(O)/LTM exit or ramp down strategy; RA(O)/LTM reports incorporating requirements of the exit or ramp down strategy).
For all remedies, optimize capital and long-term costs.	Acceptance by the COR that the Contractor has demonstrated that the proposed remedy represents the lowest 30-year present worth cost to the Army, and is acceptable to the regulators.
Complete all Remedy reviews required for the sites identified above, for the duration of the Task Order. Correct any deficiencies noted in the Remedy reviews. Consolidate Remedy reviews into a single installation-wide review conducted at the conclusion of the Task Order.	Army approval through the COR and Regulator approval (e.g., formal documentation accepting the reviews and any corrections).

Remedy in Place, Remedial Action (Operations), Response Complete, ROD/DD and Long-Term Management are terms used for the Defense Environmental Restoration Program. These terms are defined in Attachment C.

5.0 Project Management Requirement(s)

This Task Order incorporates all the Project Management requirements established in Section C.4.1.1 through C.4.1.13 of the basic contract (e.g., Project Management Plan, Project Schedule, Status Reports and Milestone Presentations, Environmental Requirements, Health and Safety Requirements, Quality Control Testing, Project Repository and Administrative

Record, Regulatory Involvement, Public Involvement, Additional Site Plans, Project Stakeholders, and Deliverable Requirements), in addition to the following:

5.1 Project Management Plan

The Contractor shall develop and maintain a detailed Project Management Plan (PMP) in accordance with the requirements of Section C.4.1.1.1 of the basic contract. The draft PMP shall be due within thirty (30) calendar days of Task Order award and shall include a payment milestone plan prepared in accordance with the requirements of Section C.4.1.4 of the basic contract. The final PMP shall be due within 30 calendar days of receipt of COR comments on the draft PMP. The draft PMP, proposed payment milestones, and subsequent revisions shall be subject to Army review and approval, through the COR. A payment milestone will be established for Army approval of the final PMP through the COR. As part of the PMP, the contractor will identify a means for providing status reports to the Army COR in accordance with Section C.4.1.3 of the basic contract.

5.2 Project Schedule

As part of the PMP, the Contractor shall develop and maintain an Activity-Based Schedule that fully supports the technical approach and outlines activities and milestones defined at the appropriate detail level and logically sequenced to support and manage completion of the performance objectives in this Task Order. Additionally, the due dates for all payable deliverables shall be identified in accordance with Section C.4.1.2 of the basic contract. It is the Army's intent to make all payments after verification of milestone completion in accordance with this schedule. Unless otherwise noted in Table 1, all performance objectives must be completed within the allowable Task Order period of performance provided all Task Order options have been exercised.

5.3 Milestone Presentations

Milestone presentations shall be made in accordance with the requirements of Section C.4.1.4 of the basic contract. Interim milestones proposed by the Contractor are subject to Army review and approval in accordance with Section C.4.1.4.2 of the basic contract. At the COR's request, the Contractor may also make milestone presentations to the other project stakeholders, consistent with the applicable regulatory drivers listed in Section 1.0 of this Task Order, to show achievement of the performance objectives. This includes participation in annual Installation Action Plan (IAP) meetings, if requested by the COR. Certification and approval of project milestones will be made in accordance with Section C.6.1 of the basic contract.

5.4 Environmental Requirements

The Contractor shall comply with all Environmental Requirements identified in Section C.4.1.5 of the basic contract.

The Army is in the process of establishing a Standard Operating Procedure and a Geographic Information System (GIS)-based tracking system to ensure that Land Use Controls (LUCs) are enforced. The LUCs will be incorporated into the post-wide Master Plan and compliance with LUCs will be reported in the Monitoring Reports for each site. The Contractor is required to comply with the LUC policy in all RA(O), LTM and CERCLA 121(c) and Remedy review activities.

The Contractor shall adhere to all applicable federal, DoD, and Army geospatial data standards for tasks and deliverables in this Task Order. Spatial data shall conform to the Federal Geographic Data Committee (FGDC) National Standard for Spatial Data Accuracy (NSSDA). In addition, each Geographic Information System (GIS) data set shall be accompanied by metadata conforming to FGDC's Content Standard for Digital Geospatial Metadata (CSDGM) and be provided in a geodatabase that is compliant with the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE). The horizontal accuracy of any GIS data created by the contractor shall be tested in accordance with the NSSDA and the results shall be recorded in the metadata. All data shall be provided in the Universal Transverse Mercator (UTM) project in the appropriate zone, and shall have a datum of WGS84.

The Contractor shall review and fully understand "Executive Order 13423 -- Strengthening Federal Environmental, Energy, and Transportation Management," in particular those requirements pertaining to environmental management system (EMS). The Contractor shall also be required to review and adhere to the installation's environmental management system, including the environmental policy and significant aspects / impacts.

5.4.1 MEC Related Guidance

MEC related guidance includes, but may not be limited to, the following:

- MEC includes: UXO, as defined in 10 U.S.C. 101(e)(5); DMM, as defined in 10 U.S.C. 2710(e)(2); or MC, as defined in 10 U.S.C. 2710(e)(3) (Reference (ai)), present in high enough concentrations to pose an explosive hazard.
- MEC distinguishes specific categories of military munitions that may pose unique explosives safety risks. Because MEC that is being actively managed may be determined to be hazardous wastes, 29 Code of Federal Regulations (CFR), Hazardous Waste Operations and Emergency Response, Section 1910.120 may apply.
- Per the guidelines set forth in DoDI 4140.62 and DDESB Technical Paper 18, UXO qualified personnel will be responsible for determining the explosive safety status of any material recovered that may pose an explosive hazard (i.e., material potentially presenting an explosive hazard (MPPEH)).
- Should MEC be encountered during this response, UXO-qualified personnel will evaluate the explosive hazard and remove it, including by open detonation in place. This response will be conducted per the CERCLA and the NCP, applicable state and federal regulation, and applicable DoD, U.S. Army policies and procedures.

5.5 Health and Safety Requirements

Prior to beginning any field work, the Contractor shall implement a written Safety and Health Program and Site Safety and Health Plan (SSHP) in accordance with Section C.4.1.6 of the basic contract. Additionally, the Contractor must adhere to all DoD policies, procedures and regulations for munitions response. This includes but is not limited to DoD 6055.09-STD, DoD Ammunition and Explosives Safety Standards; Army Regulation 385-10, the Army

Safety Program; Department of Army Pamphlet 385-63, Range Safety; Department of Army Pamphlet 385-64, Ammunition and Explosives Safety Standards; and training and medical screening per 29 CFR 1910.120(e).

The sites are not suspected to contain Chemical Warfare Materiel (CWM); however, if suspect CWM is encountered during any phase of site activities the Contractor shall immediately halt operations and contact the COR for assistance and guidance.

All activities involving work in areas potentially containing MEC hazards shall be conducted in full compliance with Department of Army, state, and local requirements regarding personnel, equipment and procedures, and DoD Standard Operating Procedures and safety regulations.

5.5.1 Personnel Qualifications and Work Week

Personnel involved in certain munitions response activities will, as required, meet the qualifications of DDESB, Technical Paper (TP) 18 - Minimum Qualifications for UXO Technicians and UXO-Qualified Personnel. Due to the inherent risks associated with munitions response activities, personnel performing munitions response activities that present an explosive risk shall be limited to a 50-hour work week, with no individual workday exceeding 10-hours total, unless specifically authorized by the COR.

5.5.2 Safety Documentation and Reporting

Army Engineering Manual 385-1-1, part 01.D "Accident Reporting and Recordkeeping" is required for the work identified in this PWS.

5.6 Quality Management

Since the technical approach for this Performance-Based Acquisition (PBA) shall be developed by the Contractor, the Contractor shall develop a proposed Quality Assurance Surveillance Plan (QASP) for use by the Army. A Draft QASP using the template provided in Attachment D shall be submitted with the PMP deliverables within thirty (30) calendar days of award. The Final QASP will be prepared by the Army.

The QASP should highlight key quality control activities or events that the COR will use to determine when Army (COR or Contracting Officer (KO)) inspections can be conducted to assess progress toward and/or completion of milestones. Activities identified in the QASP should be appropriately coded in the project schedule to allow for planning of QA inspections.

5.6.1 Quality Control Testing

The Contractor shall comply with all Quality Control Testing requirements identified in Section C.4.1.7 of the basic contract. Additionally, the Contractor may establish an on-site testing laboratory at the project site if determined necessary by the Contractor. However, on-site testing shall meet the requirements of USEPA, specific state regulator requirements, and all requirements of the most recently approved DoD Quality Systems Manual.

5.7 Project Repository and Administrative Record

A project repository and the Administrative Record for the Installation are currently maintained at the US Army Aviation Warfighting Center, Building 1121, Fort Rucker, AL.

The Contractor shall comply with Section C.4.1.8 of the basic contract. Additionally, the Contractor shall update at least monthly a multimedia (i.e., both paper and electronic format) project repository of all project-related information to ensure that pertinent documentation and data are available for project reviews, and to provide a clear record of the PBA approach to support final decisions and remediation completion. The Contractor shall also update the repositories for the Administrative Record for CERCLA activities, as needed. Final electronic document files must be in text-searchable PDF format and be accompanied by defined metadata for upload into the Army Repository of Environmental Documents (READ). The Army, through the COR, will provide the metadata field requirements for READ to the Contractor.

5.7.1 Army Environmental Database and Environmental Restoration Information System

The Contractor shall comply with all applicable requirements for data validation and submission for Army Environmental Databases and Environmental Restoration Information System (ERIS) in accordance with Section C.4.1.8.2 of the basic contract. Once a site identified in this Task Order has achieved Response Complete (i.e., appropriate documentation is finalized), the Contractor shall be responsible for providing the COR with the data and documentation necessary for the closeout of each site in the Army Environmental Database - Restoration Module (AEDB-R). In addition, the Contractor shall upload at least quarterly, all generated analytical data into the Environmental Restoration Information System (ERIS). The Army, through the COR, will provide data specifications for AEDB-R and ERIS to the Contractor. The Contractor shall comply with all applicable requirements for data validation and submission.

5.8 Additional Site Plans

Prior to beginning any field work the Contractor shall prepare any additional plans or documents (e.g., sampling and analysis plans, quality assurance project plan, waste minimization plans, health and safety plans) consistent with Section C.4.1.11 of the basic contract, the applicable regulatory drivers listed in Section 1.0 of this Task Order, and any other agreements, orders, or regulations that apply to the Installation and sites. These plans and documents shall be subject to Army review and approval, through the COR.

5.9 Project Stakeholders

For the purposes of this Task Order, project stakeholders pursuant to Section C.4.1.12 of the basic contract include the Army, ADEM, and USEPA Region 4. Required level of stakeholder involvement may differ from site to site and the Contractor shall be responsible for obtaining comments with appropriate approval or concurrence on project deliverables consistent with applicable regulatory drivers and agreements for each site to comply with Section C.4.1.9 and C.4.1.10 of the basic contract.

5.9.1 Regulatory Involvement

The requirements of Section C.4.1.9 of the basic contract apply to this contract. Additionally, with approval of the COR, the contractor may also informally discuss remediation issues with regulators and provide an after-action report back to the COR.

5.9.2 Restoration Advisory Board

Fort Rucker does not have a Restoration Advisory Board (RAB). Community involvement in a RAB was last sought in August 2008 and there was no expressed interest. However, the Contractor is responsible for conducting a biannual public interest assessment. If the assessment(s) indicate adequate public interest exists, the Contractor shall assist the COR, as necessary, in conducting each RAB meeting and communication.

The Contractor is responsible for developing an approved community involvement plan, as appropriate, to achieve the objectives for the sites in this PWS.

5.9.3 Communications

The Contractor shall not make available or publicly disclose any data or report generated under this contract unless specifically authorized by the COR. If any person or entity requests information from the Contractor about the subject of this scope of work or work being conducted hereunder, the Contractor shall refer them to the COR. All reports and other information generated under this scope of work shall become the property of the Government, and distribution to any other source by the Contractor is prohibited unless authorized by the COR.

5.10 Deliverable Requirements

The requirements of Section C.4.1.13 of the basic contract apply to this Task Order except that the Army, through the COR, will receive initial draft documents and will provide comments to the Contractor within 20 business days.

The Contractor shall follow the substantive requirements for all subject areas of the US Army Corps of Engineers (USACE) guidance applicable to deliverables required for achievement of performance objectives identified in this PWS. If versions of Engineer Manuals, Data Item Description (DID), etc. are updated, the substantive requirements of the most recently approved version will apply to this PWS. The requirements can be found at http://www.hnd.usace.army.mil/oew/CX_mission.aspx.

In addition, the Munitions Response Site Prioritization Protocol (MRSPP) requirements in 32 CFR Section 179 require the DoD in consultation with representatives of the states and Indian tribes, to assign each Munitions Response Site (MRS) a relative priority for response actions. The initial MRSPP score for MRSs is developed during the SI phase. These MRSPP scores must be reviewed annually and must be revised whenever new data are obtained. Pursuant to this requirement, the Contractor shall annually review, revise MRSPP scores based on new information, and submit to the Army by 30 November. In addition, the Contractor shall also include any information that may have influenced the MRS priority or MRS sequencing decision in the Administrative Record and the Information Repository. Furthermore, the FY02 Defense Authorization Act creating the MMRP requires DoD to develop and maintain an inventory of defense sites that are known or suspected to contain UXO, DMM or MC. Pursuant to this requirement, the Contractor shall submit annual updates to the Installation Munitions Response (MR) map that reflect changes to the location, boundaries and/or extent of the MMRP sites in .pdf format by 30 November.

The Contractor shall propose deliverables and payment milestones as part of its proposal, and if approved by the Army, included as part of the PMP. Final decisions regarding the adequacy of milestone and deliverable completion resides with the COR (see *Section 4.3, Milestone Presentations*) and will be based on the appropriate acceptance and approval of required documentation by Regulatory Agencies, consistent with CERCLA and the NCP. Note that the two annual deliverables due by 30 November will not be accepted as interim payment milestones.

6.0 Key Personnel Requirements

The Government requires that the following positions, at a minimum, be designated as "key personnel," subject to the terms and conditions for such set forth in Section C.5 and H of the basic contract.

POSITION	PERSONNEL
Project Manager	[TBD]
Senior Scientist/Engineer	[TBD]
Military Munitions Specialist	[TBD]

7.0 Performance

7.1 Period: date of award through 31 December 2015, inclusive of all options

7.2 Primary Location: Fort Rucker, Dothan, AL

7.3 Basic and Optional Requirements: [to be developed during proposal process]

8.0 Other Requirements

8.1 Government Property

8.1.a Government-Furnished Property (and Resources)

This Task Order incorporates all the Additional Requirements established in Section C.6.3 of the basic contract. In addition to the Government-furnished resources identified herein, the Army, through the COR, shall also make available the following resources to the Contractor:

- The existing Rights of Entry (ROEs) for sites included in this Task Order provide for the existing four (4) wells in the off-site area of the AOC-S plume.
- All Army-owned property used for remediation purposes. This property must be maintained by the Contractor in accordance with applicable maintenance requirements and may not be replaced by the Army should new equipment be required.

- GIS database resources from the SI reports will be provided by the COR following Task order award.

8.1.b Contractor-Furnished and/or Acquired Property (and Resources)

The contractor must possess all the required expertise, knowledge, equipment, and tools required to meet or exceed the government’s objectives identified in this PWS in accordance with established industry standards. This Task Order incorporates all the Additional Requirements established in Section C.6.4 of the basic contract, in addition to the following:

- The provision and cost of the utilities associated with implementation of remedies, including installation of individual meters for necessary utilities.

In addition to the contractor-furnished equipment and resources identified herein, the Contractor shall also be responsible for the following:

- All waste generated under this Task Order.

8.2 Contractor's Guarantee

The following definitions apply to this PWS:

- "Project Price" for each site identified in this Task Order will be equal to the approved proposed price for achieving the performance objectives identified in the PWS (excluding the PMP). The Project Price payment will be tied to one or more project milestones.
- "Guarantee Limit" is equal to one and one half (1.5) times the sum of all of the Project Prices for the sites identified in this PWS provided the contractor maintains a COR assigned performance rating of acceptable or higher in accordance with the QASP performance standards throughout the life of the contract.
- "Contractor's Project Costs" are defined as those costs incurred by the Contractor (including costs covered by insurance) in executing the work required to achieve the performance objectives identified in the PWS (excluding the PMP), for all sites identified in this Task Order.

The Contractor guarantees to complete and meet all of the performance objectives, subject to the Guarantee Limit. This guarantee by the Contractor shall not exceed the Guarantee Limit. In the event the Contractor's Project Costs reach 80% of the Guarantee Limit, the KO, COR and the Contractor shall enter into discussions to determine if completion can be accomplished within the Guarantee Limit. If it is determined that completion will not be accomplished within the Guarantee Limit, work on the contract will stop when 100% of the Guarantee Limit is reached; unless and until there is agreement by modification to the contract to continue and U.S. Army Environmental Command (USAEC) has committed adequate funding.

8.3 Insurance Specifications

If the Contractor chooses to use environmental insurance as part of their risk management approach on this PWS and will request a separate contract line item for environmental insurance, the following requirements apply:

The Contractor shall procure Environmental Insurance (EI) in the form of Remediation Stop Loss Insurance (Clean Cost Cap or CCC) and thereafter carry and maintain the EI coverage in full force and effect over the duration of the contract, to include options, at all sites identified in this PWS as requiring EI. The EI shall meet or exceed the following objectives:

1. Provides coverage applicable to the sites, performance objectives, and performance standards identified in Table 1 of this PWS as requiring insurance, and confirms that all the obligations assumed under this PWS are incorporated into the definition of the insured "remedial plan" as specified in the insurance endorsements.
2. Provides coverage at a minimum, equal to the Guarantee Limit of the PWS, minus insurance, travel, and PMP costs and costs for any site locations excluded from the award or not requiring insurance.
3. Coverage to include a Waiver of Subrogation, as applicable, for claims associated with matters and scope items addressed in this PWS that the Contractor or insurance company may have against the Army.
4. Coverage provided from a carrier rated A.M. Best's A- (Excellent) and Financial Size Category (FSC) IX or better.
5. Requires that technical and schedule progress reports to be provided to the Army on the same schedule that they are provided to the insurance carrier.
6. Contains no "War Exclusion" or contains a limited war exclusion that excludes cleanup costs caused solely by a hostile or violent act of war after the inception date.
7. Provides the Army the primary right to assign the policy to a replacement contractor acceptable to the insurance company should the Contractor default or otherwise be unable to meet the PWS requirements.

The Contractor must provide proof of insurability with the submitted proposal. Proof of insurability will be in the form of a draft policy specifying terms and conditions (e.g., all endorsements) in sufficient detail to allow evaluation of:

- The identity of the insurance companies offering to insure the contractor;
- The limits of liability for each coverage part;
- The premium for each policy or coverage part;
- The amount of the self-insured retention, buffer layer (if applicable), and /or co-insurance;
- The policy length (term) for each policy;
- The policy forms, and proposed endorsements;
- The insured scope of work or definition of the insured remedial plan;
- A list of the documents provided to the underwriter as part of the application for insurance;
- The name of the insurance broker and the full compensation of the insurance broker including any and all commissions, fees, incentive payments, reinsurance commissions or wholesale brokerage commissions earned by any firm within the insurance brokers economic family disclosed as a separate cost item, even if these costs are incorporated into the premiums of the insurance policies being provided;
- How, in the event of Contractor default, its provisions will ensure that this PWS is completed to the satisfaction of the Army.
- Any exclusions to be added to these polices by endorsement along with an explanation of the rationale behind attaching the exclusion; and
- Any deviations from these insurance specifications with explanation using a checklist as to why the specification was not met, or why the deficiency in question is not material to the CCC coverage to be provided.

Within ten (10) workdays of contract award, the Contractor shall provide a quote letter containing a policy with endorsements to KO/COR. The KO and COR shall have the right to review the quote letter to ensure consistency with the objectives as listed above. The Government reserves the right to withhold or adjust payment for the insurance policy if the final bound policy terms and conditions are changed from the draft policy terms and conditions presented in the Contractor's proposal submittals. The Contractor is responsible for paying the costs associated with all insurance requirements, including but not limited to the self-insured retention and co-pays. Contractors should note that the Army will allow the first payment milestone to include necessary insurance costs (e.g., insurance premium).

A Certificate of Insurance shall be furnished to the KO on an annual basis evidencing the above insurance coverage is bound.

8.4 Stop Work

This Task Order supersedes the requirements established in Section C.6.10 of the basic contract as follows:

The Contractor, authorized Installation personnel, and the COR have the responsibility to stop work immediately if the work is considered to be a serious threat to the safety or health of workers, other personnel, or to the environment. Authorized Installation personnel include Installation safety officers, Environmental Division personnel, and command personnel with responsibility for overall Installation operations. When work is stopped due to a hazard/threat to worker safety, health, or the environment, the situation and resolution must be documented and submitted to the KO. Work must be stopped whenever chemical and biological warfare agents or radiological materials are encountered.

8.5 Environmental Responsibility Considerations

This Task Order incorporates all the Environmental Responsibility Considerations established in Section C.6.11 of the basic contract.

8.6 Inspections

The Army technical experts will independently review Contractor work to ensure compliance with all applicable requirements.

Remedy reviews conducted during the duration of the Task Order constitute a Government Inspection of Services. The Contractor will correct any problems and/or deficiencies noted within Remedy reviews or any Contractor furnished service or submittal.

Any service or submittal performed that does not meet Task Order requirements shall be corrected or re-performed by the Contractor and at no additional cost to the Government. Corrective action must be certified and approved by the COR consistent with Section C.6.1 of the basic contract. If the Contractor performs any task unsatisfactorily and not all defects are corrected, the Government reserves the right to terminate the Task Order for default. In addition, the Government reserves its rights under FAR clause 52.246-4, "Inspection of Services – Fixed Price, for further remedies concerning a Contractor's failure to perform in conformance with contract requirements. If the Contractor is conducting RA(O) or LTM, or completing a Remedy review, for a remedy that they did not implement or modify (i.e., an on-going pump and treat system inherited as part of the PBA scope), correction of substantive remedy deficiencies noted during RA(O), LTM or within a remedy review which may require modification of that remedy are considered outside the scope of this Task Order effort.

8.7 Organizational Conflicts of Interest

Any eligible ACSIM contractor currently performing work on Fort Rucker must ensure that all data pertaining to contamination at the sites compiled by or in the possession of such firm shall be made available to all potential contractors in a timely fashion to the maximum extent possible by providing such data to a data depository.

8.8 Access and Security

This Task Order incorporates all the Additional Requirements established in Section C.6.8 of the basic contract, in addition to the following:

In order to ensure the security and orderly running of Fort Rucker, any contractors, consultants, or visitors who wish to gain access to the Installation will need to follow procedures established by Fort Rucker. Due to security restrictions, detail of these and other procedures will be provided to the successful Contractor.

Limited ROEs are in currently place for AOC-S. If additional ROEs are required, a period of 120 calendar days should be used for planning purposes to allow the Government to obtain a simple ROE. If more complicated easements, restrictions or water rights are required, a period of 180 calendar days or greater should be anticipated.

8.9 Security/Classification:

☐ Classified (Level ____________)

DD Form 254 attached: Yes ☐ No ☐

☒ Unclassified

8.10 Applicable Labor Laws

8.10.a Service Contract Act Not Applicable ☐

Applicable ☒ SCA Wage Determination SCA Wage Determination No.: 2005-2005 Revision No.: 5 Date Of Revision: 06/12/2008

8.10.b Davis Bacon Act Not Applicable ☐

Applicable ☐ DBA Wage Determination

____

8.11 Travel

Travel to/from the Installation and to other CONUS locations for such purposes as to attend meetings, briefings, and/or presentations may be required incidental to this remedial action, the costs for which shall be included in the total price for the Task Order pursuant to Section C.6.2 of the basic contract.

8.12 Performance and Payment Bonds

In accordance with Section C.1.1.1 and C.1.1.3 of the base contract, the Contractor:

☒ is NOT required to furnish Performance and Payment Bonds on this Task Order.

☐ is required to furnish Performance and Payment Bonds on this Task Order in accordance with the following:

> The Contractor shall furnish a performance bond (Standard Form 1418) for the protection of the Government in an amount equal to 100 percent of the original contract price and a payment bond (Standard Form 1416) in an amount equal to 100 percent of the original contract price.
>
> The Contractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the Contracting Officer, prior to the start of any fieldwork after Task Order award.

8.13 Warranty

In accordance with Section C.1.1 and C.1.1.3 of the base contract, the Contractor:

☒ is NOT required to provide a 5-year warranty for each site as specified in this Task Order.

☐ is required to provide a 5-year warranty for each site as specified in this Task Order.

9.0 Contracting Officer's Representative [Information to be provided upon issuance of the Task Order]

Name:
Organization:
Address:
Address:
City, State, Zip Code:
Telephone:
Facsimile:
Email:

Attachment A: Reference Documents

The Army believes that documentation provided with the solicitation represents the most recent and appropriate documentation available for the Installation and sites identified in this Task Order. However, if there is a conflict between this information and other site documentation (the existing reports), the Contractor is solely responsible for reviewing all available information and forming their independent, professional conclusions/interpretation of site conditions and requirements to meet the objectives of this Task Order. This information is not intended as a substitute for complete analysis of technical data available, nor is it intended to be a guide on how the Contractor should address achievement of the performance objectives/standards.

Specific documents may be made available following a request to the Contracting Officer, if the documentation can be distributed in a timely manner. Electronic format is not guaranteed.

Table 2: Available Reference Documents.

Title	*Author*	*Date*
Draft RFI: AOC-S	CH2M HILL	February 2009
Final Site Inspection Report	Malcolm Pirnie	May 2005
Final Draft United States Army Military Munitions Response Program Munitions Response Remedial Investigation/Feasibility Study Guidance	US Army	October 2008

Attachment B: List of Acronyms

ACSIM	Assistant Chief of Staff for Installation Management
ADEM	Alabama Department of Environmental Management
AEDB-R	Army Environmental Database - Restoration Module
AR	Administrative Record
ARAR	Applicable or Relevant and Appropriate Requirement
CAIS	Chemical Agent Identification Sets
CCC	Clean Cost Cap
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLIN	Contract Line Item Number
COR	Contracting Officer's Representative
CPAR	Contractor Performance Assessment Report
CSDGM	Content Standard for Digital Geospatial Metadata
CWM	Chemical Warfare Materiel
DDESB	Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DMM	Discarded Military Munitions
DoD	Department of Defense
DTSC	Department of Toxic Substances Control
EI	Environmental Insurance
EMS	Environmental Management System
ERIS	Environmental Restoration Information System
ESP	Explosives Site Plan
ESS	Explosives Safety Submission
FAR	Federal Acquisition Regulation
FFA	Federal Facility Agreement
FGDC	Federal Geographic Data Committee
FSC	Financial Size Category
GIS	Geographic Information System
IAP	Installation Action Plan
IRIS	Integrated Risk Information System
KO	Contracting Officer
LTM	Long-Term Management
LUC	Land Use Controls
MC	Munitions Constituents
MCL	Maximum Contaminant Level
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
MM	Military Munitions
MMRP	Military Munitions Response Program
MPPEH	Material Potentially Presenting an Explosive Hazard
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
NCP	National Oil and Hazardous Substances Contingency Plan
NPL	National Priorities List
NSSDA	National Standard for Spatial Data Accuracy
NTP	Notice to Proceed
PBA	Performance Based Acquisition

P/C	Pollutants and/or Contaminants
PMP	Project Management Plan
POP	Period of Performance
PWS	Performance Work Statement
QA	Quality Assurance
QASP	Quality Assurance Surveillance Plan
RAB	Restoration Advisory Board
RA(O)	Remedial Action (Operations)
RC	Response Complete
RCRA	Resource Conservation and Recovery Act
RCWM	Recovered Chemical Warfare Materiel
RDX	Royal Demolition eXplosive
RfD	Reference Dose
RI	Remedial Investigation
RIP	Remedy In Place
ROE	Rights of Entry
ROD	Record of Decision
RPO	Real Property Officer
RSC	Range Support Center
SARA	Superfund Amendments and Reauthorization Act
SDSFIE	Spatial Data Standards for Facilities, Infrastructure, and Environment
SI	Site Inspection
SSHP	Site Safety and Health Plan
TNT	Trinitrotoluene
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
U.S.C.	United States Code
UST	Underground Storage Tank
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance

Attachment C: Definitions

Activity-Based Schedule: Activities and milestones defined at the detail level and logically sequenced to support, and manage completion of the performance objectives.

Chemical Warfare Materiel (CWM): An item configured as a munitions containing a chemical substance that is intended to kill, seriously injure, or incapacitate a person through its physiological effects. CWM also includes V- and G- services nerve agent, H-series blister agent, and lewisite in other than munitions configurations. Due to their hazards, prevalence, and military-unique application, Chemical Agent Identification Sets (CAIS) are also considered CWM. CWM does not include: riot control agent, chemical herbicides, smoke and flame producing items, or soil, water, debris, or other media contaminated with chemical agent.

Contractor's Project Costs: Costs incurred by the Contractor (including costs covered by insurance) in executing the work required to achieve the performance objectives identified in the PWS (excluding the PMP), for all sites identified in this Task Order.

Deliverables: Documentation or data that support the completion of milestones or achievement of the performance objectives identified in this Task Order.

Discarded Military Munitions (DMM): Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of consistent with applicable environmental laws and regulations.

Explosive Ordnance Disposal (EOD): The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded explosive ordnance. It may also include explosive ordnance that has become hazardous by damage or deterioration.

Guarantee Limit - is equal to one and one half (1.5) times the sum of all of the Project Prices for the sites identified in this PWS provided the contractor maintains a COR assigned performance rating of acceptable or higher in accordance with the QASP performance standards throughout the life of the contract.

Long-Term Management (LTM): The remedial phase including maintenance, monitoring, record keeping, remedy reviews, etc. initiated after response (removal or remedial) objectives have been met (i.e., after Response Complete). LTM includes development and implementation of an exit or ramp-down strategy for LTM activities at each site.

Milestones: Significant events or activities that occur in the course of the Contractor achieving the performance objectives identified in this Task Order.

Munitions Constituents (MC): Any materials originating from unexploded ordnance, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.

Munitions Debris (MD): Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.

Munitions and Explosives of Concern (MEC): This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means UXO, as defined in 10 .SC 101(e)(5)(A) through (C); DMM, as defined in 10 USC 2710(e)(2); or MC (e.g., TNT, RDX), as defined in 10 USC 2710(e)(3), present in high enough concentrations to pose an explosive hazard.

Military Munitions (MM): All ammunition products and components produced or used by or for the DoD or the U.S. Armed Services for national defense and security, including MM under the control of the DoD, the U.S. Coast Guard, the U.S. Department of Energy, and National Guard personnel. The term military munitions includes: confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries used by DoD components, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof. MM do not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components thereof. However, the term does include non-nuclear components of nuclear devices, managed under DOE's nuclear weapons program, after all required sanitization operations under the Atomic Energy Act of 1954, as amended, have been completed.

Munitions Response: A response action, including investigation, removal actions, and remedial actions, to address the explosives safety, human health, and/or environmental risks presented by munitions and explosives of concern (MEC) and/or MC.

PMP Documents: The original PMP (including project schedule), revisions, and status reports.

Project Documents (RCRA or CERCLA): Documentation and data required by RCRA or CERCLA remediation and RA(O) and/or LTM activities. These documents include the additional site plans referenced in Section 5.0 of this Task Order and Section C.4.1.11 of the basic contract.

Project Price: The approved proposed price for achieving the performance objectives identified in the PWS (excluding the PMP). The Project Price payment will be tied to one or more project milestones.

Project-related information: All previous environmental restoration documentation of a technical nature developed by the Army and previous Army contractors and subcontractors during their work at the sites specified in this Task Order, and all the documentation developed by the Contractor in order to achieve the performance objectives specified in this Task Order.

Remedial Action (Operations) [RA(O]: The remedial phase during which the remedy is in place and operating to achieve the cleanup objective identified in the Record of Decision (ROD) or other formal decision document. Any system operation (long-term operations) or monitoring (long-term monitoring) requirements during this time are considered RA(O). RA(O) includes development and implementation of an exit or ramp-down strategy for LTM activities at each site.

Remedy In Place (RIP): A final remedial action has been constructed and implemented and is operating as planned in the remedial design. An example of a remedy in place is a pump-and-treat system that is installed, is operating as designed, and will continue to operate until cleanup levels have been attained. Because operation of the remedy is ongoing, the site cannot be considered Response Complete.

Response Complete (RC): The remedy is in place and the required remedial action-operations (RA-O) have been completed. If there is no RA(O) phase and all response action objectives have been achieved and documented, then the remedial action-construction end date will also be the RC date.

Site Close-Out: Site Close-Out signifies when the Army has completed active management and monitoring at an environmental cleanup site, no additional environmental cleanup funds will be expended at the site and the Army has obtained regulator concurrence. For practical purposes, Site Close-Out occurs when cleanup goals have been achieved that allow unrestricted use of the property (i.e., no further LTM, including institutional controls, is required). Site Close-Out may include, but not be limited to, the dismantling, removal, recycling, reclamation and/or disposal of all remedial activity systems and ancillary equipment above and underground to return the site to its natural state.

Unexploded Ordnance (UXO): Military munitions that have been primed, fuzed, armed, or otherwise prepared for action; have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and remain unexploded either by malfunction, design, or any other cause.

Unforeseen Environmental Issues: Include unknown and/or varied concentrations of contaminants at cleanup sites (off-installation areas included) identified in this Task Order, but not unknown sites (e.g., sites not identified in this Task Order).

Attachment D: Quality Assurance and Surveillance Plan (QASP) Template

1.0 Overview

This performance-based Quality Assurance Surveillance Plan (QASP) sets forth the procedures and guidance that the Contracting Officer's Representative (COR) will use in evaluating the technical performance of the Contractor in accordance with the terms and conditions of the Task Order. The QASP objective is to explain Government procedures to be used to verify that appropriate performance and quality assurance methods are used in the management of this performance-based contract. The purpose of the QASP is to assure that performance of specific activities and completion of milestones are accomplished in accordance with all requirements set forth in the Task Order.

This QASP describes the mechanism for documenting noteworthy accomplishments or discrepancies for work performed by the Contractor. Information generated from COR's surveillance activities will directly feed into performance discussions with the Contractor. The intent is to ensure that the Contractor performs in accordance with performance metrics set forth in the Task Order documents, the Army receives the quality of services called for in the Task Order, and the Army only pays for the acceptable level of services received.

The QASP details how and when the COR will monitor, evaluate, and document Contractor performance on the Task Order. The QASP is intended to accomplish the following:

1. Define the role and responsibilities of participating Army officials.
2. Define the key milestones/deliverables that will be assessed.
3. Define acceptable, superior, and unacceptable performance standards for key milestones/deliverables.
4. Describe the surveillance methodology that will be employed by the Army in assessing the Contractor's performance.
5. Describe the surveillance documentation process and provide copies of the form that the Army will use in evaluating the Contractor's performance.
6. Outline payment and corrective action procedures.

This QASP will be revised and finalized by the COR and Contractor upon completion of the Project Management Plan (PMP) in accordance with Section 5.6, Quality Management, of the Task Order.

2.0 Roles and Responsibilities of Army Officials

The COR is responsible for technical administration of the project and assures proper Army surveillance of the Contractor's performance. The COR is responsible for monitoring, assessing, recording, and reporting on the technical performance of the Contractor on a day-to-day basis.

The Contracting Officer (KO) has overall responsibility for overseeing the Contractor's performance. The KO is responsible for the day-to-day monitoring of the Contractor's performance in the areas of Task Order compliance, and Task Order administration; reviewing the COR's assessment of the Contractor's performance; and resolving all differences between the COR's assessment and the Contractor's assessment of performance. It is the KO that assures the Contractor receives impartial, fair, and equitable treatment under the Task Order. The KO is ultimately responsible for the final determination of the adequacy of the Contractor’s performance. The KO is the only one authorized to obligate the Government on this Task Order.

The COR and KO may call upon the technical expertise of other Army officials and subject matter experts (SME) as required. These Army officials/SMEs may be called upon to review technical documents and products generated by the Contractor. Contracting Agency representatives will also conduct review of Task Order documentation such as invoices, monthly status reports, and work plans.

3.0 Key Milestones/Deliverables to be Assessed

At a minimum, the following milestones and associated deliverables will be evaluated in accordance with this QASP:

- Completion of the final Project Management Plan (PMP)
- Achievement of performance objective at each site specified in the Task Order
- Completion of annual monitoring report(s)
- Completion of the final exit or ramp-down strategy for LTM
- Completion of final remedy review(s)
- Correction of deficiencies noted in the remedy review(s)
- Approved interim milestones identified in the final PMP

Additionally, the Army will evaluate performance on the key quality control activities and events specified by the Contractor through their Quality Assurance (QA) strategy (see Task Order Section 5.6: Quality Management).

4.0 Performance Standards for Key Milestones/Deliverables

Since price is fixed in the performance-based acquisitions utilized by the Army, the Contractor’s performance will be evaluated by assessing the key milestones/deliverables described above according to three standards: quality, timeliness, and safety. For each of these performance standards, the COR will assign one of three ratings of the Contractor’s performance: superior, acceptable, or unacceptable (as shown in Table 1). Note: These performance standards may be modified to meet the needs of the Army.

Table 1 Performance Standards

Performance Standard	*Superior Performance*	*Acceptable Performance*	*Unacceptable Performance*
Quality	Contractor exceeds the requirements in the Task Order for the milestone/deliverable. Deliverables/milestones are approved after one round of comments from Army and Regulators and no revisions are required.	Contractor meets the requirements in the Task Order for the milestone/deliverable. Deliverables /milestones are approved with two rounds of comments received from Army and Regulators and no further revisions are required.	Contractor does not meet the requirements in the Task Order for the milestone/deliverable. Deliverables/milestones require more than two rounds of comments from Army and Regulators before being approved.

Table 1 Performance Standards

Performance Standard	*Superior Performance*	*Acceptable Performance*	*Unacceptable Performance*
Timelines	Contractor provides acceptable milestone/deliverable ahead of the schedule outlined in the PMP.	Contractor provides milestone/deliverable according to the schedule outlined in the PMP.	Contractor provides milestone/deliverable behind the schedule outlined in the PMP
Safety	No safety deficiencies are reported during QA inspection of fieldwork. No lost time accidents or injuries are recorded during the fieldwork.	No more than two safety deficiencies are reported during QA inspection of fieldwork. If any safety deficiency is noted during the project, appropriate investigation, corrective action, implementation, and written verification of the corrective action are provided to the Army. No lost time accidents or injuries are recorded during the fieldwork.	More than two safety deficiencies are reported during QA inspection of fieldwork or a safety deficiency is reported but is not properly investigated, corrective action identified, implemented, and then verified through documentation provided to the Army. A lost time accident or injury is recorded during the fieldwork.

If a milestone/deliverable identified as a key QA activity as described in Section 5.6 of the Task Order is rated as being of unacceptable quality at the time that the PMP deadline for the milestone/deliverable expires, the milestone/deliverable will automatically receive an unacceptable rating for timeliness. At no point will a milestone/deliverable receive an acceptable or superior rating for timeliness if it is rated as being of unacceptable quality. Overall acceptable performance on a milestone/deliverable requires ratings of acceptable or superior for the quality, timeliness, and safety standards.

5.0 Surveillance Methodology

The surveillance methods listed below will be used in the execution of this QASP.

100% Inspection
At the completion of all key milestones and deliverables, performance will be evaluated through 100% inspection (e.g., document review). The COR will document performance for each completed milestone/deliverable prior to payment, as described in Section 6.0.

Periodic Progress Inspection
At the COR’s discretion, periodic inspections may be conducted to evaluate progress toward and/or completion of key milestones and deliverables. The COR may complete a periodic progress inspection if s/he believes that deficiencies exist that must be addressed prior to milestone/deliverable completion. While corrective action or re-performance will be required if necessary, the Contractor will not be financially penalized for unacceptable performance

recorded in periodic progress reports, provided that final performance evaluation of the milestone/deliverable is deemed acceptable.

Customer Feedback

Additional feedback will be obtained through random customer feedback. To be considered valid, customer complaints must set forth clearly and in writing the detailed nature of the feedback, must be signed, and must be forwarded to the KO. The KO will maintain a summary log of all formally received customer feedback as well as a copy of each feedback in a documentation file.

6.0 Surveillance Documentation

The COR will use a performance evaluation form to record evaluation of the Contractor’s performance for each milestone and deliverable in accordance with the methodology described in Sections 4.0 and 5.0. The COR must substantiate, through narratives in the form, all superior and unacceptable ratings. Performance at the acceptable level is expected from the Contractor. At a minimum, the evaluation form will indicate actual and scheduled delivery times and number of reviews required to achieve the final product.

The COR will forward copies of all completed performance evaluation forms to the KO and Contractor within one week of performing the inspection. When a milestone/deliverable receives an overall unacceptable rating, the Contractor will explain, within 15 days, in writing to COR why performance was unacceptable, how performance will be returned to acceptable levels, and how recurrence of the problem will be prevented in the future.

The KO will review each performance evaluation form prepared by the COR. When appropriate, the KO may investigate further to determine if all the facts and circumstances surrounding the event were considered in the COR opinions outlined on the form. The KO will immediately discuss any unacceptable rating with the Contractor to assure that corrective action is promptly initiated.

At the end of every year, the COR will prepare a written Contractor Performance Assessment Report (CPAR) for the KO summarizing the overall results of his/her surveillance of the Contractor’s performance during the previous 12 months. This report will become part of the formal QA documentation.

The COR will maintain a complete QA file. This file will contain copies of all performance evaluation forms and any other related documentation. The COR will forward these records to the KO at termination or completion of the Task Order.

7.0 Payment and Corrective Action

Full payment for a milestone/deliverable will be provided upon verification of overall acceptable performance, as rated on quality and timeliness. This verification will be recorded in a performance evaluation form submitted to the KO specifying overall Contractor performance as either acceptable or superior for the milestone/deliverable.

If a milestone/deliverable receives an unacceptable rating for the quality performance standard, re-performance is required until the milestone/deliverable receives an acceptable rating. This re-performance is required regardless of cost or schedule constraints that may result from the unacceptable performance, unless the KO has opted to terminate the Task Order. If an acceptable rating is not achieved, the Government may reduce the contract price to reflect the reduced value of the services in accordance with FAR 52.246-4(e).

Table 2 summarizes the minimum key elements planned for the QASP. The final QASP will be developed with the COR and the contractor and will be based on the final PMP.

Additional Government surveillance activities may include, but are not limited to, the following:

- Work plan review and approval
- Participation in Technical Project Planning sessions
- Oversight of geophysical survey & analysis activities
- Oversight of drilling, field sampling activities
- Oversight of all waste management functions/responsibilities
- Review of all waste management documentation
- Separate/split laboratory QA samples
- Review and approval of all access agreements associated with off-site areas
- Review and approval of meeting minutes from RAB/BCT meetings
- Review and approval of all deliverables to regulatory agencies
- Review and approval of FS options to be considered
- Review of quality control documentation
- Review of project safety record
- Adherence to the approved work plan

Table 2 Performance Objectives, Acceptance Criteria, and Monitoring Methods

(SAMPLE) QASP Performance Objectives, Acceptance Criteria, and Monitoring Methods

Performance Objectives	***Performance Standards***	***Acceptable Quality Levels***
Approved Project Management Plan (PMP) and Quality Assurance Surveillance Plan (QASP): • Draft PMP and QASP within 30 calendar days of Task Order award, • Final PMP within 30 calendar days of receipt of COR comments on the drafts.	Army approval through the Contracting Officer's Representative (COR).	Acceptable or superior performance, as defined in Table 1 of the QASP.

Monitoring Method: 100% inspection of milestones / deliverables associated with objective

What we're looking for:

- Detailed technical approach included in the PMP
- Project Team and Roles and Responsibilities are included in the PMP
- Interim Payment schedule included in the PMP
- Activity-based schedule included in the PMP
- Complete document submittal distribution list included in the PMP
- Project Status reports provided as proposed
- The Contractor keeps a record of each phone conversation, written correspondence, and meeting minutes affecting decisions related to the performance of this scope of work. Copies of this correspondence are submitted to the COR.

QUALITY ASSURANCE MONITORING FORM

Date: ___/____/______

Work Task (Milestone/Activity): ____

Survey Period: ___/____/______ through ___/____/______
Method of Surveillance: COR Review

Evaluation of Contractor's Performance: _______

Evaluation

Corrective Action Required: ☐ Yes ☐ No

Narrative Discussion of Contractor's Performance During Survey Period:

Discussion

CORRECTIVE ACTION FORM FOR QASP

1) Work Task (Milestone/Activity):_________________________

2) Survey Period: ___/____/______ through ___/____/______

3) Description of the Failure/Deficiency that Precipitated the Corrective Action:

Description

4) Description of the Criterion that the Failure/Deficiency was Evaluated Against:

Description

5) Personnel Involved in the Identification of the Failure/Deficiency, Determination of the Appropriate Corrective Action, Approval of the Corrective Action, and Implementation of the Corrective Action:

6) Description of the Corrective Action that was Required:

Description

7) Date/Time of Implementation of the Corrective Action: ___/____/______

Description

8) Follow-Up Information to Prevent Recurrence of Failure/Deficiency (i.e., Need For Revision of Procedures or Specifications):

9) Personnel Responsible for Follow-Up Work:

10) Planned Date for Follow-Up Surveillance: ___/____/______

11) Other Notes:

Other

Appendix B
Site Maps

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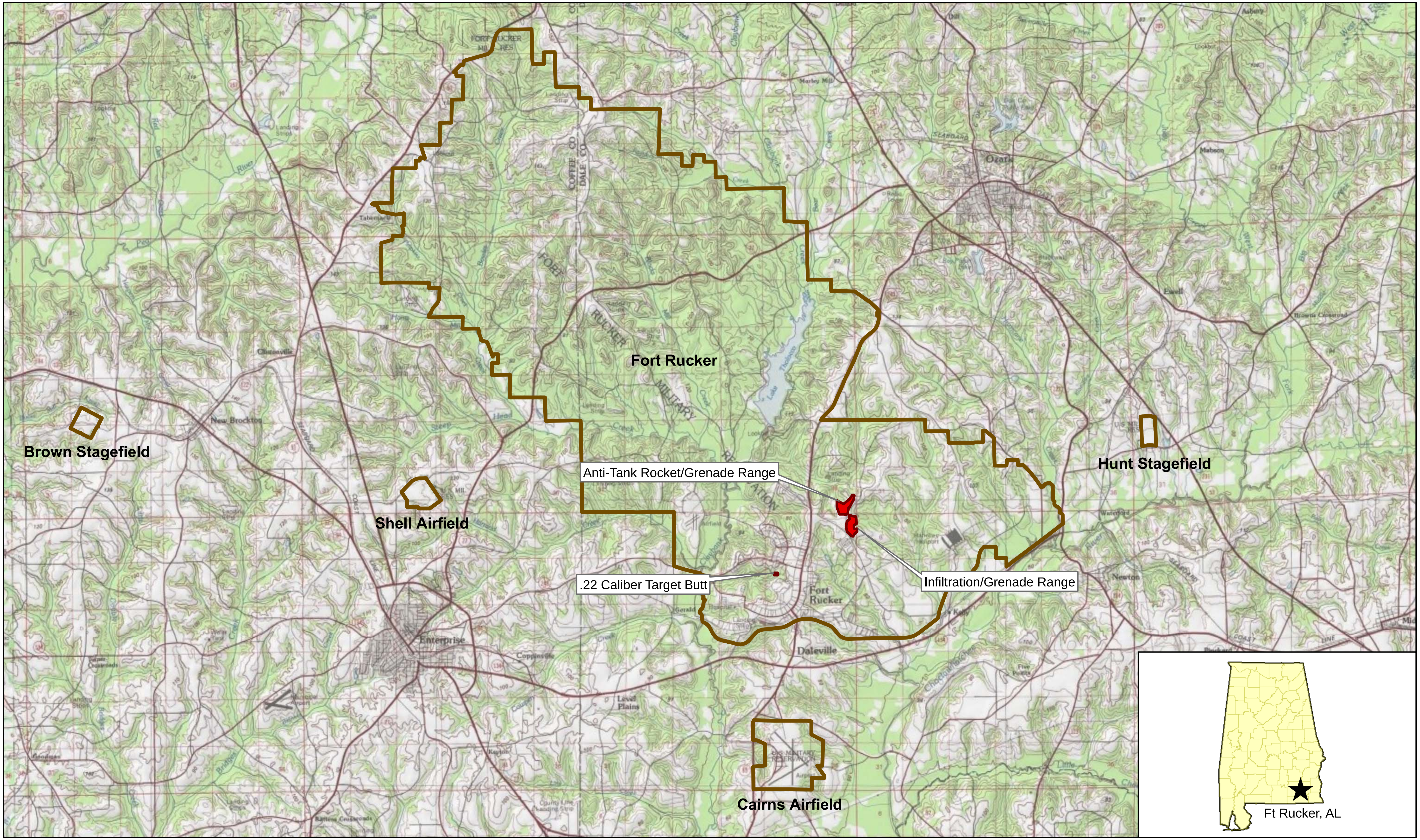

▭ Installation Boundary
🟥 Munitions Response Site Boundary
NGS USA Topographic Maps

N
0 0.5 1 2
Miles

FIGURE 1-1
General Location Map
Fort Rucker, Alabama

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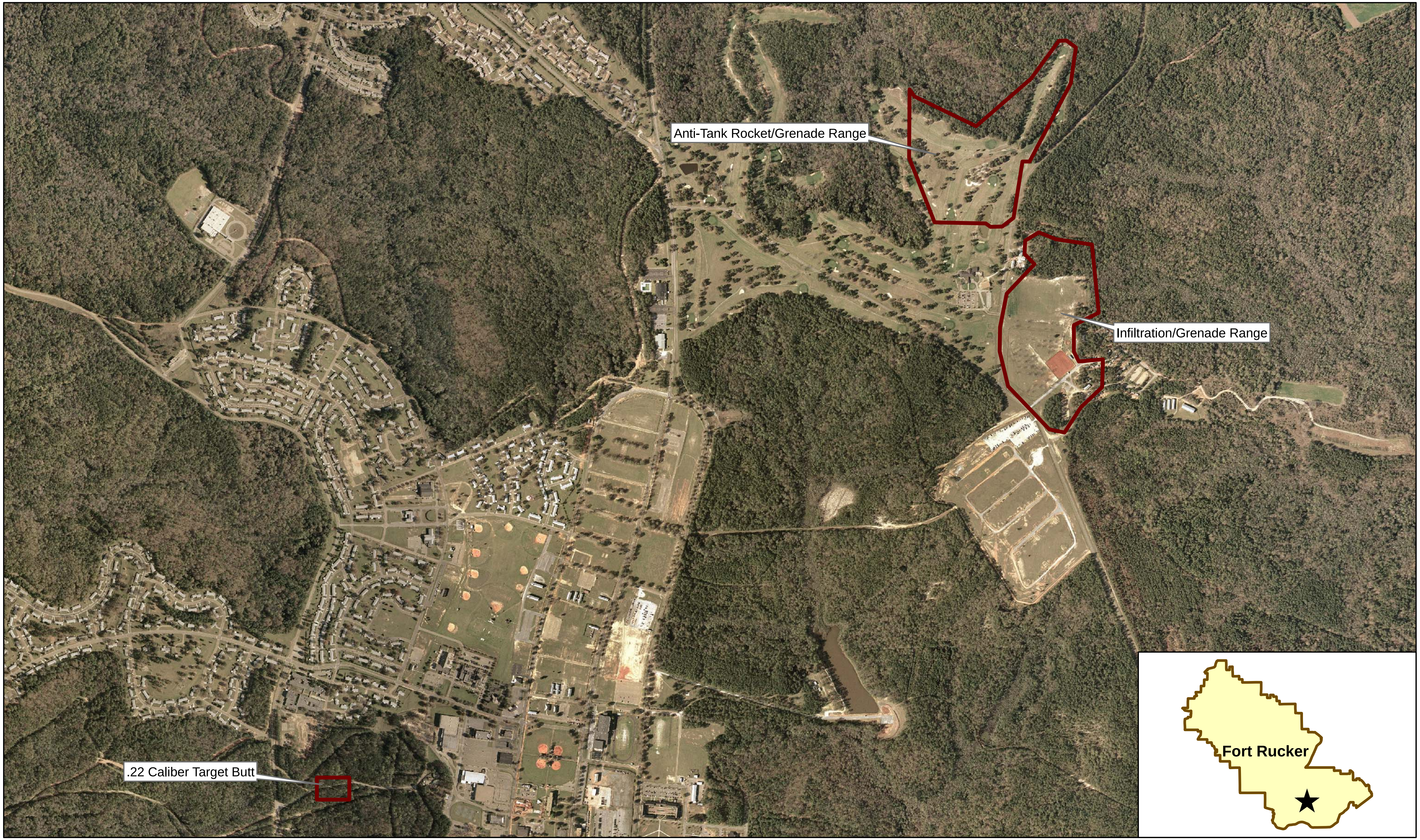
CH2MHILL



▭ Munitions Response Site Boundary

FIGURE 1-2
Munitions Response Sites
Fort Rucker, Alabama

FIGURE 1-3 Conceptual Site Model (MEC) -Exposure Pathway Analysis

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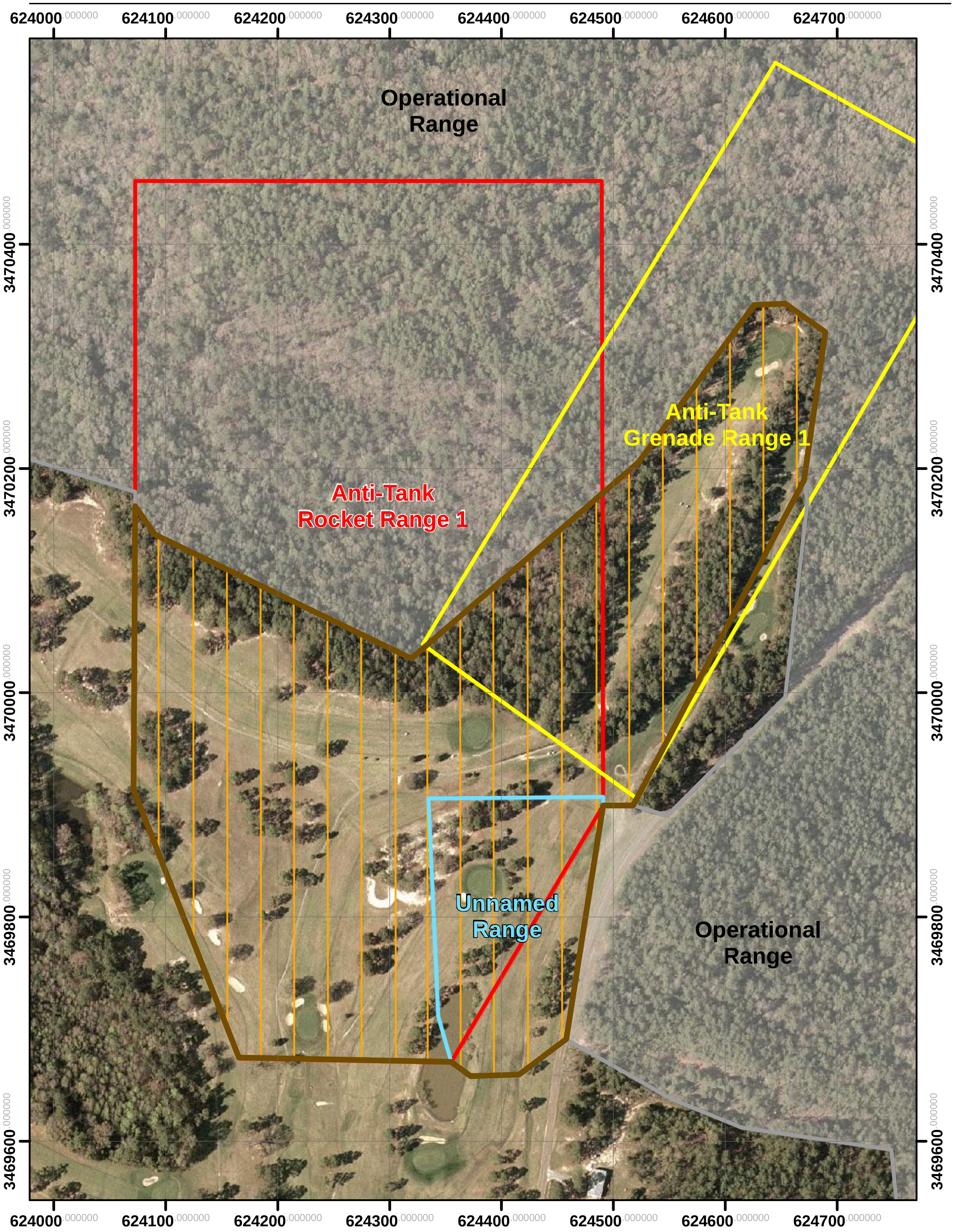

— DGM Transects
🟫 Site Boundary
🟨 Anti-Tank Grenade Range 1
🟥 Anti-Tank Rocket Range 1
🟦 Unnamed Range
⬜ Operational Range

FIGURE 3-1
Idealized DGM Transects for the Anti-Tank/Rocket Grenade Range
Fort Rucker, Alabama

\\GALILEO\PROJ\USACE\FT_RUCKER\MAPFILES\RFI\FIGURE_3-1-IDEALIZEDDGMTRANSECTSANTITANK.MXD SSMITH21 3/15/2010 12:42:45

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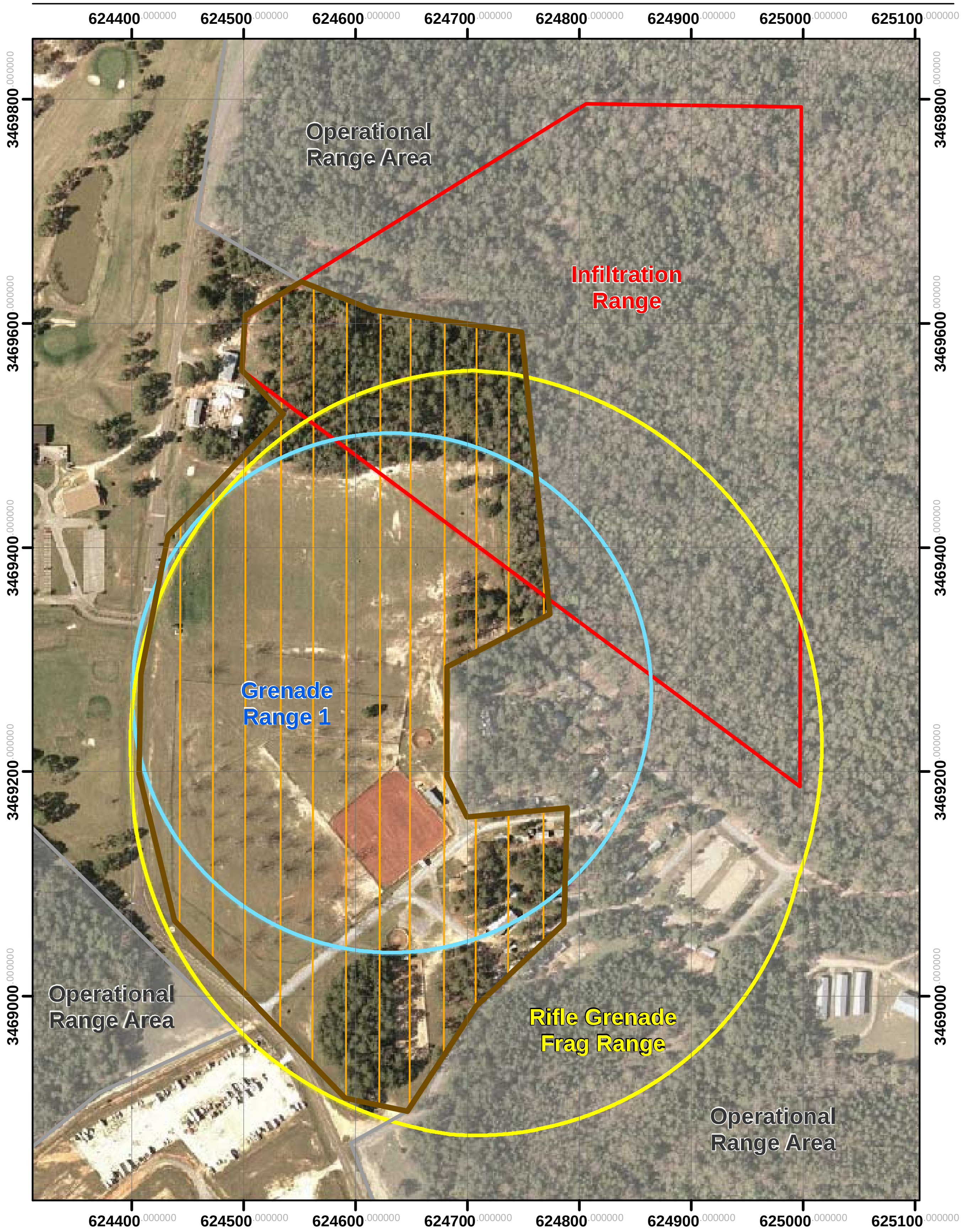

FIGURE 3-2
Idealized DGM Transects for the Infiltration/Grenade Range

Fort Rucker, Alabama

\\GALILEO\PROJ\USACE\FT_RUCKER\MAPFILES\RFI\FIGURE_3-2-IDEALIZEDDGMTRANSECTSINFILTRATION.MXD SSMITH21 12/8/2010 22:29:37

CH2MHILL

Figure 3-3
Boundaries for Site Walkabout for the .22-Caliber Target Butt

Fort Rucker, Alabama

\\GALILEO\PROJ\USACE\FT_RUCKER\MAPFILES\RFI\FIGURE_3-3-22CALIBERTARGETBUTT.MXD SSMITH21 3/15/2010 12:56:04

CH2MHILL

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Appendix C
Local Points of Contact

Points of Contact
MEC RCRA Facility Investigation
Fort Rucker, Alabama

Name	Telephone/E-mail	Project Function
Ms. Susan Cowart IMSE-RCK-PWE Building 1121 Fort Rucker, AL 36362	(334) 255-1652/susan.cowart@us.army.mil	Fort Rucker Acting IRP Manager
Mr. Sean M. Sparks Building 24314, Hwy 27 Fort Rucker, AL 36362	(334) 255-4837/2620/sean.m.sparks@us.army.mil	Chief Training Division, DPTMS, Fort Rucker
Mr. Robert Saliewicz Installation Safety Office Fort Rucker, Alabama	(334) 255-3210/ robert.saliewicz@us.army.mil	Fort Rucker Installation Safety Officer
Ms. Martie Haverfield	(334) 598-3384/martie.haverfield@us.army.mil	Fort Rucker Equestrian Center
Ms. Kathryn Simmons	(334) 598-3384/Kathryn.simmons@us.army.mil	Fort Rucker Equestrian Center Manager
Ms. Kristine Doggett	(334) 598-2449/Kristine.doggett@us.army.mil	Fort Rucker Silver Wings Golf Course

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Appendix D
Accident Prevention Plan\Site Safety and Health Plan

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Accident Prevention Plan and Site Safety and Health Plan

MEC RCRA Facility Investigation

Anti-Tank/Rocket Grenade Range - FTRU-001-R-01
Infiltration/Grenade Range - FTRU-003-R-01
.22-Caliber Target Butt - FTRU-004-R-01

Fort Rucker, Alabama

FINAL

Contract W91ZLK-05-D-0014
Task Order No. 0001

Prepared for:

U.S. Army Environmental Command

Prepared by:

CH2MHILL

Northpark 400
1000 Abernathy Road
Suite 1600
Atlanta, Georgia

December 9, 2010

Contents

Attachments

Figures

Tables

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Acronyms and Abbreviations

ADEM	Alabama Department of Environmental Management
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
AOC	Area of Concern
APP/SSHP	Accident Prevention Plan/Site Safety and Health Plan
ASR	air purifying respirator
AST	Aboveground storage tank
BBLPS	Behavior Based Loss Prevention System
BbPK	Bloodborne Pathogen Kit
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
COC	Constituent of Concern
COR	Contracting Officer's Representative
CPR	cardiopulmonary resuscitation
CRZ	contamination reduction zone
CSE	Confined Space Entry
CWA	Chemical Warfare Agent
dB	decibel
DDESB	Department of Defense Explosives Safety Board
DEET	N, N-diethyl-meta-polyamide
DFWP	Drug Free Workplace Program
DGM	Digital Geophysical Mapping
DoD	Department of Defense
DOT	Department of Transportation
EM	Engineering Manual; electromagnetic
EMS	Emergency Medical Service
EMT	emergency medical technician
EOD	Explosive Ordnance Disposal
ESC	erosion and sediment control
ESP	Explosives Site Plan
EZ	exclusion zone
FAR	Federal Acquisition Regulation
FC	foot candle
FID	Flame Ionization Detector

GFCI	ground fault circuit interrupter
GPR	ground-penetrating radar
HAZWOPER	Hazardous Waste Operations and Emergency Response
HBV	Hepatitis B Virus
HEPA	high-efficiency particulate air
HIV	Human Immunodeficiency Virus
HR	heart rate
HRR	Historical Records Review
IDLH	immediately dangerous to life and health
IDW	investigation-derived waste
IRF	Incident Report Form
ISV	instrument verification strip
KA	Contracts Administrator
lpm	liters per minute
LPO	Loss Prevention Observations
mg/kg	milligrams per kilogram
MC	munitions constituents
MCL	Maximum Contaminant Level
MD	munitions debris
MEC	Munitions and Explosives of Concern
MMRP	Military Munitions Response Program
MPPEH	materials presenting a potentially explosive hazard
MSDS	Material Safety Data Sheet
NLI	Near-loss Investigation
OEL	Occupational Exposure Limit
OSHA	Occupational Safety and Health Administration
OVA	Organic Vapor Analyzer
PEL	Permissible Exposure Limit
PM	Project Manager
POC	Point of Contact
PPE	Personal Protective Equipment
ppm	parts per million
PRG	Preliminary Remediation Goal
PTSP	Pre-Task Safety Plan
RCRA	Resource Conservation and Recovery Act
RDX	cyclotrimethylenetrinitramine

RI	remedial investigation
RFI	RCRA Facility Investigation
RMSF	Rocky Mountain Spotted Fever
RQ	Reportable Quantity
SAR	supplied air respirator
SI	Site Inspection
SM	Site Manager
SOP	Standard Operating Procedure
SSHO	Site Safety and Health Officer
STARI	Southern Tick-Associated Rash Illness
SUXOS	Senior UXO Supervisor
SWO	Stop Work Order
SZ	Support Zone
TP	Technical Paper
TVA	Toxic vapor analyzer
UL	Underwriters Laboratory
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer
XRF	X-ray fluorescence

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1.0 Signature Sheets

Plan Prepared By:

Name: Mark Sherrill, P.G.
Title: Project Manager
Company: CH2M HILL
Telephone: (678) 530-4320/Office or (678)938-0923/Cell

Signature: ______________________

Approved By:

Name: Mike Goldman, CIH, CSP, CHMM, CPEA
Title: Safety and Health Manager
Company: CH2M HILL
Telephone: (678) 530-4133/Office or (770) 331-3127/Cell

Signature: ______________________

Plan Concurrence:

Name: George DeMetropolis, PhD, CMQ/OE, CQA
Title: MR Safety and Quality Officer
Company: CH2M HILL
Telephone: (619) 687-0120 x37239/Office or (619) 564-9627

Signature: ______________________

1.1 Revisions

Revisions Made By: **Date:**

Revisions to Plan:

Revisions Approved By: Date:

1.2 Introduction

CH2M HILL Constructors, Inc. (CH2M HILL) has prepared this Accident Prevention Plan and Site Safety and Health Plan (APP/SSHP) in response to Contract W91ZLK-05-D-0014, Task Order (TO) 0001 for the Munitions and Explosives of Concern (MEC) Resource Conservation and Recovery Act (RCRA) Facility Investigation at Fort Rucker, Alabama. The three Military Munitions Response Program (MMRP) sites subject to this investigation, the Anti-Tank/Rocket Grenade Range - FTRU-001-R-01, the Infiltration/Grenade Range - FTRU-003-R-01, and the .22-Caliber Target Butt - FTRU-004-R-01, are shown on Figure 1-1.

Accident prevention is a key program element used to achieve compliance and strive toward the ultimate goal of zero safety incidents. Personnel active in site operations will be thoroughly familiar with the programs and procedures outlined in this APP/SSHP prior to conducting work at the site.

It is the intent of this APP/SSHP to address requirements set forth by 29 Code of Federal Regulations (CFR) 1910, 29 CFR 1926 and Engineering Manual (EM) 385 1-1, Appendix A. All site personnel, including CH2M HILL and subcontractors, who may be covered by this APP/SSHP, must review this document and sign the APP/SSHP Acknowledgement Form (Attachment 1).

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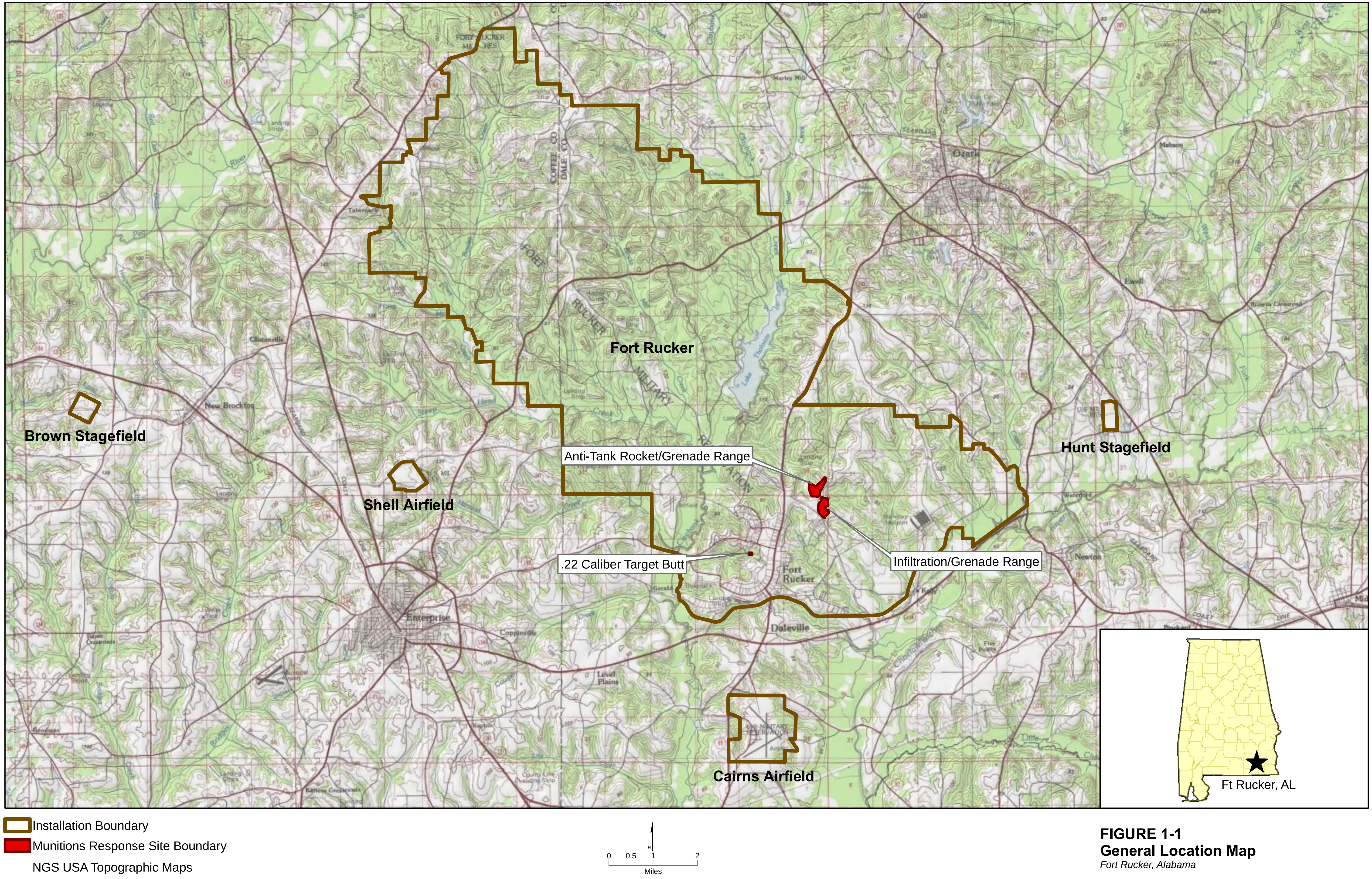

FIGURE 1-1
General Location Map
Fort Rucker, Alabama

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2.0 Background Information

CH2M HILL:

CH2M HILL
Northpark 400
1000 Abernathy Road, Suite 1600
Atlanta, GA 30238
Contact Name: Mark Sherrill
Title: Project Manager
Telephone: (678) 938-0923/Cell

CONTRACT #: W91ZLK-05-D-0014, TO No. 0001

PROJECT NAME: MEC RCRA Facility Investigation
Fort Rucker, Alabama

2.1 Site Background

Fort Rucker commenced operations in 1942 in response to the United States military escalation following the attack on Pearl Harbor. Originally named the Ozark Triangular Division Camp, it became Camp Rucker in 1943. It was renamed Fort Rucker in 1955.

Fort Rucker has been the site of an infantry training ground, aviation school flight training, and heliport. Since 1973, the mission at Fort Rucker has been to maintain and operate facilities and provide services and material to support rotary and fixed-wing pilot training for Army aviation enlisted specialists and related test activities.

The site history of each MMRP site is described below.

The Anti-Tank/Rocket Grenade Range was historically used as an anti-tank rocket and grenade range. The Historical Records Report (HRR) determined that training took place at this site between 1942 and 1951. It is assumed, since specific training dates are not available, that the Anti-Tank/Rocket Grenade Range was used for artillery training during this period. It has since been developed as a golf course.

The Infiltration/Grenade Range was used historically as an infiltration and grenade range. It has since been developed as an equestrian center.

At the .22-Caliber Target Butt MMRP site, the only operational indication for the Target Butt is based on a 1944 map. It is assumed that the site was only used for small arms training. The HRR identified small arms (.22-caliber) as potentially being used at this site. It is undeveloped.

2.2 Nature and Extent of Contamination

2.2.1 Anti-Tank/Rocket Grenade Range- FTRU-001-R-01

The Anti-Tank/Rocket Grenade Range, also known as FTRU-001-R-01, covers approximately 57 acres. Most of the site (39 of the 57 acres) consists of a well-maintained golf course. The remaining 18 acres are wooded. The historical footprint of the Anti-

Tank/Rocket Grenade Range resides in the operational and non-operational ranges of Fort Rucker. For this investigation, only the portions of the Anti-Tank/Rocket Grenade Range within the non-operational area (52 of the 57 acres) will be investigated. The remaining 5 acres are in the operational range and therefore are not part of the RFI.

This Munition Response Site (MRS) was historically used as an anti-tank rocket and grenade range. The HRR report and 2005 Site Inspection (SI) report identified several munitions that could be present at the site: M6A1 2.36-inch rockets; M9A1 HEAT rifle grenades; MII A1-MII A4 Practice Grenades, M17 Fragmentation Grenades, and M19A1 White Phosphorus Smoke Grenades. During the 2005 SI, four munitions debris (MD) items were discovered on the Anti-Tank/Rocket Grenade Range. The MD consisted of a fragment from a practice rifle grenade, a fragment of an expended 2.36-inch rocket, and fragments from two expended M28 3.5-inch rockets. Based on the HRR, M28 3.5-inch rockets were not expected to be present on the site; however, this type of munition is consistent with other historical activities known to have taken place in the area of this site.

In addition to the MD items, a World War I-era tank hull with numerous holes and pockmarks resulting from the use of live armor-piercing ammunition was identified just outside of the non-operational range boundary. The orientation of the Anti-Tank/Rocket Grenade Range and the orientation of the tank hull relative to the range indicate that the tank may have been fired at from the non-operational range area of the Anti-Tank/Rocket Grenade Range.

During the 2005 SI, approximately 20 discrete subsurface anomalies were detected throughout the site during the site walk. Munitions constituents (MC) sampling activities associated with the SI included collecting ten surface soil samples, and one duplicate sample which were analyzed for explosives. One sample contained detectable concentrations of nitrobenzene, but none of the analyzed soil samples contained any explosives in concentrations exceeding the U.S. Environmental Protection Agency (USEPA) Region 9 Industrial Preliminary Remediation Goals (PRGs).

2.2.2 Infiltration/Grenade Range- FTRU-003-R-01

The Infiltration/Grenade Range, also known as FTRU-003-R-01, is adjacent to but not contiguous with the Anti-Tank/Rocket Grenade Range. The site is composed of approximately 44 acres in the non-operational range. Fort Rucker's equestrian center and golf course driving range comprise most of the site (34 acres), while the remaining 10 acres are wooded.

The site was used historically as an infiltration and grenade range. It has since been developed. During the 2005 SI, no MEC or MD items were observed. Information from Fort Rucker Range Control identified two Explosive Ordnance Disposal (EOD) responses to MEC items in 2003. The two items, rifle grenades, were destroyed by EOD personnel. The HRR and SI Report identified several munitions that could be present at the site: MII A1 – MII A4 Practice Grenades, M2/MK2 Hand Grenades, and M17 Fragmentation Grenades.

During the 2005 SI, a magnetometer assisted site walk of approximately 10% of the undeveloped portions of the MRS was completed and no MD was observed. Ten surface soil samples, one field duplicate, and one MS/MSD were analyzed for explosives. Three explosive compounds (nitrobenzene, 2-amino-4,6-dinitrotoluene, and 4-amino-2,6-

dinitrotoluene) were identified in two soil samples at concentrations below the USEPA Region 9 Industrial PRGs.

2.2.3 The .22-Caliber Target Butt- FTRU-004-R-01

The .22-Caliber Target Butt, also referred to as FTRU-004-R-01, covers approximately 2.4 acres in the central portion of the cantonment area. The site is heavily wooded, with uneven terrain and several small streams. A dirt road runs east to west through the northern portion of the area. A cleared power line right-of-way cuts east to west through the southern portion. A fitness trail with exercise stations extends through the site. During the 2005 SI, an expended M48 Trip Flare (a non-fragment-producing munition) was found. The flare, installed at the base of a tree, appeared to have been undisturbed since its setup.

The only indication of operational use of this MMRP site comes from a 1944 map of the Target Butt. It is assumed that the site was only used for small arms training. The HRR identified small arms (.22-caliber) as potentially being used at this site. There is no historical evidence of MEC at this site. Small arms ammunition are defined by the U.S. Army Corps of Engineers (USACE) EM 385-1-97, Explosives Safety and Health Manual, as ammunition without projectiles that contain explosives (other than tracers) that are 0.50 caliber or smaller, including 20 mm, or ammunition for shotguns. In accordance with USACE Engineering Pamphlet (EP) 1110-1-18, Ordnance and Explosives Response, small arms ammunition is considered a minimal explosives safety hazard for the purposes of explosives safety and munitions responses. Since there is no potential for MEC/Material Potentially Presenting and Explosive Hazard (MPPEH), the only RFI activities that will be performed within the .22-Caliber Target Butt MMRP site are associated with MC sampling.

No MEC activities were conducted at the .22-Caliber Target Butt MMRP site as part of the 2005 SI, due to its suspected use as a small arms range. However, an extensive site walk was performed to locate surface features associated with a small arms range. No surface features were found that would indicate the presence of a former small arms range in the MMRP site. No explosive compounds were present in detectable concentrations in the single soil sample submitted for analytical testing.

2.3 General Task Order Scope of Work

CH2M HILL will conduct a preliminary characterization of the Anti-Tank/Rocket Grenade Range MRS and the Infiltration/Grenade Range MRS by conducting an instrument-assisted surface clearance for MEC/MPPEH, MD, and range residue (for removal of ferrous metal debris on the ground surface), followed by digital geophysical mapping (DGM) of magnetic anomalies over representative portions of these MRSs. Magnetic anomalies that may indicate the presence of buried MEC/MPPEH will be intrusively investigated. At the .22-Caliber Target Butt MMRP site, CH2M HILL will conduct an instrument-assisted site walkabout to identify any areas of potential small arms use.

In addition, soil sampling will be performed at the three MMRP sites. Soil samples at each MMRP site will be biased, if possible, to areas where MEC/MPPEH or small arms ammunition has or may be potentially found (i.e. target berms, craters, other munitions related features, or as indicated by MD). In the absence of any evidence of munitions, a systematic grid-based sample distribution will be applied across the site. At the .22-Caliber Target Butt MMRP site, additional field screening of soils will be performed for lead using x-ray fluorescence (XRF) and will be used to bias laboratory samples. All other samples will be analyzed in laboratory settings. Samples will be collected in accordance with the Munitions Constituents Sampling and Analysis Plan (Work Plan Appendix E, Part I) and the Quality Assurance Project Plan (QAPP) (Work Plan Appendix E, Part II). The geophysical and analytical results will be used aid in the characterization of the extent of MEC and MC contamination, if present, over the three identified MMRP sites.

Project field activities requiring Activity Hazard Analyses (AHAs) to be executed under the proposed RFI are anticipated to be as follows:

PHASES OF WORK AND HAZARDOUS ACTIVITIES REQUIRING AHA

- Mobilization—AHA 1
- Site Preparation—AHA 2
- Site Survey with MEC Avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)—AHA 3
- Vegetation Removal with MEC Avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)—AHA 4
- Instrument-Assisted Surface Clearance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)—AHA 5
- Digital Geophysical Mapping (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)—AHA 6
- Subsurface Anomaly Investigation (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)—AHA 7
- Detonation/Disposal of MEC (if necessary) (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)—AHA 8
- Soil Sampling—AHA 9
- Transportation and Disposal of Generated Wastes—AHA 10
- Site Restoration—AHA 11
- Decontamination—AHA 12
- Demobilization—AHA 13

These AHAs are presented in Section 10.6.

2.4 Safety and Health Plan Assumption Set

The assumption set for the development of this APP/SSHP is that CH2M HILL site personnel, and subcontractors controlled by CH2M HILL who may be covered by this APP/SSHP, will not be exposed to MEC hazards, or identified MC in excess of established Occupational Exposure Limits (OELs) while executing their assigned tasks. This assumption set is based on the following:

- Site personnel will execute good personal hygiene practices to facilitate a negative exposure to identified site MC via incidental dermal or ingestion exposure vectors.
- Where use of personal protective equipment (PPE) is specified, it will be used in accordance with Table 9-2 of this APP/SSHP.
- Munitions and explosives of concern (MEC) will be handled or otherwise managed, in accordance with an approved Explosives Site Plan (ESP) and approved Work Plan.
- There is no potential worker exposure to biological waste or Chemical Warfare Agents (CWA) in connection with this project.
- The XRF unit will be operated in strict accordance with the manufacturers specifications to avoid any exposure to radiological hazards.

In the event that the above assumption set is not valid, the conditions of this APP/SSHP will be re-evaluated and amended as necessary to address applicable hazards that may be associated with newly encountered project conditions or newly defined project tasks.

2.5 HAZWOPER-Regulated Tasks

Where certain tasks include the handling, removal, containment, investigation, or other physical site management of hazardous waste/material or other regulated materials, execution of such tasks and potential employee exposure to chemical hazards associated with these tasks may be regulated under 29 CFR 1910.120/29 CFR 1926.65. For this task order, the following activities will be considered Hazardous Waste Operations and Emergency Response (HAZWOPER)-regulated tasks because of the potential worker exposure to identified site hazards (MEC and MC). Anomaly avoidance procedures will be employed to ensure employees' safety when performing land and utility surveys, vegetation clearance, DGM survey, and sample screening and collection.

- Land and Utility Survey Activities to support the remedial objectives, within the Munitions Response Site
- Vegetation removal within the Munitions Response Site
- Stockpiling (disposal as necessary) of MD, material determined as safe (MDAS), or other range residues
- Instrument assisted surface clearance
- DGM survey
- Subsurface anomaly investigation
- Surface soil screening with X-ray fluorescence (XRF) and soil sampling
- Sample collection for confirmation or waste characterization analysis
- Decontamination and waste handling
- Disposal of MEC

2.6 Non-HAZWOPER-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of HAZWOPER regulations under 29 CFR 1910.120/29 CFR 1926.65 may not be applicable. In these cases, it must be demonstrated that the assigned tasks can be performed without the possibility of exposure to chemical hazards in order to use personnel who do not meet the criteria established by these standards. A determination from the Safety and Health Manager is required before project tasks are conducted by personnel who do not meet the requirements of 29 CFR 1910.120/29 CFR 1926.65 and where there is a question as to potential exposure to chemical hazards. Where it is unlikely or not possible that workers could be exposed to site chemical hazards during the normal execution of assigned tasks, the task can be considered a Non-HAZWOPER Regulated Task. For this project, the following activities can be considered Non-HAZWOPER Regulated Tasks:

- Mobilization (mobilization of crew, equipment, materials, temporary facilities)
- Land and Utility Survey Activities to support the remedial objectives, where impacted soil IS NOT disturbed or accessible, with MEC avoidance support (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)
- Site Set-up, where disturbance of soil or sediment impacted by MC does not occur
- Establishment of instrument verification strip (IVS) in an area not known or suspected to contain MEC or MC contamination.

3.0 Statement of Safety and Health Policy

CH2MHILL

HSSE
Target Zero
World-Class Performance

Health, Safety, Security, and Environment Policy

Protection of people and the environment is a CH2M HILL core value. It is our vision to create a culture within CH2M HILL that empowers employees to drive this value into all global operations and achieve excellence in health, safety, security, and environment (HSSE) performance. CH2M HILL deploys an integrated, enterprise-wide behavior-based HSSE management system to fulfill our mission and the expectations of our clients, staff, and communities based on the following principles:

- We require all management and supervisory personnel to provide the leadership and resources to inspire and empower our employees to take responsibility for their actions and for the actions of their fellow employees to create a safe, healthy, secure, and environmentally-responsible workplace.
- We provide value to clients by tailoring HSSE processes to customer needs and requiring all CH2M HILL employees and subcontractors to deliver projects with agility, personal service, and responsiveness and in compliance with HSSE requirements and company standards to achieve health, safety, security, and pollution prevention excellence. Our performance will aspire to influence others and continually redefine world-class HSSE excellence.
- We systematically evaluate our design engineering and physical work environment to verify safe and secure work conditions and practices are established, consistently followed, and timely corrected.
- We continually assess and improve our HSSE program to achieve and maintain world-class performance by setting and reviewing objectives and targets, reporting performance metrics, and routinely reviewing our progress.
- We care about the safety and security of every CH2M HILL employee and expect all employees to embrace our culture, share our core value for the protection of people and the environment, understand their obligations, actively participate, take responsibility, and "walk the talk" on and off the job.

The undersigned pledge our leadership, commitment, and accountability for making this policy a reality at CH2M HILL.

Dated the 1st day of October 2009.

Lee A. McIntire
Chief Executive Officer

Garry Higdem
President, Energy Division

Jacqueline Rast
Jacqueline Rast
President, Major Programs Group

Robert C. Allen
Chief Human Resources Officer

Mark Lasswell
President, Transportation Business Group

Catherine Santee
Catherine Santee
Chief Financial Officer

Bob Card
President, Facilities & Infrastructure Division

Margaret McLean
Chief Legal Officer

Thomas G. Searle
President, International Division

Bill Dehn
Senior Vice President, Special Projects

Michael E. McKelvy
President, Government, Environment, and Nuclear Division

Nancy R. Tuor
Vice-Chair, International

Keith Christopher
Keith Christopher
Senior Vice President, Health, Safety, Security, and Environment

3.1 Safety Goals and Objectives

As noted in the company's Corporate Safety and Health Policy Statement, above, CH2M HILL holds safety and health as a core value. It is CH2M HILL's objective to maintain a safe working environment and complete every job with zero accidents.

3.2 Primary Safety and Health Program Functions

The following are the primary functions of the Environmental and Safety and Health Program:

- Define the Safety and Health responsibilities of CH2M HILL personnel.
- Administer the medical surveillance program.
- Prepare the site Safety and Health documents that identify project hazards, present appropriate hazard control measures to mitigate identified hazards, and establish guidelines by which program participants will be expected to operate.
- Provide safety training/maintaining training records.
- Provide safety procedures and protocols to be used at project sites, shops, and offices.
- Conduct accident investigations and maintain records.
- Verify Occupational Safety and Health Administration (OSHA) compliance with 29 CFR 1910, 29 CFR 1926, and EM 385 1-1, as applicable to executable contract work.
- Provide guidance and assistance with preparation of safety protocols for specific tasks.
- Promote safety- and health-conscious ethic within the program.
- Designate the functional organization of stakeholders with respect to employee safety and health to meet corporate and project specific safety and health needs.

3.3 Regulatory Compliance Policy

It is the intention of CH2M HILL to adhere to federal, state, local, and client requirements that are applicable to assigned contract work regarding the safety and health of its employees. It is the responsibility of all personnel to perform all work in accordance with established program requirements. All project personnel will immediately bring any condition regarding safety and health compliance to the attention of supervisory personnel.

CH2M HILL will also endeavor to ensure that its procured subcontractors adhere to applicable regulatory compliance, by oversight of safety performance records, relevant training, and medical surveillance, as applicable.

3.4 Medical Surveillance

All employees who perform work at hazardous waste sites or perform emergency response in accordance with 29 CFR 1910.120(a)(1)(i)-(v)/29 CFR 1926.65(a)(1)(i)-(v) will be subject to CH2M HILL's medical surveillance program requirements. (CH2M HILL-Standard

Operating Procedures [SOPs] HS-01, Medical Surveillance, and HS-02, Safety and Health Training).

Key personnel must meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated the Site Safety and Health Officer (SSHO)/Unexploded Ordnance (UXO) Safety Officer (UXOSO) must have completed CH2M HILL's safety coordinator course, and have documented requisite field experience. At least two employees currently certified by the American Red Cross, or equivalent, in first aid and cardiopulmonary resuscitation (CPR) must be available at each job site/operation.

3.5 Position Statement on Modified Work

CH2M HILL will attempt to prevent all accidents through strict compliance with OSHA regulations and CH2M HILL Safety and Health procedures, as well as supervisor and employee safety training, safety audits, and constant attention to safety. Should an employee be injured or become ill in the course of and arising from employment, CH2M HILL will attempt to provide modified work. Modified work ("light duty") will be made available to bring the employee back to the work environment, for the benefit of the employee and the company, whenever medically appropriate.

Employees are expected to return to modified work when medically capable. The work assigned to the injured or ill employee will meet the restrictions set forth by the treating and/or company physician. Examples of modified work include but are not limited to office work, dispatching, and light shop work.

3.6 First Aid

Each facility and work location must be evaluated to determine the potential requirement for medical emergencies. At a minimum, an industrial first-aid kit will be provided. An adequate number of employees with current certification in first aid and CPR will be maintained on the project sites. At no time will field work be conducted with less than two CPR/first aid trained personnel present.

The SSHO/UXOSO will ensure that emergency medical attention is readily available. For emergency response and remediation operations, the SSHO/UXOSO will establish the requirement for medical emergency response and identify (if applicable) an emergency medical facility with chemical contamination trauma capability (see Section 9.2.10). If site conditions require, a subcontract emergency medical technician (EMT) will be made available, as well as onsite ambulance service.

3.7 Review of Safety and Health Statistics

CH2M HILL ACCIDENT EXPERIENCE (EMR):

CH2M HILL, Inc. **Updated:** **10/13/2009**

Safety Performance Metric Summary

Category	2004	2005	2006	2007	2008	2009 Q3
Experience Modification Rate (EMR)	0.78	0.83	0.76	0.74	0.66	0.67
Note: North American Industry Classification System (NAICS) code 54133 (Engineering Services) was used for rate averages.						

3.8 Specific Written Safety Procedures/Permits

In order to provide a safe and healthy workplace and communicate specific work requirements, specific tasks are incorporated by reference to the procedures/permits. These procedures/permits deal with specific areas such as confined space, hot work, lock-out/tag-out, etc. Please refer to Sections 9 through 11 for specific reference to procedures/permits applicable to the execution of this project.

All CH2M HILL personnel who may be subject to these procedures will receive appropriate training and will be held accountable for adherence to procedure requirements.

3.9 State, OSHA, and Other Regulations

Where state regulations or other requirements differ from federal regulation cited in this plan, the more stringent regulation will apply.

3.10 Changes

Any user of this plan is welcome to recommend changes. Changes normally result from finding errors, regulatory changes, equipment modification, new equipment purchases, and changes to operation procedures or site conditions. Following is the format for making a recommended change:

Submit a written recommendation to the project Safety and Health Manager via the CH2M HILL PM or the SUXOS/SM. The Safety and Health Manager will review the recommendation. After review, the Safety and Health Manager will determine if the suggestion should be included as an amendment or as a new procedure in this plan. Changes to this plan will be distributed immediately upon approval.

4.0 Responsibilities and Lines of Authorities

The following CH2M HILL personnel will have the authority to intervene and stop work in the interest of ensuring adherence to Safety and Health policies and procedures defined by the APP/SSHP:

• Mark Sherrill	Project Manager Office: (678) 530-4320 or (678)938-0923/Cell
• Mike Goldman	Safety and Health Manager/CIH, CSP, CHMM, CPEA Office: (678) 530-4133, Cell: (770) 331-3127
• Kevin Lombardo	Munitions Response Manager Office: (703) 376-5175, Cell: (703) 608-8247
• Chris Rose	SUXOS/Site Manager (SM) Office: (205) 326-8912, Cell: (205) 639-7297
• Cliff Walden	SSHO/UXOSO Office: (352) 335-5877, Cell: (787) 510-2544
• George DeMetropolis	MR Safety and Quality Officer Office: (619) 687-0120 x37239; Cell: (619) 564-9627

Organization and Responsibility for Safety and Health

CH2M HILL's first priority is the safety and protection of its employees, clients, and the community. The concern for the implementation of appropriate Safety and Health measures is focused on field operations but extends to other areas over which CH2M HILL has stewardship. If an activity or condition at a location under CH2M HILL control is determined to be inconsistent with its Safety and Health policies and procedures, attempts will be made to correct the situation immediately or as soon as possible. At no time will any CH2M HILL employee perform duties in a work environment that is immediately dangerous to life and health or in an imminently dangerous situation. In these situations, the task will not proceed until the situation is corrected.

All project personnel are responsible to the SSHO/UXOSO during fieldwork and will review, and become familiar with, the content of this project-specific APP/SSHP. Project team personnel will comply with the hazard-specific instruction provided by the Health and Safety Manager, and the SSHO. Any deviations from the procedures identified in this APP/SSHP must be based on field conditions encountered, and must be documented. Any deviations from published munitions response (MR) directives must be approved by the SUXOS, the UXOSO and the MR Safety and Quality Officer.

4.1.1 Project Manager

Mark Sherrill is the CH2M HILL PM and is responsible for ensuring all activities performed at Fort Rucker are conducted in accordance with contractual specifications and the approved Work Plan.

The CH2M HILL PM is responsible for management of all operations conducted for the project, and will ensure that all personnel assigned to the project, including subcontractors, have reviewed appropriate sections of the Work Plan before tasks associated with the project begin. The CH2M HILL PM will monitor the budget and schedule to ensure availability of necessary personnel, equipment, subcontractors, and services, and will also participate in the development of the field program, evaluation of data, and reporting.

The CH2M HILL PM is responsible for providing adequate resources (budget and staff) for project-specific implementation of the Health, Safety and Environment (HS&E) management process. He has overall management responsibility for the project tasks identified herein. The CH2M HILL PM may explicitly delegate specific tasks to other staff, as described in sections that follow, but retains ultimate responsibility for ensuring the following in accordance with this APP/SSHP.

- Inclusion of standard terms and conditions, and contract-specific HS&E roles and responsibilities in contract and subcontract agreements (including flow-down requirements to lower-tier subcontractors).
- Selection of safe and competent subcontractors by:
  - Obtaining, reviewing, and accepting or rejecting subcontractor pre-qualification questionnaires.
  - Ensuring that acceptable certificates of insurance are secured as a condition of subcontract award.
  - Including HS&E submittals checklist in subcontract agreements, and ensuring that appropriate site-specific safety procedures, training and medical monitoring records are reviewed and accepted prior to the start of subcontractor's field operations.
- Maintaining copies of subcontracts and subcontractor certificates of bond, license, training and medical monitoring records, and site-specific safety procedures in the project file, accessible to site personnel.
- Providing oversight of subcontractor HS&E practices per this APP/SSHP.
- Managing the site and interfacing with third parties in a manner consistent with the contract and subcontract agreements and the applicable standard of reasonable care.
- Ensuring that both the overall and job-specific HS&E goals are fully and consistently met.

4.1.2 Safety and Health Manager

The project Safety and Health Manager's responsibilities include the following:

- Develop and/or review the project APP/SSHP.
- Review and accept or reject subcontractor pre-qualification questionnaires that fall outside the performance range delegated to the Contracts Administrator (KA).
- Review and accept or reject subcontractor training records and site-specific safety procedures prior to start of subcontractor's field operations.

- Support the APP/SSHP's oversight of subcontractor (and lower-tier subcontractors) HS&E practices, and interface with third parties, as necessary.
- Support and assist program staff in executing the HS&E policies and procedures adopted by the program for implementation, including the program Behavior Based Loss Prevention System (BBLPS). Provide consultation and direction to project staff with regard to HS&E project and program requirements and industrial hygiene practices.
- Be available for consultation/direction with regard to project industrial hygiene and worker exposure matters, as may be required by the project team.

The project Safety and Health Manager meets established qualification, training and experience criteria requirements and exhibits sufficient knowledge in health, safety and/or industrial hygiene matters. The Safety and Health Manager acts as the responsible program officer to review and approve all developed project-specific APP/SSHP documents and to provide consultation or recommendations with regard to project worker protection and exposure issues, as required.

4.1.3 Field Team Members

Field team members are entrusted with special duties concerning the safety and health of CH2M HILL field team members. They are critical links to the success of CH2M HILL's injury and illness prevention program and are key components to achieving corporate Loss Prevention goals. Some of their responsibilities are as follows:

- Implementing the aspects of the program specific to individual project sites;
- Recognizing and taking action on safety and health hazards which are causing or are likely to cause death or serious physical harm to any employee;
- Conveying hazard information to subordinate employees at the project site;
- Investigating accidents, injuries and illness that occur under their supervision at the project site, in accordance with the accident investigation procedures identified by the program;
- Implementing routine pre-job safety overviews at sites as the project begins, as new tasks are planned, as new project hazards are identified, or when new project team members are assigned to the project site;
- Taking prompt action to correct identified acts or conditions which are personally observed by a supervisor or brought to the attention of a supervisor;
- Providing adequate pre-project planning to allow for the effective procurement of appropriate equipment, materials, safety related systems or documents to facilitate the execution of individual tasks in a safe and efficient manner;
- Promoting and ensuring an appropriate project safety culture for subordinate employees by positive example; and
- Stopping or correcting questionable acts or identified conditions that are under a supervisor's responsibility and which are inconsistent with established safety standards,

CH2M HILL's policies, and procedures and requirements established by this APP/SSHP.

4.1.3.1 Senior UXO Supervisor/SM

The SUXOS is the most senior UXO Technician onsite and will serve as the SM. The SUXOS/SM will directly control the operations of all personnel performing MEC activities, and report directly to the CH2M HILL PM concerning technical MEC and operational issues, and to the project leadership on all matters related to site safety and quality control. The SUXOS/SM will oversee implementation of the approved plans in the field and supervise all personnel on the project. The SUXOS/SM has the authority to stop work to correct an unsafe condition or procedure. The SUXOS/SM will meet the minimum requirements of Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP) 18, Minimum Qualifications for UXO Technicians and Personnel Standards for the SUXOS, position; and terms outlined by U.S. Department of Labor Employment Standards Administration Wage Hour Division for UXO Personnel.

The SUXOS/SM will be able to fully perform the following functions: planning, coordinating, and supervising all contractor onsite UXO activities; preparation of SOPs for MEC operations; ensuring compliance with Department of Defense (DoD) directives as well as local, state, and federal statues and codes; and certification of Ammunition, Explosives, and Dangerous Articles and/or range scrap as ready for turn-in or disposal in accordance with current policies. The SUXOS/SM will also be fully capable of supervising multiple project teams that may be performing MEC- and MEC-related activities (for example, vegetation clearing; land surveying; reconnaissance and classification of MEC, pyrotechnic items, and military explosives and demolition materials; locating surface and subsurface MEC; destroying MEC by burning or detonation; and/or transporting and storing MEC and explosives material).

4.1.3.2 UXO Safety Officer

The SSHO/UXOSO is responsible for implementing safety policy and guidance for the project delivery teams and for providing oversight for implementation of this APP/SSHP in matters relating to munitions response (MR). Overall, the SSHO/UXOSO is responsible for ensuring the safety of the public, the environment, and all project personnel involved in MEC operations.

The SSHO/UXOSO will have the specific training, knowledge, and experience necessary to implement the APP/SSHP and verify compliance with applicable safety and health requirements of this APP/SSHP and each Activity Hazard Analysis (AHA) for each SOP relating to the scope of work. In addition, the SSHO/UXOSO will have the ability to implement the approved MEC and explosives safety program in compliance with all DoD, Federal, State, and local statutes and codes; analyze MEC and explosives operational risks, hazards, and safety requirements; establish and ensure compliance with all site-specific safety requirements for MEC and explosives operations; enforce personnel limits and safety exclusion zones (EZs) for MEC clearance operations, MEC and explosives transportation, storage, and destruction; conduct safety inspections to ensure compliance with MEC and explosives safety codes; and operate and maintain air monitoring equipment as required for airborne contaminants.

The SSHO/UXOSO will also:

- Verify that this APP/SSHP remains current and amended when project activities or conditions change.
- Verify that CH2M HILL's site personnel and subcontractor personnel have read (or been briefed on) this APP/SSHP and signed the Acknowledgement Form in Attachment 1 prior to commencing field activities.
- Verify that CH2M HILL's site personnel and subcontractor personnel have completed any required specialty training (e.g., fall protection, confined space entry [CSE]) and medical surveillance, and maintain the Project Safety and Health Tracking and Deficiency Forms (Attachment 2) when applicable.
- Verify adherence to the requirements of this APP/SSHP and applicable subcontractor's Safety and Health Plan(s).
- Act as the project "Hazard Communication Coordinator."
- Act as the project "Emergency Coordinator," when designated by the SUXOS/SM, SSHO, or CH2M HILL PM, and perform the responsibilities outlined in this APP/SSHP or as may be required to properly coordinate the onsite response of emergencies, should they arise.
- Verify that safety meetings are conducted at least daily or more frequently as project tasks or hazards change and document for the project record in accordance with the requirements of the Behavior Based Loss Prevention System (BBLPS); verify that other components of the BBLPS, such as weekly observations, are being implemented as intended.
- Verify that project Safety and Health forms in Attachment 2, or in CH2M HILL's SOPs, are being used as intended.
- Verify that project postings are completed as required and that subcontractor certificates/documents (training and medical monitoring records) and site-specific safety procedures are available or have been executed prior to the start of subcontractor's field operations.
- Manage interface with third parties in a manner consistent with the contract/ subcontract agreements and the applicable standard of reasonable care.
- Coordinate with the CH2M HILL PM, SUXOS/SM, and Safety and Health Manager, as necessary regarding subcontractor operational performance or third-party interfaces.
- Ensure that the overall, project-specific and program Safety and Health goals are fully and continuously implemented. All OSHA and Labor related posters are located in a location observable by all personnel.
- Exclusion Zone personnel limits (including the number of visitors) are posted in a location observable by all personnel.

- Emergency phone numbers, route and location of hospital will be posted in a location observable by all personnel.

The SSHO/UXOSO is responsible for coordinating with the SUXOS/SM and CH2M HILL PM. In general, the CH2M HILL PM will contact the client in the event accidents, injuries or property damage occurs on the site. The Safety and Health Manager should be contacted by the SSHO/UXOSO, as appropriate to the situation.

4.1.3.3 UXO Technicians II & III

UXO Technician II and III personnel will report directly to the SUXOS/SM and are responsible for the safe and efficient performance of specific field tasks as assigned by the SUXOS/SM. They are also to bring an unsafe condition or procedure to the attention of the SUXOS/SM. Each UXO Technician II and III will meet the minimum requirements of DDESB TP 18 and U.S. Department of Labor Employment Standards Administration Wage Hour Division for UXO Personnel.

4.1.3.4 Other Field Team Employees

Every employee, regardless of job title, shares the responsibility for safety and must report any unsafe or deficient work conditions or acts without fear of reprisal. It is imperative that employees observe the following minimum requirements in order to achieve a safe and healthy workplace:

- Each employee must familiarize themselves with the contents of this APP/SSHP and the general safety rules herein.
- Each employee will practice procedures and follow all safety rules and regulations for the successful completion of all job tasks.
- Each employee will wear the PPE required for the job or task as specified by the APP/SSHP or other applicable requirements.
- Each employee will notify their immediate supervisor of any potential workplace hazard or work practice that is not consistent with CH2M HILL’s Safety and Health policies and procedures and could result in an accident, injury, illness, or destruction of property.
- Each employee will report all accidents to an immediate supervisor regardless of whether injury or property damage resulted. This includes all near misses (accidents without injury or damage). This requirement serves to bring unsafe conditions to the attention of management.
- Each employee will be subject to contraband search for safety purposes and for the safety of fellow employees.
- Violations of safety policies and procedures may be cause for disciplinary actions up to and including dismissal.
- Each employee who is taking any prescription or over-the-counter medications that could alter the manner in which they could be treated in an emergency or affect the job performance/safety of the employee or other employees in the work environment (i.e. via heavy equipment operations) will notify their supervisor prior to beginning work.

4.1.4 Subcontractor Responsibilities

All subcontractors are responsible for their own Safety and Health programs and the safety and health of their own employees. This requirement is based on OSHA regulations, which recognize the employer-to-employee responsibility for safety and health. A copy of their written program must be submitted to CH2M HILL for review. In an effort to assist the subcontractors, and to comply with hazard communication requirements, CH2M HILL will provide a copy of this APP/SSHP to each subcontractor for implementation by the subcontractor’s employees.

4.2 Employee Competency

Employee competency, as defined by 29 CFR 1926.32(f), for areas of executable contract work for which an employee has responsibility, will be established by the employer only. Competency will be determined by employee training, total work or on-the-job experience, professional certification(s), educational degrees, and/or demonstrated skill sets. It is the opinion of CH2M HILL that professionals identified herein are competent in their areas of expertise with regard to the management and field execution of the contract work, or in the implementation of CH2M HILL site-specific or program Safety and Health requirements, as applicable to anticipated project tasks. Executable onsite contract work, for which there is a requirement for a competent person to oversee, will not be conducted unless a designated competent person is available onsite, can perform the duties required by the position of competency, and has the authority to do so.

4.3 Pre-task Safety and Health Analysis

Requirements for completing Pre-Task Safety Plans for onsite work must be, at a minimum, in accordance with Attachment 3 and Section 10.2 of this APP/SSHP. AHA documents applicable to this project are included in Section 10.6.

The SUXOS/SM or SSHO/UXOSO will conduct Daily Site Safety Meetings at the start of each work shift for onsite personnel and periodic “work phase” meetings. The SUXOS/SM or SSHO/UXOSO must require subcontractors to follow similar meeting procedures or participate in CH2M HILL’s daily safety meetings or work phase meetings, as necessary.

4.4 Lines of Authority

Safety responsibilities, accountability, and lines of authority for this project are as identified in Figures 4-1 and 4-2.

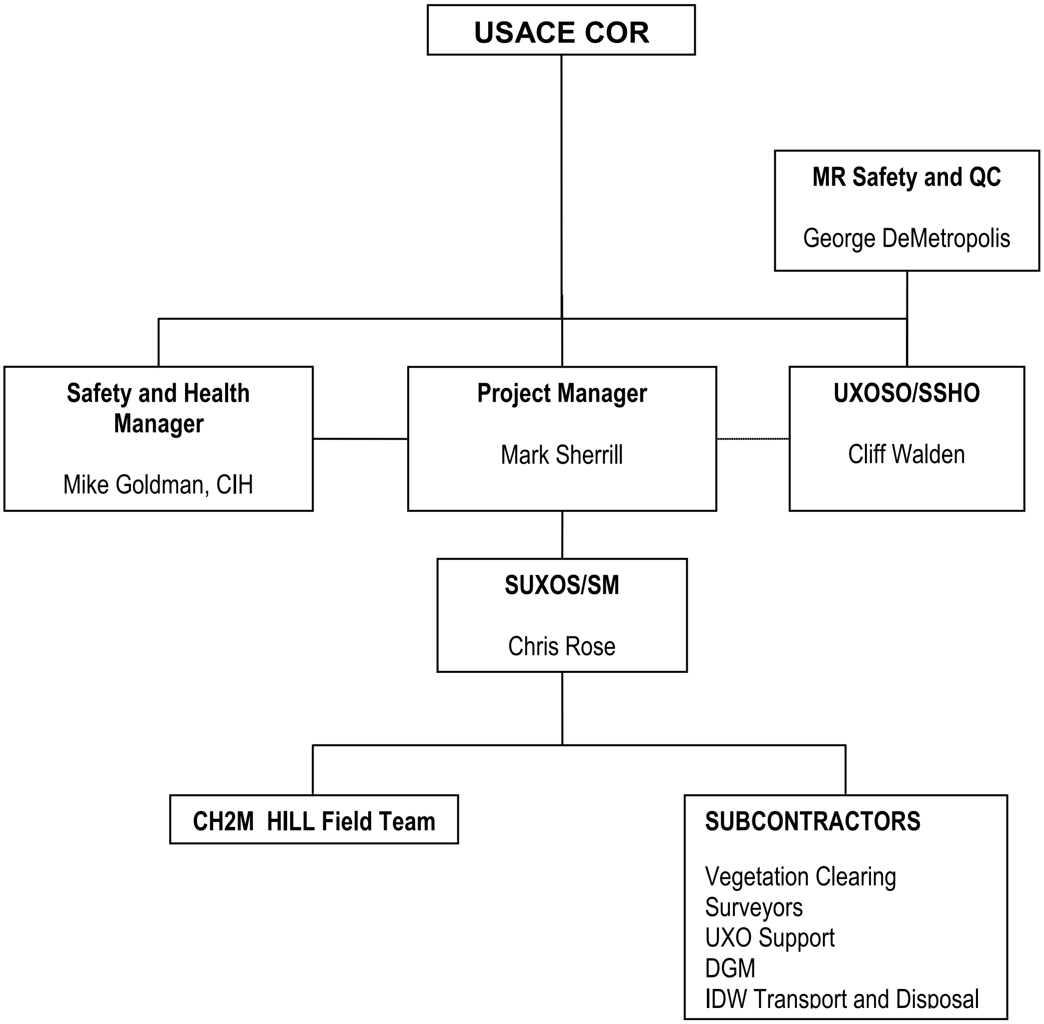
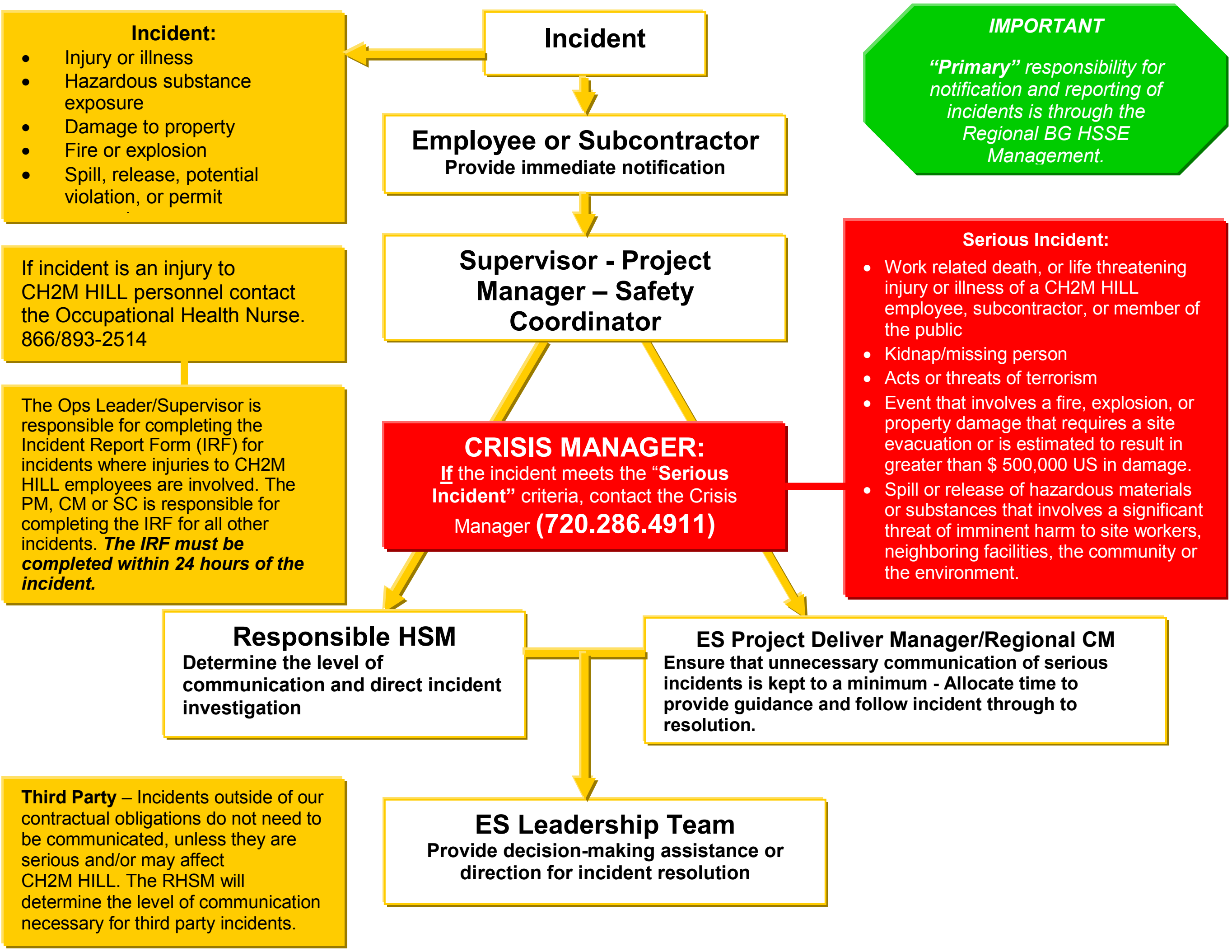


FIGURE 4-1
Safety Chain of Command

The purpose of this basic flowchart is to provide direction on the standard notification and reporting process for incidents and serious incidents. This process ensures timely notification to the appropriate Business Group Management and allows for **positive control** over flow of information, so that the incident is handled effectively, efficiently, and in conjunction with appropriate corporate entities



Incident:

- Injury or illness
- Hazardous substance exposure
- Damage to property
- Fire or explosion
- Spill, release, potential violation, or permit

Incident

Employee or Subcontractor
Provide immediate notification

IMPORTANT

*“**Primary**” responsibility for notification and reporting of incidents is through the Regional BG HSSE Management.*

If incident is an injury to CH2M HILL personnel contact the Occupational Health Nurse. 866/893-2514

Supervisor - Project Manager – Safety Coordinator

The Ops Leader/Supervisor is responsible for completing the Incident Report Form (IRF) for incidents where injuries to CH2M HILL employees are involved. The PM, CM or SC is responsible for completing the IRF for all other incidents. ***The IRF must be completed within 24 hours of the incident.***

CRISIS MANAGER:
If the incident meets the “**Serious Incident”** criteria, contact the Crisis Manager **(720.286.4911)**

Serious Incident:

- Work related death, or life threatening injury or illness of a CH2M HILL employee, subcontractor, or member of the public
- Kidnap/missing person
- Acts or threats of terrorism
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 US in damage.
- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

Responsible HSM
Determine the level of communication and direct incident investigation

ES Project Deliver Manager/Regional CM
Ensure that unnecessary communication of serious incidents is kept to a minimum - Allocate time to provide guidance and follow incident through to resolution.

Third Party – Incidents outside of our contractual obligations do not need to be communicated, unless they are serious and/or may affect CH2M HILL. The RHSM will determine the level of communication necessary for third party incidents.

ES Leadership Team
Provide decision-making assistance or direction for incident resolution

Post-emergency incident communications regarding serious incidents at a CH2M HILL office or project (regardless of the party involved) shall be considered sensitive in nature and must be controlled in a confidential manner.

FIGURE 4-2
CH2M HILL Incident Reporting Process

4.5 Noncompliance with Requirements

The duty for employee disciplinary action must be exercised by the employee’s line manager, supervisor, or Corporate official, as appropriate. Verbal or written reprimands, suspensions, or terminations will be in accordance with the requirements established by the CH2M HILL Employee Handbook.

To ensure orderly operations and provide the best possible work environment, CH2M HILL expects its employees to follow rules of conduct that will protect the interests and safety of all employees and the firm.

Acceptance of the rules and legislated regulations is of vital importance to the success of the Loss Prevention effort. Non-compliance with the following items is unacceptable and disciplinary action will result:

1. **Comply with supervisory instruction** and job training on the safe completion of each task. Each individual will be aware of the potential hazards associated with their work process and participate in the use of the required control measures.
2. **Do not use damaged equipment or tools**. Equipment, tools and materials that are not in a condition to perform the function for which they were designed will **be removed from service** until repairs are made by a qualified person.
3. **Use equipment for their intended purpose**. Machines, tools and equipment will be used as per the manufacturers’ or engineers’ specifications. Modifications will not be made unless approved by the CH2M HILL PM.
4. **Refuse to work** when in an **immediately dangerous to life or health** situation. Report the imminently dangerous situation to your supervisor immediately.
5. **Report all injuries or incidents** to your supervisor immediately for corrective measures.

Where unacceptable employee behavior or workplace actions may occur, it is CH2M HILL’s intent to administer equitable and consistent disciplinary actions. The best disciplinary measure is the one that does not have to be enforced and comes from good leadership and fair supervision at all employment levels.

Generally, a measure of progressive disciplinary action is implemented when unacceptable employee actions occur. Progressive discipline means that, with respect to most disciplinary problems, these steps will normally be followed:

- A first offense may call for a verbal warning;
- A next offense may be followed by a written warning;
- Another offense may lead to a suspension; and, still another offense may then lead to termination of employment.

CH2M HILL recognizes that there are certain types of employee problems that are serious enough to justify either a suspension, or, in extreme situations, termination of employment, without going through the usual progressive discipline steps. However, by using progressive discipline, most employee problems can be corrected at an early stage, benefiting both the employee and CH2M HILL.

4.6 Managers and Supervisors Safety Accountability

It is the duty of the first line supervisor to motivate employees to adhere to CH2M HILL's safety policy and procedures in each work environment. A first line supervisor, for these purposes, is defined as that person designated to give immediate onsite supervision to personnel involved in a task.

All managers and supervisors will have knowledge of the safe procedure for all jobs and tasks under their supervision. When in doubt, they will seek assistance of the company safety professional, prior to initiating a task. If the task cannot be accomplished safely, it will not be attempted.

Managers and supervisors will:

- Explain the safety procedure involved with a task to each employee and check frequently to see that employees are executing their assigned work as instructed.
- Allocate sufficient time for the training and mentoring of employees to ensure that everyone knows the correct procedure for properly accomplishing required tasks.
- Prevent new employees from performing any tasks until required training/orientation is completed.
- Immediately correct unsafe conditions that involve CH2M HILL employees or subcontractors.
- Ensure that the employees are outfitted with and wear PPE as specified by this APP/SSHP, CH2M HILL policies and procedures, or as directed by the CH2M HILL PM, SSHO/UXOSO, or SUXOS/SM.
- Set a good example.
- Obtain the cooperation of employees and subcontractors.
- Promote a healthy and safe work environment for employees and subcontractors.
- Confirm that subcontractor safety performance records have been verified prior to contract award and monitor CH2M HILL performance during operations.
- Report all accidents, near misses, and property damage in accordance with the Incident Reporting Process.
- Establish a safety culture, using the elements of CH2M HILL's Safety and Health program or project specific requirements, which promotes awareness, encourages participation, and recognizes excellence.

4.7 CH2M HILL Employee Responsibility Requirements

Each employee is responsible for their personal safety as well as the safety of others in the area and is expected to participate fully in the implementation of the BBLPS process. The employee must use all equipment provided in an appropriate and responsible manner as directed by the SUXOS/SM or SSHO/UXOSO. All CH2M HILL personnel must follow the policies and procedures set forth in the CH2M HILL Safety and Health Program or project specific requirements. Site personnel who are concerned with any aspect of Safety and Health will bring it to the attention of the SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM. All project personnel have the authority to stop work, if it is their judgment that serious injury could result from continued activity. The CH2M HILL PM or SSHO/UXOSO will be notified immediately if this becomes necessary. Additional notifications must be made to senior managers. Personnel who knowingly disregard safety policies/procedures may be subject to disciplinary actions in accordance with established procedure.

5.0 Subcontractors and Suppliers

5.1 Subcontractor/Supplier Coordination and Control

CH2M HILL subcontractor safety performance and adherence to established industry standards and project policies and procedures will be reviewed a contract for site work is issued. CH2M HILL subcontractors will be required to comply with the most stringent requirement defined by the subcontractor's own policies and procedures, requirements outlined in this APP/SSHP, or other policies and procedures/requirements applicable to a project (i.e. contract flow-down requirements).

CH2M HILL has identified four subcontractors for this project:

- Engineering Remediation Resources Group, Inc. (ERRG) - MEC services
- NAEVA Geophysics, Inc. (NAEVA)– DGM services
- Donaldson, Garrett, and Associates –land surveying services
- Empirical Laboratories, Inc. (Empirical)- analytical laboratory services

CH2M HILL will conduct a competitive, subcontract procurement for vegetation clearing and investigation-derived waste (IDW) transport and disposal.

The CH2M HILL procurement/contracting team maintains an extensive and detailed process for subcontractor procurement, with the Federal Acquisition Regulation (FAR) as the primary driver. Subcontractor selection is based on scope of work pricing, qualifications, safety performance, and best value evaluations.

5.2 Subcontractor/Supplier Responsibilities

All subcontractor employees are subject to the same training and medical surveillance requirements as CH2M HILL personnel, depending on job activity. Project activities involving the potential for exposure to hazardous waste materials will require medical and training certification as mandated by 29 CFR 1910.120/29 CFR 19126.65, but will be determined based on the requirements applicable to the subcontractor's assigned work.

All subcontractor personnel will be required to sign in daily at CH2M HILL controlled project sites and either attend a CH2M HILL sponsored daily safety meeting discussing operations, site-specific hazard awareness, or other pertinent issues associated with the scheduled work or hold their own meeting with similar purpose. Where CH2M HILL and subcontractor personnel are engaged in integral site operations, it is recommended that joint meetings be conducted. In addition, subcontractors must develop and provide AHAs for their work activities to CH2M HILL for review, which, depending upon contract conditions, may also be required to be forwarded to client for review as well.

The CH2M HILL PM may designate subcontractor reporting requirements to the SUXOS/SM, SSHO/UXOSO, or designee. All incidents involving subcontractor employees will be reported to the SUXOS/SM and SSHO/UXOSO, and a copy of the subcontractor's incident or injury illness report will be submitted to the CH2M HILL PM as soon as possible, but no later than 24 hours.

CH2M HILL subcontractors will be required to acknowledge and adhere to the requirements of this APP/SSHP. Subcontractors covered by this APP/SSHP must be provided a copy to read and accept prior to initiating work on this site. However, this APP/SSHP may not address specific hazards associated with specialty tasks and equipment with which the subcontractor has expertise (e.g., electrical, demolition). Where specifically applicable to the subcontractor's specialized work or where subcontractor's work is not addressed by this APP/SSHP, a subcontractor must be required to develop or implement their own APP/SSHP, which is equally or more stringent than this APP/SSHP or prime contract documents.

Subcontractors are responsible for the Safety and Health procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. It is critical that subcontractor work be performed in a manner that is consistent with applicable OSHA standards (29 CFR 1910, 29 CFR 1926), EM 385 1-1, or other applicable Safety and Health plan(s)/protocols. The SSHO/UXOSO should verify that applicable subcontractor employee training and medical clearance documents, as applicable, are valid. Identified subcontractor safety and health performance or site conditions that are not consistent with established procedures should be documented and then corrected.

Suppliers delivering materials to the site or providing equipment and equipment maintenance must adhere to established rules and regulations specified by the client. Supplier personnel will not be permitted into EZs unless training and medical surveillance are in accordance with 29 CFR 1910.120(f)/29 CFR 1926.65(f), as applicable.

Subcontractor personnel will not be allowed to ride on tractors, powered industrial trucks, or similar vehicles unless specific seats are provided. They must follow facility hot work rules if hot work is required for vehicle or equipment maintenance. Subcontractor vehicles must be loaded and unloaded in a safe and effective manner and materials must be stored safely in designated locations only. Associated packaging will be properly disposed of and litter will not be permitted to be scattered or blown from truck beds. Operators of mobile onsite equipment must observe all traffic rules such as speed limits and pedestrian rights-of-way.

CH2M HILL continuously endeavors to observe subcontractors' safety performance. This goal should be reasonable, and include observing for hazards or practices and procedures that are not consistent with established safety and health requirements that are both readily observable and occur in common work areas. CH2M HILL oversight does not relieve subcontractors of their responsibility for effective implementation of and compliance with the established plan(s), protocols, or established safety regulations or contract conditions.

In addition to this level of observation, the SUXOS/SM or SSHO/UXOSO should confirm CH2M HILL subcontractor performance against both the subcontractor's safety plan and standard industry procedures or contractual requirements.

Safety and health related communications with CH2M HILL subcontractors should be conducted as follows:

- Request subcontractor personnel to read this APP/SSHP and then require them to sign the Acknowledgement Form in Attachment 1 as applicable.
- Request subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent conditions, actions, or practices are observed that are not consistent with this APP/SSHP, or CH2M HILL Safety and Health Program protocols, notify the subcontractor safety representative and require corrective action—the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When identified conditions or practices/actions that are not consistent with CH2M HILL Safety and Health policies and procedures, or other applicable Safety and Health protocols, are repeated or persist, notify the subcontractor safety representative, individual responsible for site operations, and/or CH2M HILL PM and stop affected work until adequate corrective measures are implemented. See Stop Work Order (SWO) Form in Attachment 4.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, SUXOS/SM, and/or CH2M HILL PM and stop affected work until adequate corrective measures are implemented (see SWO form). Notify the CH2M HILL PM and Safety and Health Manager, as appropriate.
- Document all oral Safety and Health related communications in project field logbook, daily reports, or other records.

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6.0 Training

6.1 Safety Training

CH2M HILL engages in MEC and environmental investigations and other services, and endeavors to comply with the Safety and Health training requirements mandated by governmental agencies, internal policies, and client requirements.

Personnel will be provided sufficient training to execute their jobs in a safe and healthy manner.

Direct supervisors, with support by the Safety and Health Manager, are responsible for determining the training requirements of a task and ensuring that employees have the necessary training to complete the task safely. The Safety and Health Manager and/or safety and health personnel will assist with the delivery of identified required training.

Designated employer personnel and electronic databases facilitate the maintenance of training records and applicable experience documentation. When an employee is identified as lacking sufficient training or experience to perform an assigned task, attempts will be made to provide the necessary training or to provide a trained and experienced alternate until the employee has achieved the required criteria.

6.2 Safety Indoctrination Subjects

All site personnel, including CH2M HILL and subcontractors, who may be covered by this APP/SSHP, must review this APP/SSHP and sign the Acknowledgement Form (Attachment 1). Managers and supervisors may receive and more extensive program indoctrination, commensurate with their assigned responsibilities.

6.3 Mandatory Training and Certifications

All site personnel entering a regulated work area, EZ, or performing designated Hazardous Waste and/or Emergency Response Operations, or other tasks that may require specific training, will be trained to meet the requirements that may be applicable to the individual's assigned tasks. This training will include, but may not be limited to the following:

CH2M HILL PM, SUXOS/SM or SSHO/UXOSO:

- 40 hour training course in accordance with 29 CFR 1910.120(e)(3)/29 CFR 1926.65(e)(3) (as applicable to assigned duties)
- Annual 8 hour refresher training course in accordance with 29 CFR 1910.120(e) (8)/ 29 CFR 1926.65(e) (8).
- Management and supervisor training course in accordance with 29 CFR 1910.120(e)(4)/29 CFR 1910.65(e)(4)
- Munitions Response Training; DDESB TP-18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and personnel

Site Workers:

- 40 hour training course in accordance with 29 CFR 1910.120(e)(3)/29 CFR 1926.65(e)(3) (as applicable as applicable to assigned duties)
- Annual 8 hour refresher training course in accordance with 29 CFR 1910.120(e)(8)/ 29 CFR 1926.65(e)(8).
- MEC Awareness Training

Prior to commencement of site activities, the SSHO/UXOSO will ensure that all employees engaged in site operations are informed of the nature and degree of exposure to potential hazards resulting from participation in site operations. The SSHO/UXOSO will accomplish this by ensuring that all site workers have received the appropriate OSHA (including HAZWOPER) and site-specific training prior to participating in site activities. Personnel provided by CH2M HILL to work onsite will NOT be permitted to mobilize if their HAZWOPER training or any other required training will lapse during the anticipated period of deployment. The SSHO/UXOSO will check every individual's records to ensure compliance with OSHA requirements.

6.3.1 OSHA Training for General Site Workers

All employees involved in hazardous waste site activities receive 40/24 (as appropriate) hours of OSHA HAZWOPER training. They must also have current HAZWOPER 8-Hour Refresher Training prior to working on the site (if appropriate). Any site worker entering the site will be required to have current HAZWOPER training.

Additional training may include the following:

- Review of this APP/SSHP
- Review of the Corporate Safety and Health Program
- Management of hazardous waste site cleanup operations
- Management of site work zones
- Spill containment
- MEC awareness

6.3.2 OSHA HAZWOPER Manager and Supervisor Training

The SSHO/UXOSO will receive the same training as the general site workers for whom he/she is responsible. He/she will also receive an additional 8 hours of OSHA required supervisory training to enhance the ability to provide guidance and make informed decisions.

6.3.3 UXO Personnel Training

All UXO Technicians onsite will meet the requirements of DDESB TP 18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel.

6.3.4 MEC Awareness Training

Initial MEC awareness training is an appropriate safety precaution for all subcontractor personnel working in each MMRP site prior to and including anomaly investigation. MEC awareness consists of training in basic MEC characteristics, identification and reporting procedures.

6.4 Hazards Communication Training

OSHA's standard for hazard communication requires that all workers be informed of potentially hazardous materials used in their work area. Personnel will be provided information and training on hazardous materials at the work site at the time of the initial assignment and whenever a new material is introduced or found that could present a potential hazard. Personnel will be briefed on the general requirements of the OSHA hazard communication standard and duty-specific hazards before they begin any duties on the work site.

6.4.1 Daily Site Safety Meeting

The Daily Site Safety Meetings consist of a short overview of the daily operations to be performed, and who is responsible for their completion. This will be completed by the SUXOS/SM prior to commencing operations each day. This meeting will include such items as:

- Expected weather conditions
- General site hazards
- MEC hazards
- PPE required
- Emergency evacuation procedures
- Buddy system procedures
- A review of any safety violations from the previous day
- Any other significant events involving safety

Additional meetings 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 the project can be carried out in a safe and effective manner. Daily Site Safety Meetings will be recorded daily in the field notes.

6.4.2 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 SUXOS/SM during the Tailgate Safety Meeting. These safety meetings will help ensure the safety and health of field personnel in the performance of regular work activities and in emergency situations. Safety meetings will be documented.

6.4.3 Visitors

Visitors to the site may include representatives from the Army. Visitors entering a munitions response site must receive the daily safety briefing. The total number of visitors will not exceed authorized limits. Non-UXO qualified personnel will not be authorized in the EZ when intentional contact with MEC is planned-. These personnel, even if escorted by a UXO Technician, if appropriate, must receive, as a minimum, a briefing on site conditions, hazards, and emergency response procedures. Visitors must possess the appropriate level of OSHA training. The SSHO/UXOSO will provide the visitor briefing. All visitors to the site will be escorted at all times. Visitors not complying with the above requirements will not enter the site. A visitor log will be maintained. To conform to safety requirements, visitors will review and sign all required safety documentation.

6.4.4 Training Documentation

Employee training records are available at Corporate offices, by electronic means, and are typically maintained on the project site. Depending on the size of the project crew and because of work crew dynamics and scheduling, the provision of hard copy employee training and medical surveillance records, for all anticipated personnel who may be assigned to this project, within the context of this APP/SSHP, may be impractical. CH2M HILL endeavors to maintain these documents onsite for review and will provide them to government officials for verification, upon request. Additionally, training records for identified Key Project Safety personnel are identified in Attachment 5 of this APP/SSHP.

7.0 Safety and Health Inspections

The SUXOS/SM and SSHO/UXOSO are required to perform site inspections using the checklists/forms included in Attachments 2 and 3 of this APP/SSHP. The forms included in Attachments 2 and 3 are not intended to be an all inclusive detail of inspection forms/checklists which may be utilized during the execution of this project.

Site inspections/evaluations will be made by the SUXOS/SM, SSHO/UXOSO, or may be conducted by any authorized CH2M HILL, USACE, US Army Safety Office, DDESB, or Fort Rucker personnel. Discrepancies or deficiencies identified during inspection and evaluation process will be corrected as soon as practicable and documented in a Deficiency Tracking Log (Attachment 2) or Loss Prevention Observation Form (Attachment 6). Serious inconsistencies will be corrected immediately. Inspections that identify Imminent Danger or Immediately Dangerous to Life and Health situations will require that work be immediately stopped and personnel removed from the work area until the situation is abated, corrected, or controlled to a non-hazardous condition.

Non routine audits, conducted by other project personnel, shall be recorded in the CH2M HILL Audit Tracking system.

The SUXOS/SM or SSHO/UXOSO is responsible for conducting and preparing reports of daily inspections of work processes, site conditions, and equipment conditions, and maintaining these documents for the project record, as necessary. Corrective actions resulting from discrepancies identified during inspections will be reviewed with the CH2M HILL PM and implemented, as necessary. Copies of these reports are maintained on file at the project locations.

The Safety and Health Manager, the MR Safety & Quality Officer or their designee may conduct site visits and perform additional assessments of project Safety and Health performance, at their own discretion or at the request of a Corporate official or supervisor or manager. Any discrepancies identified as part of these inspection processes will be addressed with the CH2M HILL PM or may be corrected in the field if minor in nature.

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8.0 Accident Reporting and Investigation

8.1 Accident Investigation

All accidents, injuries, illnesses, and incidents of significant property damage will be investigated by the SSHO/UXOSO, SUXOS/SM, or authorized designee. Upon completion of such investigations, reports will be provided to the CH2M HILL PM for review and circulated to CH2M HILL program stakeholders (Safety and Health Manager, CH2M HILL Corporate) and Contracting Officer's Representative (COR), if appropriate.

The Safety and Health Manager, CH2M HILL PM, and/or SSHO/UXOSO, will be involved in serious accident/incident investigations. Such serious accidents include, but may not be limited to the following:

- A fatal injury
- A hospitalization of three or more people resulting from a single occurrence
- A weight handling equipment incident
- A permanent total disability
- A permanent partial disability
- Property damage of $200,000 or more

The Safety and Health Manager or CH2M HILL PM may also request that a specific written accident investigation be conducted in case of an unusual or serious injury or accident (i.e. OSHA recordable cases, property damage). In general, accident, injury, illness, and property damage incident reports will be developed in accordance with the requirements in Section 8.

8.2 Accident Investigations, Reports, and Logs

CH2M HILL accident investigations will be in accordance with this section. The Safety and Health Manager, CH2M HILL PM, or designee conducts accident investigations. Accident investigation reports (including the HITS report) are typically completed by the SSHO/UXOSO or authorized designee and are reviewed and acknowledged by the CH2M HILL PM. The report must be submitted to the Safety and Health Manager, CH2M HILL Corporate, other potential CH2M HILL stakeholders, and the COR, as required/requested, and the CH2M HILL Human Resource Manager as soon as possible, but no longer than 48 hours.

Loss/near-loss incident/incident investigations will be performed for all CH2M HILL and subcontractor incidents involving:

- Personal injuries/illnesses and near-miss injuries
- Equipment/property damage
- Spills, leaks, regulatory violations
- Motor vehicle accidents

The causes of loss and near-loss incidents are similar, so by identifying and correcting the causes of near-loss incidents, future loss incidents may be prevented. The following is the loss/near-loss investigation process:

- Gather all relevant facts, focusing on fact-finding, not fault-finding, while answering the who, what, when, where, and how questions.
- Draw conclusions, putting facts together into a probable scenario.
- Determine incident root cause(s), which are basic causes on why an unsafe act/ condition existed.
- Develop and implement solutions, matching all identified root causes with solutions.
- Communicate incident as a lesson learned to all project personnel.
- File follow-up on implemented corrective action to confirm solution is appropriate.

The SUXOS/SM or SSHO/UXOSO will perform an incident investigation as soon as practical after incident occurrence during the day of the incident, for all loss and near-loss incidents that occur on the project. Loss and near-loss incident investigations will be performed using the following incident investigation forms provided in Attachment 7:

- Incident Report Form (IRF)
- Root Cause Investigation (Guidance Document)
- Loss/Near-loss Investigation Report Form
- Determination of Root Cause(s) (Guidance Document)
- Root Cause Analysis Form
- Root Cause Analysis Flow Chart

In order for the incident to be assessed for the purposes of meeting reporting requirements, it is imperative that all personal injuries, near misses, and property damage incidents involving CH2M HILL project personnel be reported immediately (verbally) to the SUXOS/SM, UXOSO, and CH2M HILL PM and in accordance with the CH2M HILL Incident Reporting Process shown in Figure 4-2.

The following information will be provided:

- Date and time of incident
- Project name and project number
- Name and worker classification
- Extent of known injuries
- Level of medical attention
- Injury cause
- Witnesses

A written incident investigation will be prepared and submitted to the Safety and Health Manager and CH2M HILL PM within 48 hours of incident occurrence by completing the Incident Report, Near-loss Investigation and Root Cause Analysis provided in the applicable attachments of this APP/SSHP. Pertinent Incident and Investigation Reports must be forwarded to the COR as required.

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

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

Instead of implementing a work-area evacuation, small fires or spills posing minimal safety or health hazards may be controlled by onsite personnel, assuming that personnel who respond to these emergencies are properly trained to do so and wearing appropriate PPE to protect themselves against hazards that may be associated with the response.

All loss and near-loss incidents involving personal injury, property damage in excess of $1,000, or near-loss incidents that could have resulted in serious consequences will be investigated by completing the incident investigation forms and submitting them to the Safety and Health Manager, CH2M HILL Corporate, other potential CH2M HILL stakeholders, and the COR, as required/requested within 48 hours of incident occurrence. A preliminary Incident Investigation and Root Cause Analysis will be submitted to the Safety and Health Manager within 24 hours of incident occurrence. The final Incident Investigation and Root Cause Analysis will be submitted after completing a comprehensive investigation of the incident.

8.3 Immediate Notification of Major Incidents

CH2M HILL will notify the COR of any major incident, including injury, fire, equipment or property damage, and environmental incident in accordance with the conditions of the prime contract.

8.4 Exposure Data (Labor Hours Worked)

The records and reports of information related to annual labor hours and workplace accidents, injuries, and illnesses are prepared by CH2M HILL as required under 29 CFR 1904. Where annual summary postings are required under 29 CFR 1904.32(b)(6), they will be posted. A designated representative from CH2M HILL tabulates expended labor hours and recordable injuries, illnesses and lost time work cases that are relevant to CH2M HILL as they occur to verify CH2M HILL safety performance.

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9.0 Plans Required by the Safety Manual

9.1 Layout Plans

Site location maps and figures are included in the Work Plan and are not duplicated herein.

9.2 Emergency Response Plans

9.2.1 Pre-Emergency Project Planning

The SSHO/UXOSO performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with onsite parties, the facility, and local emergency-service providers as appropriate. The SSHO/UXOSO has the following pre-emergency planning responsibilities:

- Verify that onsite intercommunication networks are functioning (e.g., two-way radio or similar).
- Verify that the "buddy system" is used for all assigned work.
- Determine where the nearest offsite communication equipment is available (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Inform emergency room and ambulance and emergency response teams of site activities.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plans before site activities begin, including driving route to hospital.
- Brief new workers on the components of this APP/SSHP and emergency response plans.

The SSHO/UXOSO will evaluate emergency response actions and initiate appropriate follow-up actions.

9.2.2 Emergency Equipment and Supplies

The SSHO/UXOSO will mark the locations of emergency equipment on the site map and post the map. Equipment and locations are listed below.

Emergency Equipment and Supplies	Location
20 lb (or two 10-lb) fire extinguishers (A, B, and C classes)	Support Zone/Heavy Equipment
First aid kit	Support Zone/Field Vehicle
Eye wash	Support Zone/Field Vehicle
Potable water	Support Zone/Field Vehicle
Blood borne-pathogen kit	Support Zone/Field Vehicle
Additional equipment (specify): Mobile phone and contact information	Support Zone/Field Vehicle
Spill Control/Clean-up Materials/Proper Spill Response PPE	Support Zone & Decon. Zone and/or active work area(s)

9.2.3 Evacuation

- Evacuation routes and assembly areas will be specified at the commencement of field work. These routes will be posted and copies placed within vehicles.
- Evacuation route(s) and assembly area(s) will be designated by the SSHO/UXOSO before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The SSHO/UXOSO and a “buddy” will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The SSHO/UXOSO will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s), as may be established to meet project site conditions.
- The Hurricane Preparedness Plan, contained in Attachment 8 of this APP/SSHP, will be engaged as may be required.

9.2.4 Evacuation Signals

Evacuation signals are listed below.

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

9.2.5 Procedures and Tests

The project team will reasonable attempts to verify that emergency response processes are in place and capable of being executed, prior to the start of field assignments. However, because response to medical or fire emergencies will be by Fort Rucker installation personnel or even by outside public responders, it may be impractical and disruptive to the primary mission of these responders to perform procedural response testing. In this case, the designated responsible party (SUXOS/SM or SSHO/UXOSO) will verify that emergency services are available for response, that contact information is appropriate, and that responders know how to access anticipated work areas. Testing of the system is encouraged.

9.2.6 Spill Plans

The initial response to any spill or discharge will be to protect human safety and health, and then the environment. Identification, containment, treatment, and disposal assessment will be the secondary response.

If for some reason a chemical spill is not contained within a dike or sump area, an area of isolation will be established around the spill. The size of the area will generally depend on the size of the spill and the materials involved. If the spill is large (greater than 55 gallons) and involves a tank or a pipeline rupture, an initial isolation of at least 100 feet (ft) in all directions will be used. Small spills (less than or equal to 55 gallons) or leaks from a tank or pipe will require evacuation of at least 50 ft in all directions to allow cleanup and repair and to prevent exposure. When any spill occurs, only those persons involved in overseeing or performing emergency operations will be allowed within the designated hazard area. If possible, the area will be roped off or otherwise blocked.

If the spill results in the formation of a toxic vapor cloud (by reaction with surrounding materials or by outbreak of fire) and its release (due to high vapor pressures under ambient conditions), further evacuation must be engaged. In general, an area at least 500 ft wide and 1,000 ft long will be evacuated downwind if volatile materials are spilled. (Consult the Department of Transportation [DOT] Emergency Response Guide for isolation distances for listed hazardous materials.)

If an incident may threaten the health or safety of the surrounding community, the public will be informed (via proper local and state emergency management planning agencies) and possibly evacuated from the area. The onsite emergency coordinator will inform the proper agencies in the event this is necessary. A Project Emergency Contact List is provided in Attachment 9.

Spills or releases of oil or hazardous materials must be reported to appropriate agencies and stakeholders (i.e. USEPA and Alabama Department of Environmental Management [ADEM]) when spilled or released quantities of oil or hazardous materials are in excess of established Reportable Quantities (RQs) for the material in questions. It is understood that appropriate stakeholder notification contacts will be identified at the project Pre-Construction Conference and incorporated for reference, herein in the Emergency Contact List, in the final executed version of this APP/SSHP.

In a spill or release response/containment, personnel will take the following measures:

- Immediately warn any nearby workers and notify individual responsible for site operations.
- Assess the spill area to ensure that it is safe to respond.
- Evacuate area if spill presents an emergency.
- Provide notification to project stakeholders.

- Ensure all unnecessary persons are removed from the hazard area.
- Put on protective clothing and equipment.
- If a flammable material is involved, remove all ignition sources, and use only spark- and explosion-proof equipment for recovery of material.
- Remove all surrounding materials that could be especially reactive with materials in the waste. Determine the major components in the waste at the time of the spill.
- Stop source of spill.
- Establish site control for spill area.
- If wastes reach a storm sewer, dam the outfall by using sand, earth, sandbags, etc. Pump this material out into a temporary holding tank or drums as soon as possible.
- Place all small quantities of recovered liquid wastes (55 gallons or less) and impacted soil into drums for incineration or removal to an approved disposal site.
- Spray the spill area with foam, if available, if volatile emissions may occur.
- Apply appropriate spill control media (e.g., clay, sand, lime) to absorb discharged liquids.
- For large spills, establish diking around leading edge of spill using booms, sand, clay, or other appropriate material. If possible, use diaphragm pump to transfer discharged liquid to drums or holding tank. Follow proper ground and bonding procedures of equipment during recovery efforts. Intrinsically safe equipment must be used in recovery operations.

Anticipated Hazardous Materials

The following is a list of hazardous materials or chemicals that may be brought onsite and incorporated as part of the final completion of the work, generated during the execution of the work for offsite disposal or recycling or otherwise used to facilitate site work. These hazardous materials or chemicals may require spill prevention, control, and countermeasures to ensure that watersheds are not adversely impacted in the event of a spill or release of these materials. MSDS for any industrial grade chemical is required to be on site prior to receipt of the material.

- Gasoline (small metal safety containers for fueling small engine equipment)
- Diesel fuel in heavy equipment and potentially in a 550-gallon aboveground storage tank (AST)
- Minor quantities of sample preservatives (e.g., nitric acid, hydrochloric acid, sulfuric acid, sodium hydroxide/zinc acetate, phosphoric acid)
- Stockpiled debris
- Marking Paint
- Minor quantities of grease, motor oil and hydraulic fluid
- Insect repellent(s)

Notification

In the event a spill occurs that requires notification, project personnel will follow the CH2M HILL "Safety Chain of Command" structure shown in Figure 4-1.

In addition, the CH2M HILL PM will make notification to the designated COR as applicable, such that additional appropriate community and/or federal/state agencies may be engaged and notified, as applicable. The CH2M HILL PM will coordinate with the designated client Environmental Compliance Manager for support with regard to adhering to local, state, or federal regulations for spill notification clean-up and closure requirements.

9.2.7 Firefighting Plan

CH2M HILL personnel are not considered firefighters. Only small (incipient stage) fires that are containable by the use of the provided, portable fire extinguishers will be used by CH2M HILL personnel. All other response will be considered firefighting measures and will be conducted by facility-provided or public agency firefighting teams.

Fire prevention measures and first response fire protection equipment will be in accordance with the information identified in Sections 9.2.7, 9.5.19, 9.15, and 10.6.

9.2.8 Posting of Emergency Telephone Numbers

Emergency contact numbers appropriate to project operations are included in Attachment 9 of this APP/SSHP and are referenced as the Emergency Contact List. For temporary site facilities, the Emergency Contact List will be posted in a conspicuous location. Where temporary site facilities are not allowed or provided, the list will be available for quick reference by the individual(s) responsible for site operations and location will also be made known to other site personnel.

9.2.9 Man Overboard / Abandon Ship

(Reserved)

9.2.10 Medical Support

Location and direction to medical support facilities will be posted in a conspicuous location where temporary site facilities are established at the project site. Where temporary site facilities are not allowed or provided, the list will be available for quick reference by the individual(s) responsible for site operations and location will also be made known to other site personnel.

In addition, the project will be outfitted with first aid kits of suitable size and quality (contents) to meet Safety and Health requirements for onsite first aid or CPR response. Personal protective devices will be provided such that universal precautions against blood borne pathogens can be exercised while administering CPR or first aid. Eye wash stations, either portable or stationary, will be available.

An effective means of communication and to summon transportation of injured workers to medical treatment facilities must be evaluated and established prior to the start of field activities. Communication devices will be tested in the area of use to assure functionality.

When a medical facility or physician is not accessible within five 5 minutes of an injury to a group of two or more employees for the treatment of injuries, at least two employees will be qualified to administer first aid and CPR.

The procedures listed below may also be applied to non-emergency incidents. CH2M HILL employee injuries and illnesses must also be reported to the CH2M HILL's Occupational Nurse, contact provided in Attachment 9, once the notification requirements identified in Sections 4 and 8 of this APP/SSHP have been fulfilled. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the designated medical consultant, as applicable. During non-emergencies, follow these procedures as appropriate.

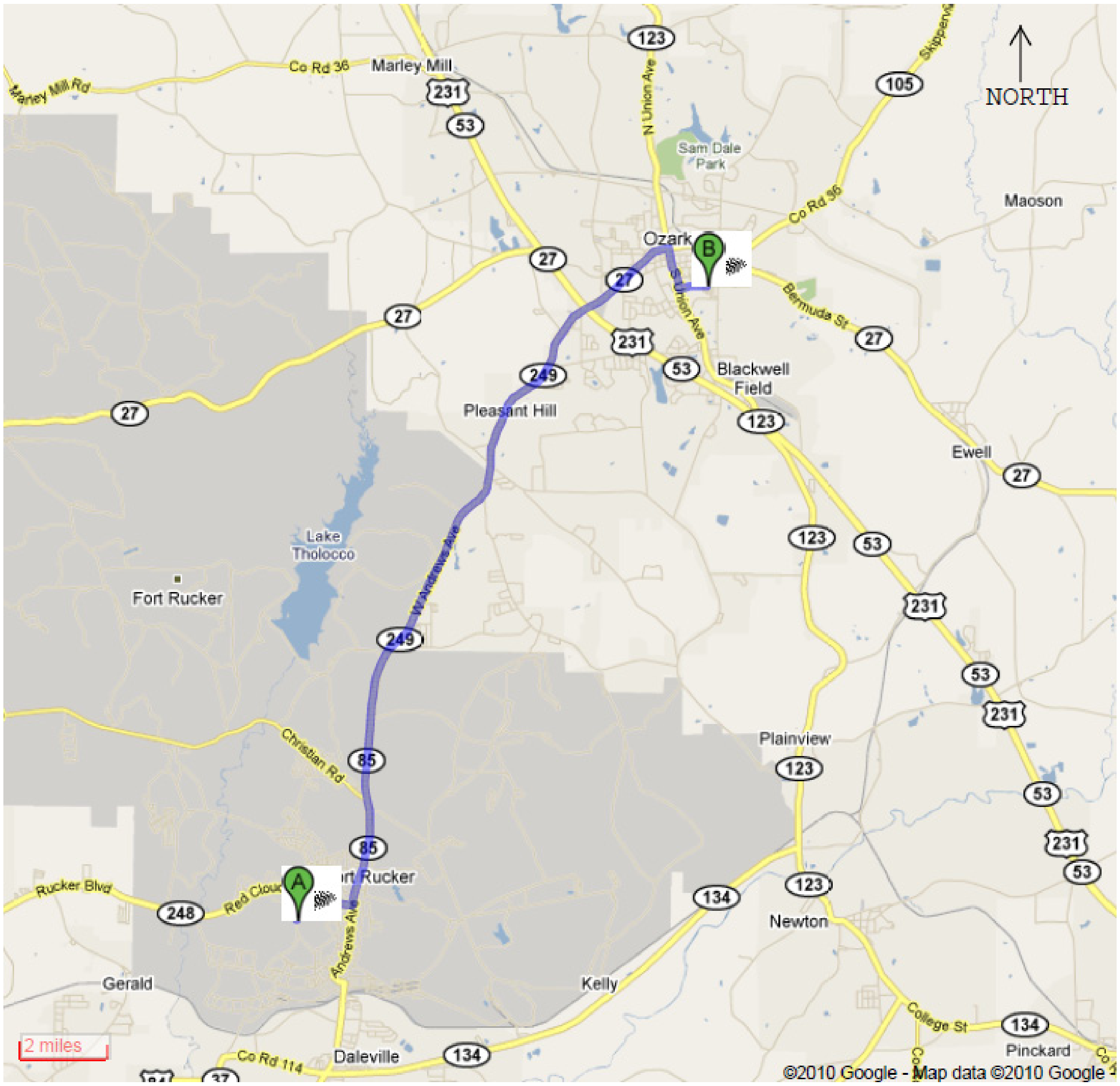
- Notify appropriate emergency response authorities (e.g., 911).
- The SSHO/UXOSO will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible and where worker "Universal Precautions" to blood borne pathogens can be used.
- For life threatening emergencies, get or summon medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 8 of this APP/SSHP.

The Fort Rucker Veterans Administration Clinic does not have the capabilities to handle critically injured personnel. Therefore, all medical emergencies should be taken to Dale Medical Center.

A map showing the route to hospital is shown on Figure 9-1.

FIGURE 9-1
Route to Hospital

Dale Medical Center
126 Hospital Avenue
Ozark, AL 36360
(334) 774-2601



1.	**9.2.10.1** Head **east** on **Red Cloud Rd** toward **Kyle Way** **9**	1.2 mi
2.	Turn **left** at **Andrews Ave**	9.8 mi
3.	Turn **right** at **S Union Ave**	0.6 mi
4.	Turn **left** at **Adams St**	0.2 mi
5.	Continue onto **James St**	0.2 mi
6.	Turn **right** at **Hospital Ave**	118 ft

9.3 Plan for Prevention of Alcohol and Drug Abuse

The CH2M HILL substance abuse program is in accordance with Section 10.5 of this APP/SSHP.

9.4 Site Sanitation Plan

Toilet facilities on construction sites will be provided as follows:

Minimum Toilet Facilities at Construction Sites

Number of Personnel	Number of Toilets
20 or fewer	One
20 or greater	One toilet seat and one urinal per 40 workers
Greater than 200	One toilet seat and one urinal per 50 workers

The above requirements do not apply to mobile crews or to normally unattended work locations if employees working at these locations have transportation immediately available to nearby toilet facilities. Separate toilet rooms for each sex need not be provided if toilet rooms can only be occupied by one person at a time can be locked from the inside, and contain at least one toilet seat.

Toilet facilities will be constructed so the occupants are protected against weather and falling objects; all cracks will be sealed; and the door will be tight-fitting, self-closing, and capable of being latched. Adequate ventilation will be provided and all windows and vents will be screened. Toilet facilities will be constructed so that the interior is lighted. Provisions for routinely servicing and cleaning all toilets and disposing of the sewage will be established before placing toilet facilities into operation. The method of sewage disposal and the location selected will be in accordance with federal, state, and local health regulations.

Washing facilities will be provided at toilet facilities and as needed to maintain healthful and sanitary conditions. Each washing facility will be maintained in a sanitary condition and provided with water (either hot and cold running water or tepid running water), soap, and individual means of drying. If it is not practical to provide running water, hand sanitizers may be used as a substitute. Washing facilities will be close to the work site.

Trash and garbage generated by the normal site operations must be properly stowed, containerized, and secured such that vermin will not be attracted.

9.5 Safety and Health Hazard Control Program

Exposure to certain project specific hazards in the work place may include injury/accidents, occupational illnesses or property damage due to execution of a variety of assigned tasks or as a result of existing site conditions. This section of the APP/SSHP is provided to aid in the recognition of potential specific and general project hazards and identify procedures and practices to be implemented on the job site that may reduce or eliminate accidents/injuries/ occupational illnesses and property damage that may be attributed to identified project hazards. All CH2M HILL personnel are required to contact the designated SSHO/UXOSO identified in this APP/SSHP regarding any questions or concerns to ensure the execution of this task order in a healthy and safe manner.

Reasonably anticipated potential hazards to personnel at the site include: MEC, other physical hazards (slips and trips [working on uneven surfaces], noise, working around heavy equipment, traffic, heat/cold, and sunburn); and infectious biological agents (snakes, spiders, insects, rodents, and plants). Each potential hazard and the potential for exposure are discussed below.

9.5.1 MEC

MEC has been documented at the two of the three MMRP sites, and appropriate avoidance safety measures will be observed during all fieldwork. The primary hazard associated with MEC is the possibility of injury as a result of an explosion. When a MEC item is identified at the site, the SSHO/UXOSO or SUXOS/SM will notify the CH2M HILL PM, who in turn will notify USAEC ERM, USACE PM, and Fort Rucker IRP Manager. Determination of appropriate safety distances will be in accordance with the approved Explosive Site Plan, which is Attachment 3-4 of the project Work Plan.

The safest method of disposal will be utilized in every case. All demolition operations will be in compliance with applicable DoD regulations, and the procedures outlined in the project Work Plan and Explosives Siting Plan.

Only essential personnel will be permitted within the MR EZ when operations are being conducted. Only the MR Safety & Quality Officer has the authority to designate essential personnel.

All non-UXO qualified and non-essential personnel will be escorted by a UXO Technician when within the EZ. Upon entry of non-UXO qualified personnel, work shall stop until the EZ is once again clear.

Personnel limits (includes visitors) shall be posted and limits shall be adhered to.

All Munitions Response (MR) related (which includes safety & quality) activities shall be performed in accordance with approved Work Plan and general industry standards.

9.5.2 Adverse Weather

Sudden inclement weather can rapidly encroach upon field personnel. Field crew members performing work outdoors should carry clothing appropriate for bad weather. In severe weather conditions, (i.e., high wind or electrical storms), the field crews should leave the area and find safe shelter until the weather abates and until a decision is made to resume the field activities. The following field procedures should be used where adverse weather is encountered or is expected to occur.

- Frequently observe the skyline for rain squalls, thunderstorms, or other severe weather systems that may be developing. Check internet, local TV weather or radio channels for daily forecasts and plan daily work activities accordingly. Have a portable radio available onsite to monitoring local weather forecasts. If onsite internet or radio monitoring are not available, check with the Fort Rucker security office if severe weather systems appear to be developing. Fort Rucker may be able to provide an update local forecast. If not, for reach-back support check with office staff who may be able to determine the severity of developing storm systems through internet access or other methods.

- Preparedness and caution are the best defenses against lightning. Many lightning deaths and injuries happen before or after a thunderstorm's peak. The SUXOS/SM or SSHO/UXOSO will monitor weather forecasts for predictions of electrical storms in the area. At first sight of lightning, operations will be stopped and then resumed only when conditions permit. The SUXOS/SM or SSHO/UXOSO will monitor weather conditions to determine when it is appropriate to resume work. Work shall stop when lightning is within 5 miles of the project location.
- Some other general precautions include:
  - Know where to go and how long it will take to get there. If possible, take refuge in a large building or rubber-tired vehicle. Do not go into a shed in an open area.
  - The inclination to see trees as enormous umbrellas is the most frequent and most deadly mistake. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae, and towers.
  - Stay away from lakes, streams, pools, and any water.
  - Stay away from railroad tracks, which can carry lightning charges for long distances.
  - If the area is wide open, go to a valley or ravine, but be aware of flash flooding. Do not stand on top of a hill.
  - If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The idea is to make your body less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands.
  - Do not use telephones during electrical storms, except in the case of emergency.
- Bring clothing suitable for anticipated daily weather conditions.
- Shut down operations during heavy rain/lightning events or high wind conditions.

9.5.3 Aerial Lifts

(Reserved)

9.5.4 Air Compressor Operations

(Reserved)

9.5.5 Asbestos

(Reserved)

9.5.6 Biological Hazards and Controls

The following sections provide information on potential biological hazards. Site personnel will notify the SUXOS/SM, the CH2M HILL PM, and the UXOSO of any potential allergic reactions that may occur as a result of contact with biological hazards in the workplace. If employee antidotes are required to counteract allergic reactions from biological hazard exposure, employees will make personnel, who may be required to administer personal antidotes, aware of the location, type, and quantity of antidotes needed to counteract any potential allergic reaction(s).

9.5.6.1 Venomous Snakes

Snakes typically are found in underbrush, tall grassy areas, near cover such as fallen logs, brush piles, rock walls, abandoned foundations, or rock ledges. They may be resting or waiting for prey. Watch where you place your hands and feet. Walk around, rather than over, fallen logs. When traveling through areas thought to contain venomous snakes, you can minimize the possibility of an encounter by using common sense. If you encounter a snake do your best to stay calm and look around as there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT apply ice, cut the wound, or apply a tourniquet**. Try to identify the type of snake: note color, size, patterns, and markings to assist medical personnel with proper treatment measures (see below – Identification of Venomous Snakes). Try to identify the type of snake: note color, size, patterns, and markings to assist medical personnel with proper treatment measures (see below – Identification of Venomous Snakes). Of the 40 species of snakes found throughout Alabama, 6 are venomous:

Note: Rattlesnakes do not always rattle when a threat is near.

1. Copperhead

2. Canebrake Rattlesnake (Timber Rattler)

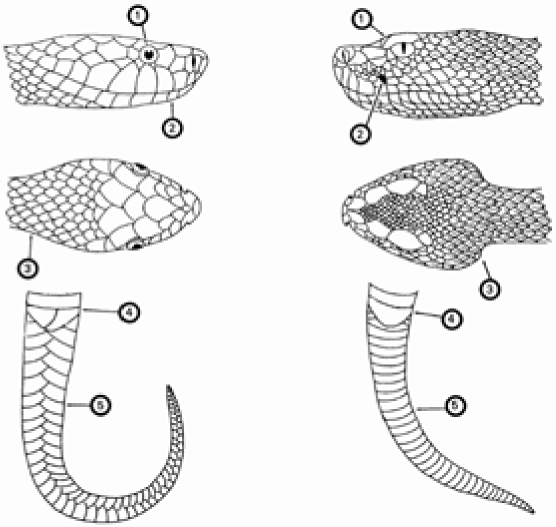
3. Eastern Diamondback Rattlesnake

4. Pigmy Rattlesnake

5. Cottonmouth (aka Water Moccasin)

6. Coral Snake

Identification of Venomous Snakes

<table>
<tr><th>(Major Identification Features)
non-venomous snake</th><th>venomous snake</th></tr>
<tr><td>1. Round pupils
2. No sensing pit
3. Head slightly wider than neck
4. Divided anal plate
5. Double row of scales on the underside of the tail</td><td>1. Elliptical pupils
2. Sensing pit between eye and nostril
3. Head much wider than neck
4. Single anal plate
5. Single scales on the underside of the tail</td></tr>
<tr><td colspan="2">
</td></tr>
</table>

9.5.6.2 Poisonous Plants

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Shrubs are usually 12 inches to 30 inches high, or can also be a tree-climbing vine, with triple leaflets and short, smooth hair underneath. Plants are red and dark green in spring and summer, with yellowing leaves anytime especially in dry areas. Leaves may achieve bright reds in fall, but the plant loses its (yellowed, then brown) leaves in winter, leaving toxic stems. All parts of the plant remain toxic throughout the seasons.

Become familiar with the identity of these plants (see below). Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

Poison Ivy

Poison Sumac

Poison Oak

Exposure:

Contamination with poison oak, ivy or sumac can happen through several pathways. These include:

- Direct skin contact with any part of the plant.
- Contact with clothing that has been contaminated
- Contact from removing shoes that have been contaminated (shoes are coated with oil)
- Sitting in a vehicle that has become contaminated
- Contact with any objects or tools that have become contaminated.

Exposure to poison oak, ivy or sumac often becomes an OSHA recordable illness. Take proper action if you are potential contaminated. The dermatitis is so severe that many people seek medical care and get prescription cortisone creams or steroid shots to reduce the suffering caused by the itch.

Best Work Practices:

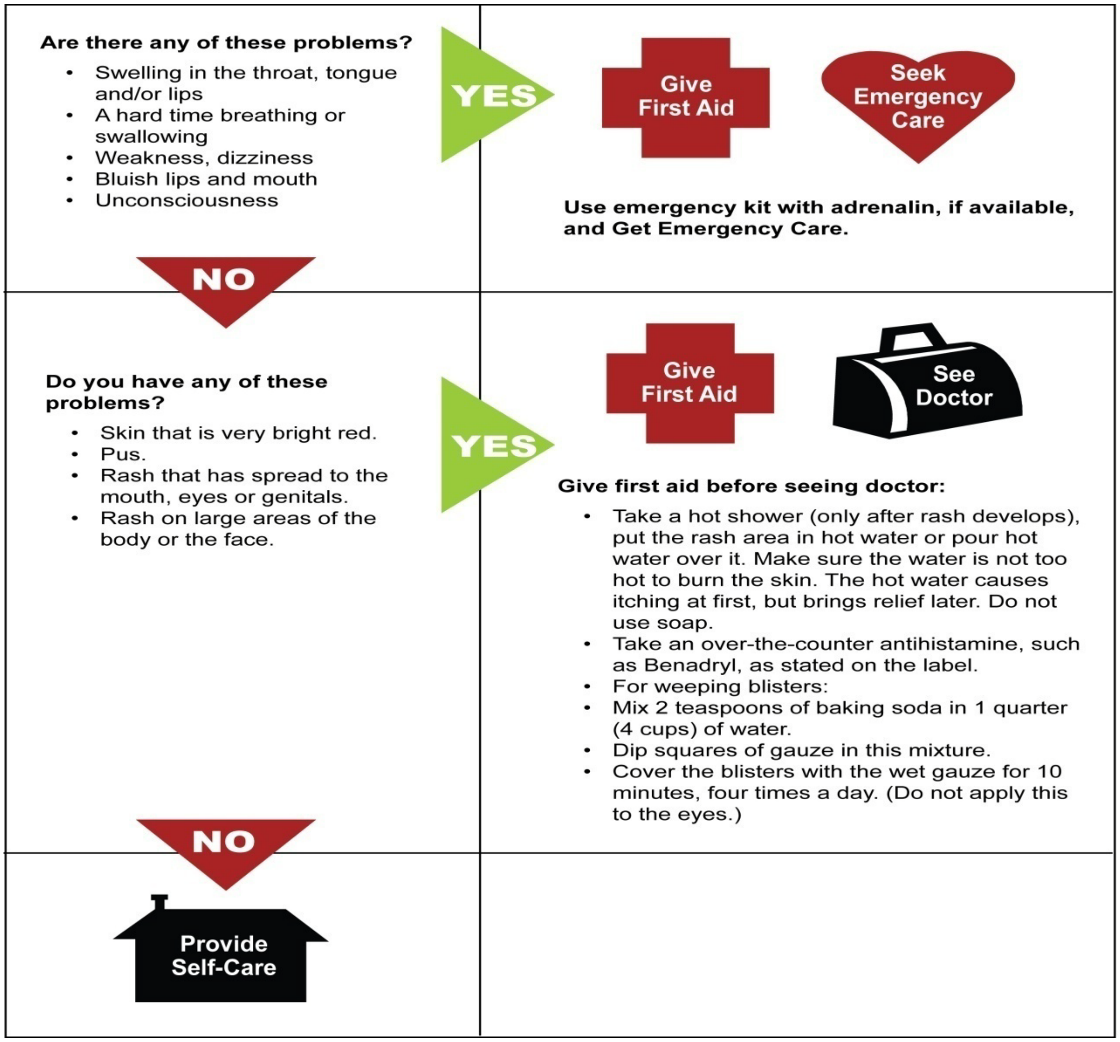
If you must work on a site that has been identified to potentially contain poison oak, ivy or sumac, the following precautions are necessary:

- Identify plants containing urushiol – The best way to prevent exposure is to recognize the plant and avoid working in areas where poison oak, ivy or sumac is present.
- If you must work in areas with urushiol containing plants, contact you project manager and Safety and Health Manager to determine the best procedures to prevent contamination.
- Do not drive vehicles onto the site where it will come into contact with poison oak, ivy or sumac. Vehicles which need to work in the area, such as heavy equipment must be washed and decontaminated as soon as possible after leaving the site.

- All tools used in the area, including those used to cut back the plants, surveying instruments used in the area, air monitoring equipment or other test apparatus must be decontaminated before they are placed back into the site vehicle. If onsite decontamination is not possible, use plastic to wrap any tools or equipment until they can be decontaminated. If working on or near the ground surface, place plastic on the ground to cover the grass and foliage.
- PPE, including Tyvek coveralls, gloves, and boot covers must be worn. PPE and plastic used to cover the ground must be placed into separate plastic bags and sealed if they are not disposed immediately into a trash receptacle.
- Shower as soon as possible to remove any potential contamination. Any body part with suspected or actual exposure should be washed with “Tecnu” or other product designed for removing urushiol. If you do not have Tecnu wash with cold water. Do not take a bath, as the oils can form an invisible film on top of the water and contaminate your entire body upon exiting the bath.
- Zanfel™ may also be used to treat exposed areas that are experiencing signs and symptoms of poison oak, ivy or sumac contamination. Refer to the Zanfel™ information guide below for specific product and contact information.
- Use products such as IvyBlock^{TM} to prevent poison oak, ivy and sumac contamination. IvyBlock^{TM} is approved by the FDA to prevent the rash caused by poison oak, ivy and sumac.

If there is exposure, use the following first aid procedures or others to alleviate the pain and itching.

Poison Oak, Ivy, and Sumac First Aid:



Are there any of these problems?

- Swelling in the throat, tongue and/or lips
- A hard time breathing or swallowing
- Weakness, dizziness
- Bluish lips and mouth
- Unconsciousness

Use emergency kit with adrenalin, if available, and Get Emergency Care.

Do you have any of these problems?

- Skin that is very bright red.
- Pus.
- Rash that has spread to the mouth, eyes or genitals.
- Rash on large areas of the body or the face.

Give first aid before seeing doctor:

- Take a hot shower (only after rash develops), put the rash area in hot water or pour hot water over it. Make sure the water is not too hot to burn the skin. The hot water causes itching at first, but brings relief later. Do not use soap.
- Take an over-the-counter antihistamine, such as Benadryl, as stated on the label.
- For weeping blisters:
- Mix 2 teaspoons of baking soda in 1 quarter (4 cups) of water.
- Dip squares of gauze in this mixture.
- Cover the blisters with the wet gauze for 10 minutes, four times a day. (Do not apply this to the eyes.)

Self-Care/First Aid

- Wash (decontaminate) all affected areas with warm water and a strong soap.
- Keep your hands away from your eyes, mouth and face.
- Do not scratch or rub the rash.
- Apply any of these to the skin rash:
- Calamine (not Caladryl) lotion
- Zanfel™ lotion
- Zinc oxide ointment
- Paste made with baking soda - mix 3 teaspoons of baking soda with 1 teaspoon of water
- Take an over-the-counter antihistamine such as Benadryl, as stated on the label
- If self-care/first aid measures don't bring relief, contact the CH2M HILL occupational nurse at1-866-893-2514.

Urushiol Plant Facts:

Urushiol Oil is Potent

- Only 1 nanogram (billionth of a gram) needed to cause rash

- Average is 100 nanograms for most people
- 1/4 ounce of urushiol is all that is needed to cause a rash in every person on earth
- 500 people could itch from the amount covering the head of a pin
- Specimens of urushiol several centuries old have been found to cause dermatitis in sensitive people.
- 1 to 5 years is normal for urushiol oil to stay active on any surface including dead plants
- Derived from **urushi**, Japanese name for lacquer

Myth 	**Fact** 
Poison oak, ivy, and sumac are contagious	Rubbing the rashes won't spread poison ivy to other parts of your body (or to another person). You spread the rash only if **urushiol oil** -- the sticky, resin like substance that causes the rash -- has been left on your hands.
You can catch poison ivy simply by being near the plants	Direct contact is needed to release **urushiol oil**. Stay away from forest fires, direct burning, or anything else that can cause the oil to become airborne such as a lawnmower, trimmer, etc.
Leaves of three, let them be	Poison sumac has 7 to 13 leaves on a branch, although poison ivy and oak have 3 leaves per cluster
Do not worry about dead plants	**Urushiol** oil stays active on any surface, including dead plants, for up to 5 years.
Breaking the blisters releases **urushiol** oil that can spread	Not true. But your wounds can become infected and you may make the scarring worse. In very extreme cases, excessive fluid may need to be withdrawn by a doctor.

New Cream to Treat Exposure to Poison Plants:

Exposure to poison oak, ivy and sumac can be uncomfortable, and in some cases the rash can become so severe that medical care is required. A relatively new product is available Zanfel™ (www.zanfel.com) that helps prevent blistering and itching from becoming severe. If you are working in an area with poison oak, ivy or sumac, you can obtain this cream by contacting and notifying your supervisor of the need to purchase this material.

Please remember, the cream does not replace preventative measures, including:

- Avoiding contact with poison oak, ivy and sumac.
- Wearing Tyvek coveralls and gloves to prevent contact.
- Washing with Tecnu® (or a similar product) after potential exposure.
- Washing clothing and decontaminating equipment with an oil-cutting detergent.

More information about Zanfel (from Zanfel):

Zanfel™ is an effective wash for urushiol-induced contact dermatitis. Urushiol is the toxin known to cause the itching and rash associated with poison oak, ivy, sumac, poisonwood, and related plants. Zanfel works by surrounding urushiol and bonding with it, thereby enabling it to be rinsed away. Unlike some products that require use within 10-20 minutes of contact or that required continued use until the rash is gone (which can take up to

5 weeks), Zanfel offers relief at any stages of the reaction and often with only one wash. Individuals with particularly severe reactions may require additional washes. Most individuals experience relief from the itching within 30 seconds of application. The rash will begin to subside within hours if the reaction is mild to moderate. Severe and systemic cases will still require medical attention. Severe cases are defined as breakouts that are present on more than 15 percent of the body, and new breakouts continue to develop after day 4.

9.5.6.3 Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into/taped to boots; spray **only outside** of clothing with permethrin or permanone and spray skin with only N, N-diethyl-meta-polyamide (DEET); and check frequently for ticks. Where exposure to ticks is verified, personnel will consider wearing "bug-out" suits to minimize potential exposures to ticks or other biting insects (i.e., chiggers). However, whenever these suits are used when ambient air temperatures are elevated (> 70 degrees), heat stress preventive measures and monitoring protocols must be implemented. See Section 9.12 for additional information.

Hazard Control:

The methods for controlling exposure to ticks include, in order of most-preferred to least:

- Avoiding tick habitats and ceasing operations in heavily infested areas
- Reducing tick abundance through habitat disruption or application of acracide
- Using personal protection through use of repellents and protective clothing
- Performing frequent tick inspections and using proper hygiene

Vaccinations are not available and preventive antibiotic treatment after a bite is generally not recommended.

Tick Identification:

There are five varieties of hard-bodied ticks that have been associated with tick-borne pathogens. These tick varieties include:

- Deer (Black Legged) Tick (eastern and pacific varieties)
- Lone Star Tick
- Dog Tick (American and Brown)
- Rocky Mountain Wood Tick
- Western Black-legged tick

Illnesses and Signs/Symptoms:

There are six distinguishable tick-borne pathogens that cause human illness in the United States. These pathogens may be transmitted during a tick bite – normally hours after attachment. The illnesses, presented in approximate order of most common to least, include:

1. Lyme (bacteria)
2. Rocky Mountain Spotted Fever (RMSF) (bacteria)
3. Ehrlichiosis (bacteria)
4. Southern Tick-Associated Rash Illness (STARI) (bacteria)
5. Tularemia (Rabbit Fever) (bacteria)

6. Babesia (protozoan parasite)

Symptoms will vary based on the illness, and may develop in infected individuals typically between 3 and 30 days after transmission. Some infected individuals will not become ill or may develop only mild symptoms. These illnesses present with some or all of the following signs and symptoms: fever, headache, muscle aches, stiff neck, joint aches, nausea, vomiting, abdominal pain, diarrhea, malaise, weakness, and small solid, ring-like, or spotted rashes. The bite site may be red, swollen, or develop ulceration or lesions. A variety of long-term symptoms may result when untreated, including debilitating effects and death.

Tick Removal:

1. Use fine-tipped tweezers or shield your fingers with a tissue, paper towel, or nitrile gloves.

2. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. (If this happens, remove mouthparts with tweezers. Consult your healthcare provider if infection occurs.)

3. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva, hemolymph, and gut contents) may contain infectious organisms. Releasing these organisms to the outside of the tick's body or into the bite area may increase the chance of infectious organism transmission.

4. Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin. This precaution is particularly directed to individuals who remove ticks from domestic animals with unprotected fingers. Children, elderly persons, and immunocompromised persons may be at greater risk of infection and should avoid this procedure.

5. After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.

6. You may wish to save the tick for identification in case you become ill. Your doctor can use the information to assist in making an accurate diagnosis. Place the tick in a plastic bag and put it in your freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag. See "First Aid and Medical Treatment" information below.

Note: Folklore remedies such as petroleum jelly or hot matches do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided. In addition, a number of tick removal devices have been marketed, but none are better than a plain set of fine tipped tweezers.

Previously infected individuals are not conferred immunity – re-infection from future tick bites can occur even after a person has contracted a tick-borne disease.

First-Aid and Medical Treatment:

Tick bites should always be treated with first-aid. Clean and wash hands and disinfect the bite site after removing embedded tick. Consult a healthcare professional if infection or symptoms and effects of tick-borne illnesses are developing.

Medical treatments for tick-borne infections include antibiotics and other medical interventions. Diagnosis of specific illness involves both clinical and laboratory confirmations. Preventive antibiotic treatment in non-ill individuals who have had a recent tick bite is recommended in specific cases only.

Tick Analysis Procedure for Lyme disease:

- For tick removal, follow the instructions in your tick removal kit using a fine pointed pair of tweezers. If the tick is alive, place it in two layered zip-lock bags. It is highly recommended that you wear gloves when removing the tick from the skin to avoid infection.
- It is important to remove the entire tick and place it in a zip-lock bag.
- Keep the tick and observe the bite mark for changes. If one or more symptoms of Lyme's Disease appear, the tick will be sent to an offsite laboratory for analysis.

For CH2M HILL employees who have been bitten by a tick, contact the project Safety and Health Manager for direction.

Fire Ants

Fire ants inflict a painful sting and can affect you if bitten. Fire ants look very much like ordinary house or garden ants. Fire ants:

- Are small and coppery-brown in color on the head and body, with a darker abdomen.
- Come in a variety of sizes within one nest, ranging from 2 mm to 6 mm. This is a distinguishing feature of fire ants.
- Have nests with no obvious entry or exit holes on top.
- Can be distinguished by their aggressive behavior, particularly near the nest.

Their nests can appear as dome-shaped mounds, up to 16 inches high, or can be found next to, or underneath other objects found on the ground, such as timber, logs, rocks, pavers, bricks etc. Mounds will not always be evident, but are usually found in open areas such as lawns, pastures, along roadsides, and in unused cropland. Mounds are rarely found in frequently cultivated areas. This species could easily be confused with the common coastal brown ant as well as some local native ants.

Fire ants inflict a fiery sting, which causes a small blister or pustule to form at the site of each sting after several hours. The blisters become itchy while healing and are prone to infection if broken.

If you are stung by a fire ant:

- Apply a cold compress to relieve the swelling and pain.

- Gently wash the affected area with soap and water and leave the blister intact.
- People who are allergic to insect stings should seek medical attention immediately. On rare occasions, fire ant stings can cause severe acute allergic reaction (anaphylaxis).

Fire Ant

Ant Mound in Electric Box

Bites on Arm

Spiders - Brown Recluse

It is regarded by many as the most dangerous spider in the United States.

Brown recluse spiders are usually 1 inch or larger in size, including the legs and can grow as large as 3 inches. Young brown recluse spiders are smaller and somewhat lighter in color. Brown recluse spider bites do not always hurt right away.

In fact, you may not know that you have been bitten until other symptoms appear. Symptoms of a brown recluse spider bite may include the following:

- Reddened skin followed by a blister that forms at the bite site.
- Mild to intense pain and itching for 2 to 8 hours following the bite.
- An open sore with a breakdown of tissue (necrosis) that develops within a few hours to 3 to 4 days following the bite and the area may become painful, itchy, hot, swollen, red and tender. An irregular ulcerous sore, caused by necrosis, will often appear that is from 1/4 inch to 10 inches in diameter. Prompt attention is the best defense against preventing the necrosis. The wound is often described as being reddish and surrounded by a bluish area with a narrow whitish separation in between the red and the blue. This gives it the famous "bull's eye" pattern. In just hours, a bite from the highly venomous brown recluse spider can create blisters and cause tissue damage.

Some people have a severe, systemic (whole-body) reaction to brown recluse spider bites, including the rapid destruction of red blood cells and anemia. Signs and symptoms include:

- Fever and chills.
- Skin rash all over the body with many tiny, flat purple and red spots.
- Nausea or vomiting.
- Joint pain.

If you think you have been bitten by a brown recluse spider:

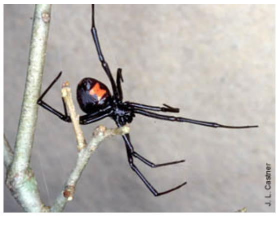
- Remain calm. Too much excitement or movement will increase the flow of venom into the blood.
- Try to collect the spider, without being bitten, (even a mangled specimen has diagnostic value), if possible, for positive identification by a spider expert. A plastic bag, small jar, or pill vial is useful and no preservative is necessary, but rubbing alcohol helps to preserve the spider.
- Apply a cool, wet cloth to the bite or cover the bite with a cloth and apply an ice bag to the bite.
- Do not apply a tourniquet. It may cause more harm than benefit.
- Try to positively identify the spider to confirm its type.
- Seek prompt medical attention.

A brown recluse bite can be serious and will likely require immediate medical care. Seek medical attention if you believe you have been bitten by a recluse spider, especially if severe symptoms develop throughout your body or an open sore and necrosis develop. A brown recluse spider bite is diagnosed through a physical examination and questions about the bite. You should be prepared to describe the spider, where and when the bite took place, and what you were doing at the time. Your health professional will ask what your main symptoms are, when they began, and how they have developed, progressed, or changed since the bite.

Spiders - Widow

There are four identified widow species that may be encountered at the site, as follows: the Southern Black, Northern Black, Brown and Red widows. Females range from 8-15 mm in body length; males are smaller, sometimes very small (2 mm). Most have globose, shiny abdomens that are predominantly black with red markings (although some may be pale and/or have lateral stripes), with moderately long, slender legs. These spiders are nocturnal and build a three-dimensional tangled web, often with a conical tent of dense silk in a corner where the spider hides during the day. In nature, most species are found under rocks and logs, but they readily adapt to human-altered environments, where they are most commonly found in outbuildings (sheds, barns, privies), water meter holes, nursery cans, and under any item or structure (e.g., barbeque grill, slide, sand box) that has been undisturbed for a lengthy period. Formerly, most bites by black widows (almost all by female spiders) occurred in outhouses, but presently, widow bites occur most frequently when the spider is trapped against human skin, either by reaching under objects where the spider is hiding or when putting on clothing, gloves or shoes containing the spider. Widow spiders are generally very timid and only bite in self-defense when they accidentally contact humans.

Southern Widow



Red Widow

Brown Widow

Note: The northern widow is similar to the southern widow except the telltale red markings are shaped slightly different.

Bite symptoms are systemic, spreading through the lymphatic system, and usually start about 1-3 hours after the bite. The most common symptoms are intense pain, rigid abdominal muscles, muscle cramping, malaise, local sweating, nausea, vomiting, and hypertension. Other symptoms may include tremors, labored breathing, restlessness, increased blood pressure, and fever. If left untreated, widow bite symptoms usually last 3-5 days.

If bitten, remain calm, and immediately seek medical attention (contact your physician, hospital and/or poison control center). Apply an ice pack directly to the bite area to relieve swelling and pain. Try to collect the spider, without being bitten, (even a mangled specimen has diagnostic value), if possible, for positive identification by a spider expert. A plastic bag, small jar, or pill vial is useful and no preservative is necessary, but rubbing alcohol helps to preserve the spider. A hospital stay may be recommended, particularly for those with a heart condition or with health problems. A physician may administer a specific antivenin to counteract the venom or calcium gluconate to relieve pain. Calcium gluconate and/or antivenin may be administered to relieve or counteract symptoms.

Blood Borne Pathogens

Bloodborne pathogens are pathogenic microorganisms present in human blood or other potentially infectious material that can cause disease. These pathogens include, but are not limited to, the Hepatitis B Virus (HBV) and the Human Immunodeficiency Virus (HIV). Other potentially infectious material includes any human body fluid that is visibly impacted with blood, such as saliva or vomit. It also includes all body fluids in situations where it is difficult or impossible to differentiate between body fluids, such as during an emergency response and any unfixed tissue (other than intact skin) from a human (living or dead).

In emergency medical situations, certain employees may need to render First Aid as a collateral duty in response to workplace accidents or injuries. This category includes the SSHO/UXOSO, SUXOS/SM, or individuals certified in First Aid and CPR.

To eliminate or minimize employee exposure to bloodborne pathogens, workers who may be exposed to blood borne pathogens or potentially infectious material must implement the following hazard control measures.

Employees expected to render First Aid will be cognizant of and adhere to the following with regard to potential exposure to blood borne pathogens:

- First Aid kits and a Blood borne Pathogen Kit (BbPK) will be immediately available at the site. The kit is commercially available through most safety or medical supply vendors.
- These kits will contain gloves, masks, CPR protectors, biohazard disposal bags, antiseptic cleanser, splash-proof goggles, towels, wipes, and an absorbent powder to clean up spills. Gloves, masks, and other PPE measures must be donned by personnel responding to emergency or first aid situations where exposure to blood borne pathogens could occur.

- A portable eye wash station or means of conducting eye washing or flushing will be readily available at each designated project site location.
- Always wash your hands and face with antiseptic soap and running water after contacting potentially infectious material. If washing facilities are unavailable, use an antiseptic cleanser with clean paper towels or moist towelettes. When antiseptic cleansers or towelettes are used, always rewash your hands and face with soap and running water as soon as available. Do not consume food or beverages, smoke, chew tobacco, or perform another hand to eye/face/mouth activity until after thoroughly cleaning your hands (with antiseptic soap and water), then your face.
- Use universal precautions when dealing with materials or situations where there is a potential for blood borne pathogens. Universal precaution is an approach to infection control whereby all human blood and potentially infectious material are treated as if known to be infectious for HIV, HBV, and other blood borne pathogens.

Mosquito Bites

Because of the detection of the West Nile Virus in the southeastern United States, it is recommended that **preventive measures** be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis. The following guidelines should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent.

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing pyrethrum or DEET because mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET. DEET in high concentrations (greater than 35%) provides no additional protection.
- Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.

Note: Vitamin B and "ultrasonic" devices are NOT effective in preventing mosquito bites.

Symptoms of Exposure to the West Nile Virus:

Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

The West Nile Virus incubation period is from 3 to 15 days.

If you have any questions or to report any suspicious symptoms, contact the project Safety and Health Manager.

9.5.6.4 Rabid Animals

Encounters with a rabid animal can lead to rabies transmission when virus from the animal's saliva, brain tissue, or spinal fluid enters open cuts or wounds in skin or mucous membranes. Therefore, not every encounter with a rabid animal is a true exposure requiring intervention. Treatment is often provided unnecessarily to people who have encountered but had no true exposure to a potentially rabid animal.

Any penetration of the skin by an animal's teeth is considered a "bite exposure.” Local wound care should be performed immediately on anyone bitten by an animal. Local treatment of wounds involving immediate and extensive washing of all bite wounds, scratches, or other sites of potential exposure for 10 minutes with soap and water is the most important measure for preventing rabies following an exposure to a rabid animal. Experiments done in animals suggest that thorough and vigorous cleansing to the depth of the wound with a 20% soap solution can reduce the risk of developing rabies. Tetanus booster vaccine (Td) should be given if indicated. A health care provider should be consulted to determine whether other measures are necessary. When a bite exposure has been determined, laboratory testing of the animal, if available, may be indicated depending upon the circumstances of the exposure (such as whether it was provoked or not) and the species involved. The risks associated with bites from different animals vary from place to place. For work on this particular contract, contact with rabid mammals is possible.

"Non-bite exposures" include any scratches, abrasions, or contamination of mucous membranes by an infected animal's saliva, brain tissue, or spinal fluid. Other types of contacts (such as with the blood, urine, feces, or fur of an animal) would not by themselves be considered exposures capable of transmitting rabies even if the animal were known to be rabid. The virus is not hardy; once dry, saliva containing rabies virus is considered non-infectious.

9.5.7 Buried Objects/Utilities (locating)

Fort Rucker will locate underground utilities and issue digging or other appropriate permits to the subcontractor(s) before the commencement of digging intentional detonation operations, if needed.

9.5.8 Chemical Injections

(Reserved)

9.5.9 Concrete Work

(Reserved)

9.5.10 Confined Space Entry

(Reserved)

9.5.11 Constituents of Concern

Table 9-1 summarizes the maximum concentrations of Constituents of Concern (COCs) that have been identified for Fort Rucker. Established OELs and symptoms and effects of overexposure to such COCs are also identified.

TABLE 9-1
Constituents of Concern

COC					
Contaminant	**Location and Maximum[a] Concentration (ppm)**	**Exposure Limit[b]**	**IDLH[c]**	**Symptoms and Effects of Exposure**	**PIP[d] (eV)**
Aluminum	GW: SB: SS:	10 mg/m^3	500	Irritation eyes, skin, respiratory system	NA
Arsenic	GW: SB: SS:	0.01 mg/m^3	5 Ca	Ulceration of nasal septum, respiratory irritation, dermatitis, gastrointestinal disturbances, peripheral neuropathy, hyperpigmentation	NA
Antimony	GW: SB: SS:	0.5 mg/m^3	50	Irritation eyes, skin, nose, throat, mouth; cough; dizziness; headache; nausea, vomiting, diarrhea; stomach cramps; insomnia; anorexia; unable to smell properly	NA
Barium	GW: SB: SS:	0.5 mg/m^3	50	Irritation eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia	NA
Beryllium	GW: SB: SS:	0.002 mg/m^3	4	Berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; potential occupational carcinogen	NA
Cadmium	GW: SB: SS:	0.005 mg/m^3	9 Ca	Pulmonary edema, coughing, chest tightness/pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, difficulty breathing, loss of sense of smell, emphysema, mild anemia	NA
Copper	GW: SB: SS:	1 mg/m^3	100	Irritation eyes, skin nose, pharynx; nasal septum perforation; metallic taste; dermatitis; in animals: lung, liver, kidney damage; anemia	NA
Nickel	GW: SB: SS:	1 mg/m^3	10	Sensitization dermatitis, allergic asthma, pneumonitis; potential occupational carcinogen	NA
Cobalt (Metal, Dusts, and Fumes)	GW: SB: SS:	0.05 mg/m^3	20	Coughing, difficulty breathing, wheezing, decreased pulmonary function, diffuse nodule fibrosous, dermatitis, respiratory hypersensitivity, asthma	NA
1,3,5-Trinitrobenzene	GW: SB: SS:	NA	NA	Headache, nausea, and dizziness	UK

COC					
Contaminant	**Location and Maximum[a] Concentration (ppm)**	**Exposure Limit[b]**	**IDLH[c]**	**Symptoms and Effects of Exposure**	**PIP[d] (eV)**
1,3-Dinitrobenzene	GW: SB: SS:	1 mg/m^3	50	Anoxia, cyanosis; visual disturbance, central scotomas; bad taste, burning mouth, dry throat, thirst; yellowing hair, eyes, skin; anemia; liver damage	10.43
2,4,6-Trinitrotoluene	GW: SB: SS:	1 mg/m^3	500	Irritation skin, mucous membrane; liver damage, jaundice; cyanosis; sneezing; cough, sore throat; peripheral neuropathy, muscle pain; kidney damage; cataract; sensitization dermatitis; leukocytosis (increased blood leukocytes); anemia; cardiac irreg	10.49
2,4-Dinitrotoluene	GW: SB: SS:	NA	NA	Central nervous system damage, kidney and heart damage	UK
2,6-Dinitrotoluene	GW: SB: SS:	NA	NA	Central nervous system damage, kidney and heart damage	UK
2-Nitrotoluene	GW: SB: SS:	2 ppm	200	Anoxia, cyanosis; headache, lassitude (weakness, exhaustion), dizziness; ataxia; dyspnea (breathing difficulty); tachycardia; nausea, vomiting	9.43
3,5-Dinitroaniline	GW: SB: SS:	NA	NA	Eye irritation, respiratory distress, skin irritation	UK
3-Nitrotoluene	GW: SB: SS:	2 ppm	200	Anoxia, cyanosis; headache, lassitude (weakness, exhaustion), dizziness; ataxia; dyspnea (breathing difficulty); tachycardia; nausea, vomiting	9.48
4-Nitrotoluene	GW: SB: SS:	5 ppm	200	Anoxia, cyanosis; headache, lassitude (weakness, exhaustion), dizziness; ataxia; dyspnea (breathing difficulty); tachycardia; nausea, vomiting	NA
HMX	GW: SB: SS:	None[1]	NA	Central nervous system effects, Nausea and vomiting.	UK
Nitrobenzene	GW: SB: SS:	1 ppm	200	Irritation eyes, skin; anoxia; dermatitis; anemia; methemoglobinemia; in animals: liver, kidney damage; testicular effects	NA
Nitroglycerine	GW: SB: SS:	0.2 ppm	75	Throbbing headache; dizziness; nausea, vomiting, abdominal pain; hypotension; flush; palpitations; methemoglobinemia; delirium, central nervous system depression; angina; skin irritation	UK

COC					
Contaminant	**Location and Maximum[a] Concentration (ppm)**	**Exposure Limit[b]**	**IDLH[c]**	**Symptoms and Effects of Exposure**	**PIP[d] (eV)**
PETN	GW: SB: SS:	NA	NA	eye irritation, respiratory distress, skin irritation, dizziness, headache, and redness in the face	Uk
Tetryl	GW: SB: SS:	1.5 mg/m^3	750	Sensitization dermatitis, itch, erythema (skin redness); edema on nasal folds, cheeks, neck; keratitis (inflammation of the cornea); sneezing; anemia; cough, coryza; irritability; malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion), insomnia; nausea, vomiting; liver, kidney damage	NA
Hexavalent Chromium	GW: SB: SS:	5 ug/m^3 (insoluble) 1 ug/m^3 (soluble)	ND	Acute: Coughing, sneezing, chest pain, breathing difficulty, itching and burning sensation to skin and lungs. Long term (Chronic): Allergic (asthma like symptoms) respiratory reaction, skin and eye irritation, nosebleeds, contact dermatitis, allergic like skin reaction, ulceration and perforation of the nasal septum.	NA
Lead	Surface Soil: 8020 mg/kg	0.05 mg/m^3	100	Lassitude (weakness, exhaustion), facial pallor, weight loss, malnutrition, abdominal pain, constipation, anemia, gingival lead line, tremors, paralysis of wrist and ankles, encephalopathy, kidney disease, irritated eyes, hypertension	NA
Mercury	GW: SB: SS:	0.025 mg/m^3	10	Skin and eye irritation, cough, chest pain, difficult breathing, bronchitis, pneumontitis, tremors, insomnia, irritability, indecision, headache, fatigue, weakness, GI disturbance	NA
Magnesium	GW: SB: SS:	15 mg/m^3	750	Irritation eyes, nose; metal fume fever: cough, chest pain, flu-like fever	NA
RDX	Surface Soil: 6200 mg/kg	None[1]	NA	Central nervous system effects, Nausea and vomiting.	UK
Selenium	GW: SB: SS:	0.2 mg/m^3	1	Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage	
Silver	GW: SB: SS:	0.01 mg/m^3	10	Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	NA

COC

Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Thallium	GW: SB: SS:	0.1 mg/m^3	15	Nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	NA
Vanadium	GW: SB: SS:	0.05 mg/m^3	35	Irritation eyes, skin, throat; green tongue, metallic taste, eczema; cough; fine rales, wheezing, bronchitis, dyspnea (breathing difficulty)	NA
Zinc	GW: SB: SS:	5 mg/m^3	500	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function	NA

Footnotes:

[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water).
[b] Appropriate value of Permissible Exposure Limit (PEL) listed.
[c] IDLH = immediately dangerous to life and health (units are the same as specified “Exposure Limit” units for that contaminant);
[d] PIP = photoionization potential; NA = Not applicable; UK = Unknown; ppm = parts per million

Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 9.5.12.	**Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through proper monitoring and respiratory protection, as specified in Sections 9.5.12 and 11.1.3, respectively.	**Other:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before eating, drinking, or smoking).

9.5.11.1 Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 9.5.12.

Other: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before eating, drinking or smoking).

9.5.12 Measures for Worker Protection from Exposure to MC

Protection of workers from exposure to identified MC will be accomplished by implementing one or more of the following measures:

- Engineering Controls
- Administrative Controls
- Use of PPE
- Proper Hygiene and Decontamination Procedures

9.5.12.1 Engineering Controls

The most effective strategy is to "engineer the hazard out" by using control methods that physically change a machine or work environment. Engineering a hazard out of a work environment is the best and least intrusive means of providing worker protection. Methods to eliminate or reduce hazards at Fort Rucker may include:

- Eliminating/reducing the hazard; engaging in site activities, using certain equipment or processes/procedures to remove the hazard, or substituting processes, equipment, materials, or other factors to lessen a perceived hazard
- Using standard dust suppression techniques

9.5.12.2 Administrative Controls

This is the "next best" strategy, if engineering control methods are insufficient. If the hazard cannot be engineered to a less hazardous condition, it will have to be administratively controlled.

Methods to eliminate or reduce employee exposure to hazards include:

- Developing new policies, procedures, and practices to reduce frequency/duration and of exposure
- Using PPE as an additional protective measure
- Revising work schedules to reduce the frequency/duration of exposure
- Monitoring potential worker exposure hazardous materials
- Alarms, signs, and warnings
- Always using the “buddy system” for tasks
- Training

For this project, all of the above procedures will be considered and implemented, as necessary.

Personal Protective Equipment

The utilization of PPE, as an administrative control strategy, is acceptable as a control method in the following circumstances:

- When engineering controls are not feasible or do not totally eliminate the hazard,
- While engineering controls are being developed,
- When safe work practices do not provide sufficient additional protection and/or
- During emergencies when engineering controls may not be feasible.

The use of one hazard control method over another higher in the control precedence may be appropriate for providing interim (temporary) protection until the hazard is abated permanently. In reality, if the hazard cannot be eliminated entirely, the adopted control measures will likely be a combination of control methods used together.

Where site workers are engaged in the handling of soil, liquid, or dust particles impacted by MC, the use of worker PPE in addition to the above hazard control measures may be prudent. Anticipated PPE is listed in Table 9-2. The proper use of PPE may provide additional assurance for achieving negative worker exposures to MC, especially with incidental dermal exposure and subsequent ingestion, at this project site.

TABLE 9-2
Personal Protective Equipment[a]

Task	Level	Body	Head	Respirator [b]
▪ Mobilization/Demobilization ▪ Utility Clearance and Land Survey Activities to support the remedial objectives, where impacted soil, sediment or groundwater IS NOT disturbed or accessible. ▪ Various site restoration activities ▪ Limited Land Clearing operations and reduction of cleared vegetation/trees	D	▪ Designated and appropriate work clothes ▪ Steel-toed work boots that provide sufficient ankle support ▪ Work gloves (cut resistant), reflective safety vest, chainsaw chaps, and snake guards ▪ Reflective traffic vest	▪ Hardhat [c] ▪ Safety glasses ▪ Hearing protection (as applicable)[d]	• None required
▪ Site Set-up (installation of IVS). ▪ Land and Utility Survey Activities to support the investigation, where impacted soil, sediment or groundwater IS disturbed or accessible. ▪ Land Clearing on transects ▪ DGM survey and UXO escort ▪ Sample collection for soil, sediment, surface water, groundwater or waste characterization analysis.	Modified D	▪ Designated and appropriate work clothes ▪ **Boots:** Hard-toed work boots that provide sufficient ankle support (preferable leather); with outer rubber/latex chemical resistant boot covers or hard-toed chemical resistant rubber boots with steel shank ▪ **Gloves:** Inner and Outer surgical-style nitrile chemical-resistant nitrile gloves.	▪ Hardhat [c] ▪ Safety glasses (non chemical injections) ▪ Ear protection (as applicable) [d] ▪ Face shields and goggles (as applicable))	None required.
Contact Safety and Health Manager prior to implementing Level C PPE upgrade. ▪ Site conditions where defined action levels are exceeded or where unknown site conditions are encountered and confirmed by Safety and Health Manager that Level C PPE is required to ensure a negative exposure to site workers.	C *	▪ **Coveralls:** uncoated Tyvek® ▪ **Boots:** Steel-toed, chemical-resistant boots OR steel-toed, leather work boots with oute rubber boot covers ▪ **Gloves:** Inner surgical-style nitrile and outer chemical resistant nitrile gloves.	▪ Hardhat [cc] ▪ Ear protection (as applicable) [d] ▪ Spectacle inserts (as applicable)	Air purifying respirator (APR), supplied air respirator (SAR) full face, MSA UltraElite or equivalent; with GME cartridges or equivalen applicable to appropriate respiratory protecti measures for specific site compounds or with P100 high-efficiency particulate air (HE cartridges for particulate exposures.

Reasons for Upgrading or Downgrading Level of Protection

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

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

[b] No facial hair that would interfere with respirator fit is permitted.

[c] Hardhat and splash-shield areas are to be determined by the SSHO/UXOSO.

[d] Ear protection should be worn when conversations cannot be held at distances of 3 ft or less without shouting.

[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range --then at least every 4 hours.
If encountered conditions are different than those anticipated in this APP/SSHP, contact the Safety and Health Manager**.** Where CH2M HILL personnel are required to use a respirator to provide respiratory protection, personnel must receive respiratory protection program training. Contact the Safety and Health Manager to receive this training, prior to using any respiratory protective device.

[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Modified Level D/Level C) is permitted only when the PPE requirements have been approved by the Safety and Health Manager and a UXOSO qualified at that level is present.

* Identification of the use of Level C PPE is included for purposes of completion of the APP/SSHP submission and for CSE operations only.

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9.5.12.3 Air Monitoring/Sampling

(Reference CH2M HILL SOP HSE-207, Exposure Monitoring for Airborne Chemical Hazards)

9.5.12.4 Air Monitoring Specifications

Instrument	Tasks	Action Levels[a]	Action to be Taken when Action Level reached	Frequency [b]	Calibration
Flame Ionization Detector [FID]: Organic Vapor Analyzer (OVA) model 128 or equivalent	All intrusive work	< 1 ppm 1 to 10 ppm > > 10ppm	Level D Level C	Initially and periodically during task	Daily
Dust Monitor: Miniram model PDM-3 or equivalent	All intrusive work	<0.5 mg/m^3 > 0.5 mg/m^3	Level D Level C	Initially and periodically during tasks	Zero Daily

[a] Action levels apply to sustained breathing-zone measurements above background.

[b] The exact frequency of monitoring depends on field conditions and is to be determined by the SC; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate. Monitoring results will be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., “Breathing Zone/MW-3,” “at surface/SB-2,” etc.).

[c] If the measured percent of O_2 is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O_2 action levels apply only to ambient working atmospheres, and not to CSE. More-stringent percent LEL and O_2 action levels are required for CSE (refer to Section 9.5,10).

[d] Noise monitoring and audiometric testing also required.

9.5.12.5 Calibration Specifications

(Refer to the respective manufacturer’s instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method
FID: OVA	100 ppm methane	3.0 ± 1.5	100 ppm	1.5 liters per minute (lpm) regular Tygon tubing
FID: Toxic Vapor Analyzer (TVA) 1000	100 ppm methane	NA	100 ppm	2.5 lpm regular Tygon tubing
Dust Monitor: Miniram-PDM3	Dust-free air	Not applicable	0.00 mg/m^3 in “Measure” mode	Dust-free area OR Z-bag with HEPA filter

9.5.12.6 Decontamination Procedures

For the execution of this contract task order, the use of Modified Level D is expected to be required to ensure a negative worker exposure to identified site MC. Regardless of worker PPE requirements, proper site worker hygiene and decontamination procedures are important to prevent any inadvertent exposure to unhealthy or unsafe conditions that could occur. It is important for site personnel to exercise the following procedures:

1) Eating, drinking, smoking and other tobacco use will only be conducted in designated and unrestricted areas and not in any areas where there is any exposure to hazardous material/waste, flammable/combustible liquids, gases.
2) Wash hands and face, if applicable, before eating, drinking, smoking or otherwise using tobacco.

3) Shower as soon as feasible after completing field activities.

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

9.5.12.7 Decontamination Specifications

Where Level D is required for worker protection, it is essential for workers to maintain good personal hygiene practices. Proper and specific decontamination procedures will be required where Modified Level D or higher is required for this project, to ensure negative worker exposure to COCs or hazardous materials. These procedures are identified below:

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

Workers/equipment will be fully decontaminated prior to leaving designated restricted access zones. Only disposable PPE will be utilized, and as such the use of onsite showers is not anticipated. Workers will be instructed to shower at offsite lodging facilities, which are in close proximity to the project site, immediately after the end of the scheduled work shifts. It is not anticipated that Level C PPE will be required or used to ensure a negative worker exposure to identified MC. However, if Level C PPE is required during the execution of the project, disposable protective coveralls will have hoods and boot coverings to minimize potential dermal contact or contact with designated work clothes. Use of dedicated clothing washing or laundering facilities should not be needed so long as workers strictly adhere to PPE and decontamination requirements. Hand washing facilities will be provided at the site and used prior to entering designated “support zones.” See Section 9.5.37 for more detail. Any utilized respiratory protection equipment will be fully cleaned, decontaminated, and stored in accordance with the respiratory protection program that is applicable to the employee. Respiratory protection devices may also require intermediate decontamination prior to resuming work after scheduled breaks.

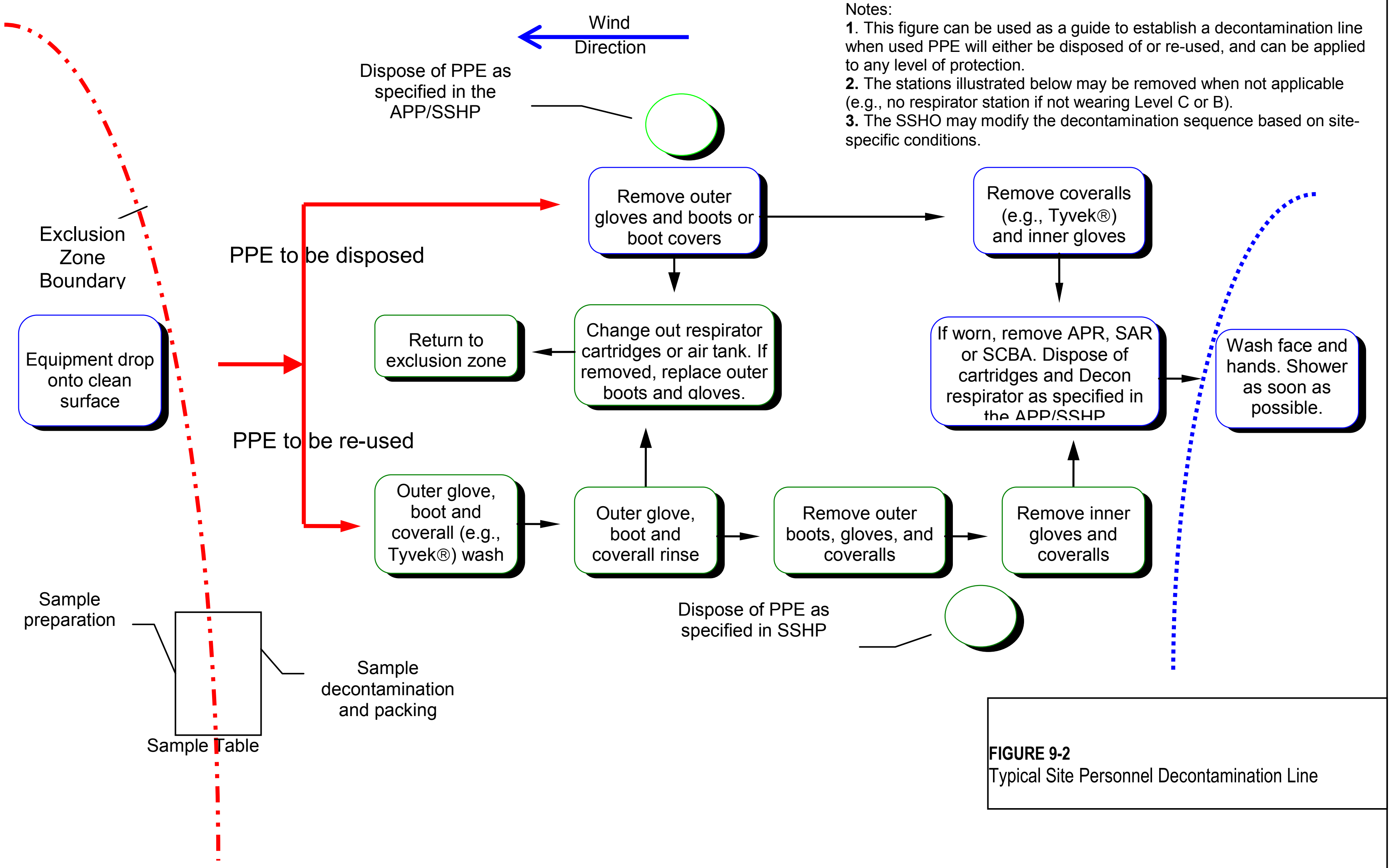
Prior the end of a scheduled work shift, all generated potentially lead-impacted PPE will be containerized to minimize the potential for the spread of contamination and all hand tools used in the daily events will be decontaminated/containerized and stored in accordance with good housekeeping practices.

9.5.12.8 Diagram of Personnel-Decontamination Procedures

Figure 9-2 is a flow chart identifying a typical Personnel Decontamination Line. A more formal/project specific version of this detail can be provided, as necessary and upon revisiting site operations/controls prior to the start of field operations.

No eating, drinking, or smoking is permitted in EZs or decontamination zones. The SSHO/UXOSO should establish areas for eating, drinking, and smoking. In all cases, whether Modified Level D or Level C is required, it is essential for workers to maintain good personal hygiene practices and avoid the inadvertent spread of site contaminants.

In addition, personnel who are injured on the job or otherwise need medical assistance will be decontaminated via the process identified in Figure 9-2. However, when decontaminating such personnel, it is absolutely critical that residual contamination and PPE be removed from the person requiring medical assistance, prior to relinquishing control of the patient to Emergency Medical Service (EMS) responders. EMS responders who are not properly trained to work with hazardous materials, in a hazardous atmosphere, or in a HAZWOPER or Confined Space environment, are not required to respond to these situations. Attempts must be made by properly trained and protected personnel to decontaminate the injured person in an expeditious manner prior to allowing untrained/unprotected EMS or first response personnel to provide medical treatment.



Notes:
1. This figure can be used as a guide to establish a decontamination line when used PPE will either be disposed of or re-used, and can be applied to any level of protection.
2. The stations illustrated below may be removed when not applicable (e.g., no respirator station if not wearing Level C or B).
3. The SSHO may modify the decontamination sequence based on site-specific conditions.

FIGURE 9-2
Typical Site Personnel Decontamination Line

Radiological Hazards and Controls

Hazards	Controls
Not Applicable	Not Applicable

9.5.13 Cranes

(Reserved)

9.5.14 Demolition/Dismantling

(Reserved)

9.5.15 Drilling/Direct Push Technology

(Reserved)

9.5.16 Electrical Safety

Several types of electrical hazards may be encountered during the project. These hazards might include, but are not limited to, the use of generators, power cords, and electric hand tools during various project activities or inadvertent contact of heavy equipment with overhead or underground electrical or communication utilities or aboveground transformer units. Where electrical exposure hazards are possible in the work environment, the following standard work practices must be implemented.

- Do not connect electric tools directly to 12 volt vehicle/tractor/boat batteries as an electrical power source. Use generators and power cords equipped with ground fault circuit interrupters (GFCIs)
- Only qualified personnel (by training, experience, and/or licensure) are permitted to work on electrical systems.
- Do not tamper with or access electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until hazardous energy control procedures (i.e., lock-out/tag-out) are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment and remove from service.
- All temporary wiring, including extension cords and electrical power tools, must have GFCIs installed.
- Extension cords must be:
  - Equipped with third-wire grounding.
  - Covered, elevated, or protected from damage when passing through work areas.
  - Protected from pinching if routed through doorways.
  - Not fastened with staples, hung from nails, or suspended with wire.
- Electrical power tools and equipment must be effectively grounded or double-insulated and Underwriters Laboratory (UL) approved.

- Operate and maintain electric power tools and equipment according to manufacturers' instructions.

Protect all electrical equipment, tools, switches, and outlets from environmental elements.

- Maintain safe clearance distances between overhead power lines and operating heavy equipment and vehicles unless the power lines have been verified as being de-energized and grounded or where insulating barriers have been installed to prevent physical contact. To determine proper clearance from energized overhead electric lines, please consult the table below.

Nominal System Voltage (kV)	Minimum Rated Clearance (ft)
0-50	10
51 - 200	15
201 - 300	20
301 – 500	25
501 – 750	35
751 – 1000	45

- Do not move heavy equipment toward overhead utilities. Do not allow vehicle operators to raise dump bed bodies underneath overhead utilities or vehicles to pull toward overhead utilities with dump bed bodies raised.
- Be cognizant of utility pole guy wires in relation to operating heavy equipment and vehicles.

Demolition operations will be done via non electric initiating devices when within 517 feet of energized power lines.

9.5.17 Excavation Activities

Anomalies will be dug to a maximum depth of 4 feet. Any deeper requires adherence to CH2M HILL SOP 307, Excavation and Trenching Safety.

9.5.18 Fall Protection

(Reserved)

9.5.19 Fire Prevention

The information provided below indicates the minimum Fire Prevention procedures that must be engaged for the project site.

- Be cognizant of and adhere to any specific Fort Rucker /Local Fire Prevention Procedures and Requirements.
- Secure a "hot work permit" from the designated Fort Rucker/Local Fire Department Official, when necessary. This task will be the responsibility of the CH2M HILL

individual responsible for site activities or SSHO/UXOSO. The CH2M HILL PM, SUXOS/SM, or SSHO/UXOSO will review established hot work procedures and appropriate emergency contact requirements with the designated Fort Rucker /Local Fire Department personnel and review this information with all applicable CH2M HILL and subcontractor personnel.

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

9.5.20 Flight Line Safety

(Reserved)

9.5.21 General Practices and Housekeeping

- Maintain good housekeeping at all times in all project work areas.
- Establish common paths of travel and keep them free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Designate specific areas for the proper storage of materials.
- Store tools, equipment, materials, and supplies in an orderly manner.
- As work progresses, neatly store scrap and unessential materials or remove them from the work area.
- Provide containers for collecting trash and other debris and remove them at regular intervals.
- Clean up all spills quickly. Clean oil and grease from walking and working surfaces.

9.5.22 Hand and Power Tools

Hand and power tools may be used during the support of mobilization operations. When the use of hand and power tools is necessary to properly complete assigned tasks, the following work practices must be implemented, where applicable.

- Tools will be inspected prior to use, and damaged tools will be tagged and removed from service.
- Hand tools will be used for their intended use and operated in accordance with manufacturer instructions and design limitations.
- Maintain all hand and power tools in a safe condition.
- Do not set power tools down in muddy or wet areas, which may damage the tool and/or or create a potential for electric shock.
- Use PPE (such as gloves, safety glasses, earplugs, and face shields) when exposed to a hazard from a tool.
- Do not carry or lower a power tool by its cord or hose.
- Portable power tools will be plugged into GFCI-protected outlets.
- Portable power tools will be UL listed and have a three-wire grounded plug or be double insulated.
- Disconnect tools from energy sources when they are not in use, before servicing and cleaning them, and when changing accessories (such as blades, bits, and cutters).
- Safety guards on tools must remain installed while the tool is in use and must be promptly replaced after repair or maintenance has been performed.
- Store tools properly in a place where they will not be damaged or come in contact with hazardous materials.
- If a cordless tool is connected to its recharge unit, both pieces of equipment must conform strictly with electrical standards and manufacturer's specifications.
- Tools used in an explosive environment must be rated for work in that environment (that is, intrinsically safe, spark-proof, etc.).
- Working with manual and pistol-grip hand tools may involve highly repetitive movement, extended elevation, constrained postures, and/or awkward positioning of body members (for example, hand, wrist, arm, shoulder, neck, etc.). Consider alternative tool designs, improved posture, the selection of appropriate materials, changing work organization, and sequencing to prevent muscular, skeletal, repetitive motion, and cumulative trauma stressors.

9.5.23 Knife Use

A razor knife should not be used unless it is demonstrated that it is the right tool for the job.

Responsibilities

- The CH2M HILL PM is responsible for funding and ensuring the correct tool is being used, employees wear the proper PPE when using knives, and they have reviewed this policy.
- Employees are responsible for having and utilizing the proper PPE while performing an activity requiring the use of a knife. Employees are also responsible for understanding the proper use of a knife.

Glove Requirements

- In general, cut resistant gloves are to be worn when using a knife in an occupational setting.

Standard Control Measures for Knife Use

- All employees who will use a knife in a work environment should understand the procedure for proper use of this tool.
- When using a knife, always cut away from yourself.
- Many tasks require a knife edge but not a sharp point. For these tasks, you can add protection against puncture wounds by using a rounded-tip blade.
- If you use a folding knife, it must be a locking blade type.
- Never use a knife that will fold under pressure.
- If you use a fixed blade knife, make sure there is a handle guard to keep your hand from slipping forward. Also, make sure the handle is dry and non-greasy/slippery to assure a better grip.
- When cutting, make the force of the cut carry the blade away from any part of your body. If you have a peculiar situation where this is not possible, protect yourself with a leather apron, or other material placed between you and the blade. Consider putting the material to be cut in a vise, or other holding device.
- If you carry a fixed blade knife, use a sheath or holder.
- Store utility knives safely, retract the blade or sheath an open blade before storing. Never leave a knife with the blade exposed on the floor, on a pallet, on a work surface, or in a drawer or cabinet.
- Keep your knife sharp. A dull blade requires you to use more force to cut, and consequently increases the risk of a slip or mistake.
- Knives used on the job, but not carried with you, must be properly stored when not in use.
- Never use a defective knife.

- Utility knife blades are brittle and can snap easily. Do not bend them or apply side loads to them by using them to open cans or pry loose objects. Use the knife only to cut. It was not designed to work as a pry bar, screw driver, hole punch, and other tool.
- **Stay focused on the cutting job.** It only takes a second of inattention with a sharp blade to produce a serious cut. Letting the mind wander or talking with others while using a knife greatly increases the risk of an accident and injury. If you are interrupted while working with a knife, stop cutting, retract the blade, and place the knife down on a secure surface before dealing with the interruption. You should never continue cutting while distracted! As always, utilize the hierarchy of controls and first attempt to engineer out the hazard and frequently make sure you have the right tool for the job.

9.5.24 Haul Trucks

Haul trucks may be used for the delivery of products or materials to be incorporated into the project for the delivery and pick-up of heavy equipment or for the transportation and disposal of excavated/removed waste materials. Where vehicles are used on the project, the following work practices will be implemented.

- All vehicles must follow the designated access road established for the Fort Rucker project site.
- Haul truck operators should be familiar with their equipment and inspect all equipment before use.
- Haul truck operators should ensure that all persons are clear before operating trucks or equipment. Before moving, operators should sound horn or alarm. All equipment should be equipped with an operational back-up alarm.
- Haul trucks or equipment with restricted visibility should be equipped with devices that eliminate blind spots.
- Employees will stay off access roads. When approaching a haul area, employees should make eye contact and communicate their intentions directly with the equipment operator.
- If possible, minimize steep grades on access roads.
- Access roads should be well lit, sufficiently wide (at least 50% of the width of the equipment on both sides of road), and equipped with reflectors to indicate access points.
- Access roads should have adequate right-of-way signs indicating haul directions, where appropriate.
- Ground personnel will stay clear of the dump radius of vehicles dumping aggregates or common fill materials at the site.

9.5.25 Heavy Equipment

Heavy equipment may be used during vegetation clearing and possibly MEC investigation activities. Where heavy equipment is used on the project, the following work procedures will be exercised by CH2M HILL personnel who may be designated to operate or supervise the operation of site heavy equipment. Work performed within the munitions response (MR) exclusion zone (EZ) will be done under the direct supervision of a UXO Technician.

- CH2M HILL authorizes only those employees qualified by training or previous experience to operate heavy equipment.
- Equipment must be checked at the beginning of each shift to ensure the equipment is in safe operating condition and free of apparent damage. The check should include service brakes, parking brakes, emergency brakes, tires, horn, back-up alarm, steering mechanism, coupling devices, seat belts, and operating controls. All defects will be corrected before the equipment is placed in service.
  - Documentation of this inspection must be maintained onsite at all times.
- Equipment must be on a stable foundation such as solid ground or cribbing; outriggers are to be fully extended.
- Seat belts will be used by all personnel operating equipment.
- Equipment must not be used to lift personnel; loads must not be lifted over the heads of personnel.
- Equipment, or parts thereof, which are suspended must be substantially blocked or cribbed to prevent shifting before personnel are permitted to work under or between them. All controls will be in a neutral position, with the motors stopped and brakes set.
- Equipment that is operating in reverse must have a reverse signal alarm distinguishable from the surrounding noise or a signal person when the operator's view is obstructed.
- When equipment is used near energized power lines, the closest part of the equipment must be at least 10 ft from power lines < 50 kV. Provide an additional 4 ft for every 10 kV over 50 kV. A person must be designated to observe clearances and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. All overhead power lines must be considered energized until the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded.
- Underground utility lines must be located before excavation begins; see "Procedures for Locating Buried Utilities" contained in this APP/SSHP for additional information.
- Operators loading/unloading from vehicles are responsible for seeing that vehicle drivers are in the vehicle cab or in a safe area.
- The parking brake will be set whenever equipment is parked; wheels must be chocked when parked on inclines.

When heavy equipment is not in operation, the blade/bucket must be blocked or grounded; the master clutch must be disengaged when the operator leaves the cab. When equipment is unattended, power must be shut off, brakes set, blades/buckets landed, and shift lever in neutral.

9.5.26 Vegetation Clearing Operations

Clearing of trees (diameter < 4 inches), saplings, or brush overgrowth in the area of proposed DGM transects at the Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range will be performed using MEC avoidance procedures. Limited vegetation clearing operations may be facilitated by the use of hand-held brush cutters, or appropriately sized chain saws. Depending on the size and bulk of the removed vegetation, it will likely be reduced in place by hydraulic mowing apparatus, removed and stacked in-place for eventual offsite disposal or potentially incorporated in-situ as erosion control measures. AHAs will be implemented for all vegetation clearing/mowing operations, as necessary. The minimum PPE to be used by ground personnel performing vegetation clearing operations will be as follows:

- Appropriate work clothes (long pants, shirts, sturdy hard-toed work boots with sufficient ankle support)
- American National Standards Institute (ANSI) Z87 approved eyewear with a face shield (ground personnel not protected by closed equipment cabs or using chainsaws/brushcutters)
- A hardhat with the visor facing forward
- Leather work gloves
- Long-sleeved shirt
- Ear muffs (or equivalent hearing protection)

Note: For ground personnel engaged in vegetation clearing operations, the substitution of high visibility clothing (reflective/high visibility vests) may be considered where there is potential for worker entanglement in heavy brush growth or working in proximity to rotating heavy equipment.

The following sections identify general work practices that will be implemented onsite in connection with the execution of vegetation clearing operations.

Land Clearing via Hydraulic Mowing

Where standard landscaping mowers or hydraulic mowers/brush cutting equipment is used, to meet limited vegetation clearing objectives, the following will be applicable.

- Only qualified personnel, by training or previous experience, will operate landscaping mowers or hydraulic mowers/brush cutters.
- Only essential person will be involved in mowing or brush removal operations. Sufficient distance must be maintained by ground support personnel or personnel observing the operations.
- Ensure that equipment kill switches are properly operating and accessible by mowing equipment operators.
- Mower and hydraulic mower/brush cutter operators should not operate equipment on steep, slippery, or uneven slopes that could cause the mower to flip over or otherwise

become unstable to the point where operators or ground personnel could become exposed to the blades.

- Ensure that all mechanic guards or protective devices over mower discharge chutes are in place.
- Operators of hydraulic mowers/brush cutters should not raise cutting decks more than 6 inches above ground surface.
- Operators should review mower manufacturer manuals to ensure that the mower is operated in accordance with manufacturer's parameters.

Vegetation Clearing – Chainsaws/Brushcutters

The following safe work operations apply to personnel using chainsaws or hand-held brushcutters (where applicable).

- In addition to the PPE listed above, personnel using chainsaws or brush cutters will also wear chainsaw chaps, appropriately sized for each applicable worker.
- Do not start a chainsaw until all coworkers are clear from the operating envelope and potential "kickback" zone of the chainsaw.
- Do not allow personnel to use chainsaws/brushcutters who do not have appropriate experience or training for the assigned tasks.
- Verify that the owner's manual is available to personnel using the equipment.
- Chainsaw inspections and maintenance will address, at a minimum, the following:
  - no leaks
  - chainsaw chain sharp and maintained
  - chainsaw oiling mechanism operating properly and not clogged with debris
  - inspection of chain integrity/tension
  - chain brake mechanism
  - throttle control operation
  - hand guard and chain catcher
  - carburetor idle
  - chain slack adjustment mechanism
  - stop control
- Do not distract or disturb someone who is operating a chainsaw or brushcutter. Non-essential ground personnel or other team members engaged in vegetation clearing operations who must interface with personnel actively engaged in chainsaw use must first establish eye contact with the operator and signal (via hand) that they would like to approach the fall zone. Both the chainsaw operator and ground personnel must assess that it is safe to enter the fall zone.
- Refrain from smoking while fueling or operating the saw. Refuel the saw only after it has cooled, and require funnel use. Make sure the fuel cap is secured and any fuel spillage is cleaned up. Move sufficient distance away from refueling area before

restarting saw. Keep a fire extinguisher nearby. Transport and store fuel only in approved containers.

- Implement proper work break regimens, heat stress monitoring, and fluid intake for personnel operating chainsaws. If they become tired or overheated, ensure they are examined for heat stress— refer to Section 9.12 for information regarding heat stress monitoring and treatment.
- Ensure personnel operating chainsaws properly maintain and stow chainsaws after work is completed.
- Ensure that when chainsaws must be un-jammed, cleaned, or maintained, that the saw is shut off.
- Working from heights (ladder, aerial lift, back of trucks) requires additional planning and must be approved by the Safety and Health Manager.
- Review biological hazard information in Section 9.5.6. Use appropriate insect repellents, as applicable.

Land Clearing - Tree Felling via Chainsaws

- The following work practices apply to personnel performing tree felling operations.
- Evaluate the tree(s) and the surrounding area for anything that may cause property damage or worker injury when the tree falls, this includes the UXO Technician checking the surface area where the tree will fall for MEC.
- Evaluate the shape of tree(s), lean of the tree and decayed or weak spots.
- Evaluate wind force and direction. Evaluate the location of people and other perceived hazards.
- Evaluate potential electrical hazards. (Note: no electrical hazards exist in area where tree felling operations are to occur.)
- Work area will be routinely cleared to permit safe working conditions. An escape route will be evaluated by each worker performing tree felling operation.
- Each worker will be involved in tree felling operations will be advised on their roles. All workers not directly involved in the operation will be kept clear of the work area. Create sufficient buffer zone between non-essential ground support personnel and tree felling crew.
- Perform proper maintenance and inspection of all equipment to be utilized in the operation.
- All equipment to be operated and maintained by experienced and qualified operators/personnel.
- De-limb trees from base to top prior to “topping” trees.

- Use directional notching for tree felling (top cut ~60° angle to 20-25% tree diameter and bottom horizontal cut to meet termination point of top cut) before through-cutting of trunks/limbs.
- Tree “topping” operations are to be performed by qualified and experienced personnel only.

Site Clearing -Chippers

- Mechanical chippers must be maintained in accordance with the manufacturer's specifications.
- The motor ignition will be locked out and the key removed from the ignition before any maintenance or service is performed, or when the chipper is left unattended.
- The chipper drum will be blocked, and only authorized persons allowed to perform any service or maintenance.
- On the drum or blades, retightening of chipper blade bolts will be done according to manufacturer's specifications.
- The chipper will be equipped with a workable "kill switch” of approved design located at the in-feed location.
- The chipper will have a curtain in place at all times (workable in all weather conditions, in order to prevent fly-back of material.
- Before the wood chipper is started, the apron and feed platform should be checked and cleared of any foreign objects.
- The front of the feed apron table will be a minimum of 5 ft from the chipper blades.
- Hands or feet will not be placed beyond the curtain guard while the blade is in operation.
- A “push stick” will be used to force shorter or thorny brush into the chipper.
- Care will be exercised when chipping dead or frozen wood in order to avoid kickback.
- Maximum diameter of material to be fed into the chipper will be 6 inches, unless manufacturer's specifications allow larger material size.
- Material from 3 to 6 inches in diameter will not exceed 8 ft in length, unless manufacturer's specifications allow longer material length.
- The person feeding the chipper will stand to the side of the apron at the rear of material being fed into the machine.
- No person will be allowed to stand or sit on any part of the discharge chute while the brush chipper is in operation.

- No person will stand or sit on any part of the brush chipper while it is in operation or while it is being transported from one job site to another.
- The chipper apron is to be secured in the "up" position when being transported from one job site to another.

9.5.27 Lock-Out/Tag-Out

(Reserved)

9.5.28 Machine Guarding

Machine guarding procedures for the anticipated work will likely be applicable to power and hand tool use, vegetation clearing operations, and certain mechanized equipment that may be used during vegetation clearing. For these identified activities, the following machine guarding precautions may be applicable.

- Ensure that all machine guards are in place to prevent contact with drive lines, belts, pinch points, mechanically energized equipment, or any other sources of mechanical injury.
- Unplugging jammed equipment will only be performed when equipment has been shut down, all sources of energy have been isolated, and equipment has been locked/tagged and tested.
- Maintenance and repair of equipment that results in the removal of guards or would otherwise put anyone at risk requires lock-out of that equipment prior to work.

9.5.29 Manual Lifting

Manual lifting is likely to occur during many phases of the project. Personnel executing assigned tasks where manual lifting is required should use the following procedures to help reduce the potential for personal injury.

- CH2M HILL and subcontractor personnel must notify the SUXOS/SM, SSHO/UXOSO, and/or CH2M HILL PM of pre-existing medical conditions that may be aggravated or re-injured by lifting activities, such that appropriate personnel may evaluate safe operational procedures with regard to the required task.
- Proper lifting techniques (use of knees, not back) must be used when lifting any object.
- Plan storage and staging to minimize lifting or carrying distances.
- Use drum dollies/carts with a latching mechanism when handling full/loaded drums. Avoid “shimming” drums wherever possible.
- Split heavy loads into smaller loads.
- Use mechanical lifting aids whenever possible.
- Have someone assist with the lift— especially for heavy (>40 lbs.) or awkward loads. Note: If personnel are not capable of lifting 40 lbs., seek assistance from a team member to split the load.

- Make sure the path of travel is clear prior to the lift.

9.5.30 Noise

Unprotected exposure to excessive noise levels may lead to gradual and permanent hearing loss. The greater the intensity of a noise and the longer a person is exposed to the noise, the greater the chance of hearing loss. A hearing loss can be permanent or temporary. After certain noise exposures, a person may experience a temporary threshold shift (hearing loss) that results in the inability to hear certain sounds. The ability to hear will usually return. However, repeated or intense noise exposure can prevent this recovery, resulting in permanent hearing loss.

Each employee is responsible for the following:

- Notify the SSHO/UXOSO of high-noise-level areas.
- Wear hearing protection when required.
- Complete noise training and audiometric testing (as required).
- Hearing protection is required in work environments exceeding 85 decibels (dB).
- Hearing protection will be worn when operations occur within or adjacent to high-noise sources (i.e. potentially exceeding 85 dB).

9.5.31 Pressure Washing Operations

Pressure washing operations may be implemented prior to the final demobilization of equipment used at the site that may be in contact with site MC. Whenever pressure washing operations are performed at the site, the following procedures must be implemented:

- Rain gear (disposable coated chemical suits for HAZWEPER operations), 16-inch-high, steel-toed rubber boots, safety glasses, hard hat with face shield, and inner and outer nitrile gloves should be worn, at a minimum during pressure washing operations.
- Only trained, authorized personnel may operate the high-pressure washer.
- Rinse waste from pressure washing operations must be collected and properly disposed.
- Follow manufacturer’s safety and operating instructions.
- Inspect pressure washer before use and confirm “dead-man switch” fully operational.
- The wand must always be pointed at the work area.
- The trigger should never be tied down
- Never point the wand at yourself or another worker.
- The wand must be at least 42 inches from the trigger to the tip.
- The operator must maintain good footing.
- Non-operators must remain a safe distance from the operator.
- No unauthorized attachment may be made to the unit.

- Do not modify the wand.
- All leaks or malfunctioning equipment must be repaired immediately or the unit taken out-of-service.

9.5.32 Sample Collection or Handling

Sample handling, packaging, and preservation may be conducted in support of the limited characterization of waste materials or confirmation sampling activities that may be executed by CH2M HILL during the project. When personnel perform sample collection or handling activities, the work practices and procedures identified below must be followed.

- Skin contact with water, soil, sediment, or debris of undetermined chemical characterization will be avoided at all times.
- PPE and air monitoring requirements will be met in accordance with Section 9.5.12 to minimize potential dermal and respiratory exposures to identified site COCs while conducting sample collection or characterization of potentially contaminated media (soil, water, PPE, etc.). In addition, good personal hygiene practices and procedures must be maintained (see Sections 9.5.12 and 10.6).
- Caution should be exercised when filling bottles containing acid or base preservatives. Both liquid and vapor phases of acid can cause severe burns.
- Following sample collection, sample container lids should be tightened securely to prevent leaks, and the outsides of containers should be rinsed with clean water to ensure that they are free of chemical constituents.

9.5.33 Handling or Sampling of Drummed Waste

During the execution of the contract, various types and quantities of generated waste materials will be generated and may include, but not be limited to, PPE, or decontamination fluids, MD that has been processed to MDAS, and cultural debris. Personnel are permitted to handle and/or sample drums containing known waste sources/materials, but handling or sampling other drums (unknowns) requires an APP/SSHP revision or amendment approved by the project Safety and Health Manager. The following control measures must be taken when managing drums containing waste sources/materials:

- Minimize transportation of drums or other containers with generated waste materials. However, where this is deemed necessary, appropriate drum “dollies”/hand trucks or other suitable material handling equipment will be used to transfer drums of generated waste materials.
- Sample or open only labeled drums or drums known to contain generated waste materials. Unknown drums or drums that show evidence of excessive buckling/bulging, corrosion, vapors, crystallization, unusual discoloration, or other abnormalities may not be sampled without the evaluation of engineering controls, proper PPE, air monitoring equipment, and the use of properly trained personnel familiar with the sampling of unknown drum contents.
- Use caution when sampling bulging or swollen drums. Relieve pressure slowly and step away from the drum as pressure is being released.

- If drums contain, or potentially contain, flammable materials, use non-sparking (i.e., brass) tools to open the drum.
- Picks, chisels, and firearms may not be used to open drums.
- Reseal bung holes or plugs whenever possible.
- Avoid mixing incompatible drum contents.
- Sample drums without leaning over the drum opening.
- Transfer the content of drums using a method that minimizes contact with material.
- Spill-containment procedures specified in Section 9.2.6 of this APP/SSHP must be appropriate for the material to be handled.

Drum Management

Drums containing material removed from the munitions response exclusion zone must be labeled as non-regulated waste. In addition each drum will be numbered. In addition each drum will have affixed to the outer portion a copy of the DD Form 1348-1A. Drums containing MDAS will be locked to prevent addition of unknown items.

For regulated Waste:

- Typically drums of hazardous materials are handled during characterization, removal, consolidation or transportation and disposal events.
- Accidents may occur during the handling of drums and other hazardous containers. Accidents may result from:
    - Accidental Detonation/Explosion
    - Fires
    - Vapor generation
    - Moving heavy drums by hand/heavy equipment
    - Working around stacked drums
    - Managing deteriorated drums

These hazards may be reduced by minimizing handling by workers and increasing handling by heavy equipment and isolating workers, to the extent possible, from hazardous materials.

When handling and characterizing significant quantities of drums, a “Drum Management Matrix” will be developed and reviewed by the project Safety and Health Manager.

Preliminary Inspection

- Appropriate drum handling procedures depend on drum contents. Prior to any handling, drums are to be visually inspected.
- Assess the need for PPE for inspection operations
- Drum type (future access)

- Symbols, words, or other marks indicating contents.
- Symbols, words, or other marks indicating discarded laboratory chemicals, reagents, or other potentially dangerous small volume containers (lab pack).
- Signs of deterioration (corrosion, leaks)
- Bulging
- Explosive/Shock-sensitive (blast protection)
- Biohazards
- Assume unlabeled drums are hazardous and watch for "conflicting markings" (potential past re-use)
- Have an Inventory and Tracking system in-place.

Drums with Potential Shock-Sensitive Material

- Personnel with special training and equipment to manage shock-sensitive wastes
- Evidence of crystalline material on container
- Laboratory waste (lab packs) until otherwise determined.
- Must be managed with EXTREME precautionary measures
- Nonessential personnel removed
- Blast shields grapplers/remote handlers
- Consider implementing "Blast Operation" procedures
- Ensure that operations do not unnecessarily generate waste

Handling

- Purpose
    1) Respond to obvious threats or hazards that affect worker safety or environment.
    2) Unstack and orient drums for sampling
    3) Organize drums for final characterizations, neutralizations/stabilization, repackaging or offsite shipment
- Sufficient spill response personnel (properly trained) and materials
- Containment structures and collection methods.
- Physical handling by workers only as necessary, increase mechanical device use.

9.5.34 Stairways and Ladders

(Reserved)

9.5.35 Unknown or Suspect Objects/Materials

If unknown or suspect objects/materials are encountered (i.e., exposed or partially buried drums, tanks, cylinders, unusually stained/discolored soil) are encountered during site operations, the material will be investigated as hazardous. During MEC operations, if an unknown filler is encountered, the instructions outlined within the ESP will be followed. Ongoing activities will be immediately stopped, and the UXOSO and/or SUXOS/SM will be consulted for isolating the object/material for identification and disposition in accordance with the Explosives Siting Plan.

Project personnel encountering unknown or suspect objects/materials will (1) secure the area and identify the location of the object/material to the extent possible, without disturbing the object, (2) evacuate the work area, (3) immediately notify the SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of the encountered condition, and (4) not cause additional disturbance or otherwise handle the suspect object/material pending direction from the UXOSO or SUXOS/SM. Potential hazards associated with the specific situation encountered will be evaluated prior to disturbance of the object/material. The CH2M HILL PM, UXOSO, SUXOS/SM, or SSHO/UXOSO will then address the need for the use of special procedures, engineering controls, PPE or specialized subcontract personnel to safely mitigate the situation.

9.5.36 Munitions and Explosives of Concern

MEC are suspected to be present onsite at the Anti-Tank/Rocket Grenade Range and the Infiltration/Grenade Range, and may be present as a result of training exercises at the .22-Caliber Target Butt. Appropriate safety measures will be used during all fieldwork. The primary hazard associated with MEC is the possibility of injury and/or death as a result of an explosion (blast and fragmentation). All personnel assigned to or managing this munitions response (MR) project are required to be properly trained, and all work will be performed under the purview of the UXOSO and SUXOS/SM.

MEC known or suspected to be inert will be assumed to have an explosive filler with potential to cause a high-order detonation. MEC will be considered inert when inert filler is exposed. Vented inert ordnance items can be treated and disposed as scrap after the venting and demilitarization process is complete.

Excavations of DGM anomalies are performed by manual, or manual and mechanical aided means, as stated in Section 3.8.9.3 of the Work Plan. If mechanical equipment is necessary based on the depth of the anomaly, measures will be taken to avoid any contact with the anomaly. Excavation will be performed to the side of the anomaly and hand tools will be used to move in horizontally to the anomaly.

9.5.37 Site Control Measures

To prevent both exposure of unprotected personnel and migration of contamination, work areas and PPE requirements will be clearly identified when operations that fall under the requirements of 29 CFR 1910.120/29 CFR 19126.65 or potential MEC are identified. This APP/SSHP recommends that the area surrounding each of the work areas be divided into three distinct zones; the EZ, the contamination reduction zone (CRZ), and the support zone (SZ).

Only individuals who meet the requirements of 29 CFR 1910.120/29 CFR 1926.65 and the DDESB TP 18 Minimum Qualifications for UXO Technicians and are authorized by the UXOSO or SUXOS/SM (Anti-Tank/Rocket Grenade Range and the Infiltration/Grenade Range) will be allowed entry into the EZ and CRZ. Suitable means and methods (high visibility fencing, caution tape signage, other physical barriers) will be used to demarcate the EZ and CRZ boundaries to prevent unauthorized entry into these controlled work zones. A CRZ for decontamination will be established adjacent to the EZ. The SZ will be kept free from contamination.

Personnel who work at the site during operation periods will be required to sign into and sign out of the site via a daily sign-in/out and/or site visitor log.

9.5.37.1 Exclusion Zone

An EZ will be constructed to surround each work area where the potential for worker exposure to MEC exists. The EZ may need to be transient as the work progresses, depending upon the type of work being executed. Because of potential site space limitations, the EZ fencing may also include any available permanent perimeter fencing or other established physical barriers. Note that the term "permanent" is often used to describe the outer limits (or perimeter) of a work site or designated site area. Other temporary barriers (e.g., caution tape or signs) may be used to supplement existing permanent barriers to demarcate the EZ to identify the restricted access. Access to the EZ will be restricted to personnel deemed essential.

9.5.37.2 Support Zone

Temporary support zones and staging areas will be established at the entrance of each control area. Potable water, an eye wash, and first aid supplies will be located at each temporary support zone. No hazardous or potentially hazardous materials will be allowed in the support zone unless it is in a properly labeled container that has no external contamination. Eating, drinking, and smoking will only be allowed in this area, at designated locations.

Portable bathroom facilities will be located near the work areas. In addition, potable water and water and soap for hand washing will be available at the support zone, along with containers for solid waste for use by site personnel, first aid stations, and administrative information.

9.5.38 Vacuum Truck Operations

(Reserved)

9.5.39 Vehicular Traffic (Exposure to)

The following standard work practices must be exercised when personnel are working in or around vehicle routes or near an area where traffic controls have been established.

- When parking your vehicle, park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so it can serve as a barrier.

- Shut off and secure site vehicles prior to exiting them. Park on level ground where possible. If parking on an incline, engage parking brake. If the vehicle has a manual transmission, ensure the transmission is in gear (not neutral) and the parking brake is engaged before exiting the vehicle.

- Exercise caution when entering or exiting an access road, parking— avoid sudden stops and use hazard flashers when necessary.
- All staff working adjacent to access road or within work area must wear reflective/high-visibility safety vests.
- Eye protection should be worn to protect from flying debris.
- Remain aware of factors that influence traffic-related hazards and required controls— sun glare, rain, wind, limited sight-distance, hills, etc.
- Always remain aware of an escape route, such as behind an established barrier or parked vehicle.
- Always pay attention to moving traffic – never assume drivers are looking out for you.
- Work as far from access road as possible to avoid creating confusion for drivers.
- When workers must face away from a vehicle to perform assigned duties, a “buddy system” should be used, where one worker is looking toward traffic.
- Work area should be protected by a physical barrier.
- Lookouts should be used when physical barriers are not available or practical.

In addition to the above work practices, CH2M HILL personnel and subcontractors will adhere to the following procedures while operating motor vehicles or other motorized equipment on military/government facilities.

- Always use a seat belt while driving
- Always observe posted speed limits, traffic signs and signals
- Never use a cell phone or two-way radio while driving

Violating any of these requirements may result in loss of military/government facility driving privileges.

9.5.40 Visible Lighting

Munitions response (MR) work will be performed during hours of daylight only. Other non-MR related work should be performed during daylight hours whenever possible. Work conducted during hours of darkness (including dusk and dawn) requires the set-up of supplemental lighting equipment. (Note: A general “rule of thumb” is that the illumination intensity must be sufficient to read a newspaper without difficulty). The chart below provides a reference for illumination requirements for various construction related work environments.

Illumination (Foot Candles)	Illumination (Lux)	Area of Operation
5	~ 55	General construction area lighting
3	~ 33	General construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas
5	~ 55	Indoors: warehouses, corridors, hallways, and exit ways
5	~ 55	Tunnels, shafts, and general underground work areas: (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines approved caplights will be acceptable for use in the tunnel heading)
10	~ 108	General construction plant and shops (e.g., batch plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active store rooms, mess halls and indoor toilets and workrooms.)
30	~ 323	First aid stations, infirmaries, and offices

Notes:
A **foot candle** is a unit of illumination on a surface that is everywhere 1 ft from a point source of one candle.

A **lux** is a unit of measurement of the intensity of light. It is equal to the illumination of a surface 1 meter away from a single candle.

CONVERSIONS

Foot Candles (FC) = Lux x .0929

Lux = Foot candles x 10.76 - (i.e.: 50 FC = 538 LUX)

The following safe work practices will be considered with regard to lighting in the workplace.

- Do not enter poorly lit areas without first providing portable illumination.
- Do not use non-explosion-proof lighting in areas of flammable or combustible gases or liquids.

9.5.41 Welding or Cutting Operations

(Reserved)

9.5.42 Working Alone

– Not authorized on munitions reponse (MR) projects.

9.5.43 Working Around Material Handling Equipment

Where material handling equipment or vehicles may be operating on or adjacent to the project work sites, it is important to observe the following measures when working in the same areas.

- Never approach operating equipment/vehicles from the rear. Always make positive contact with the operator, and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment; remain outside of the swing and turning radius.
- Maintain distance from pinch points of operating equipment/vehicles.
- Never turn your back on any operating equipment/vehicles.
- Never climb onto operating equipment or operate subcontractor/client equipment/vehicles.
- Never ride CH2M HILL, subcontractor, or client equipment/vehicles unless authorized to do so and unless it is designed to accommodate passengers (equipped with firmly attached passenger seat).
- Never work or walk under a suspended load.
- Never use equipment as a personnel lifts; do not ride excavator buckets, crane hook, or material handling equipment forks.
- Always stay alert and maintain a safe distance from operating equipment, especially equipment/vehicles on cross slopes and unstable terrain.
- Personnel will pull to the side of the road when encountering a forklift/heavy equipment. Even if the forklift/heavy equipment is not loaded with cargo, personnel will still pull to the side of the road and stop until the unit has passed.

Rigging

Rigging may be needed during the execution of this task order for the lifting and/or lowering of materials to be incorporated into the project, equipment set-up or during fence removal operations. Where rigging equipment is required on the project, the following work practices will be applicable.

- All rigging equipment must be inspected by a competent person prior to use for signs of excessive wear; equipment found to be damaged will be tagged and removed from service.
- Suspended loads will not pass over workers at any time. Site personnel are prohibited from passing under suspended loads.
- Rigging use, maintenance and inspection will be performed in accordance with the applicable standards of 29 CFR 1926.250 and USACE EM 385 1-1, Section 15, Rigging, whichever is more stringent.
- Only load rated (tagged or labeled) rigging will be utilized on this project. Users will familiarize themselves with design load rate capacities (i.e. vertical, basket/cradle or choker applications) for the selected rigging.

- Tag lines will be attached to every load being lifted. Tag lines will be used for all suspended loads so that riggers and tenders will not have to be in direct contact with any suspended load while controlling position or orientation. **NO PERSON SHALL BE IN CONTACT WITH A LIVE LOAD AT ANY TIME**.
- Rigging will be properly stored in a vertical position, where possible, and inspected daily, by a competent person, before use. An inspection log must be maintained to document inspection findings and condition of the rigging. Rigging identified as damaged must be identified as such and removed from service.
- Personnel will not ride on materials under control loads being lifted.

Powered Industrial Trucks

Powered industrial trucks (i.e. forklifts, material handlers) may be required for materials movement during project activities. Powered industrial trucks present the potential for damage to equipment, materials and personnel by impaling or striking personnel or materials with the fork tines. Additionally, powered industrial trucks may tip if they are incorrectly loaded, driven at excessive speeds, operated with the forks too high or during excessively windy conditions.

The following rules apply whenever a powered industrial truck is used on the project:

- Only trained and authorized drivers will operate powered industrial trucks. Operators must receive training in accordance with 29 CFR 1910.178.
- A rated lifting capacity must be posted in a location readily visible to the operator.
- A powered industrial truck must not be used to elevate employees unless a platform with guardrails, a back guard, and a “kill switch” are provided on the vehicle. When guardrails are not possible, fall arrest protection is required.
- The subcontractor operating the powered industrial truck must post and enforce a set of operating rules for powered industrial truck.
- Horseplay is prohibited.
- Employees must not ride on the forks.
- Employees must never be permitted under the forks (unless forks are blocked).
- The driver must inspect the unit once a shift and document this inspection.
- The operator must look in the direction of travel and must not move the vehicle until all persons are clear of the vehicle.
- Forks must be carried as low as possible.
- The operator must lower the forks, shut off the engine, and set the brakes (or block the wheels) before leaving the operator’s position unless maintenance or safety inspections require the forklift to be running.
- Trucks must be blocked and have brakes set when driven onto their beds.

- Extreme care must be taken when tilting elevated loads.
- Every powered industrial truck must have operable brakes capable of safely stopping it when fully loaded.
- Trucks must have parking brakes and an operable horn.

When the operator is exposed to possible falling objects, industrial trucks must be equipped with overhead protection (canopy).

9.5.44 Working on or Over Water

(Reserved)

9.6 Hazard Communication Program

The information contained in this section is intended to address the requirements of the OSHA Hazard Communication standard (29 CFR 1910.1200). This standard establishes requirements to ensure that chemical hazards in the workplace are identified and that this information, along with information on protective measures, is transmitted to all affected employees.

This section describes how CH2M HILL employees are informed of the potential chemical hazards in their work environment so they can avoid harmful exposures and safeguard their health. Components of this program include the following:

- Labeling
- Posting material safety data sheet (MSDSs), which will be included as Attachment 10
- Training

(Reference CH2M HILL SOP HSE-107, *Hazard Communication)*

The Hazard Communication Coordinator (SSHO/UXOSO) is to perform the following:

- Complete an inventory of chemicals brought onsite by CH2M HILL.
- Confirm that an inventory of chemicals brought onsite by CH2M HILL subcontractors is available.
- Before or as the chemicals arrive onsite, obtain and file an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific HAZCOM training using Attachment 5.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

9.6.1 Shipping and Transportation of Chemical Products

If chemicals brought to the site are defined as hazardous materials by the DOT, all staff who ship the materials or transport them by road must receive training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the CH2M HILL PM, Safety and Health Manager or program regulatory specialist for additional information.

9.7 Process Safety Management

(Reserved)

9.8 Lead Abatement Plan

(Reserved)

9.9 Asbestos Abatement Plan

(Reserved)

9.10 Radiation Safety Program

(Reserved)

9.11 Abrasive Blasting

(Reserved)

9.12 Heat/Cold Stress Monitoring Program

9.12.1 Heat Stress

- It is recommended that personnel drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.

- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).

- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.

- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.

- When practical, conduct the most strenuous field activities in the early morning or evening and rotate shifts of workers.

- Whenever possible, avoid direct sun, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.

- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the UXOSO to avoid progression of heat-related illness.
- To counteract the onset of heat stress symptoms, a work-break regimen must be established. Workers in Level C PPE will be allowed to rest and lower core body temperature to normal status when any one of these conditions is exceeded:
  - Visual signs and symptoms of heat stress are present in a worker.
  - It is determined that a worker's core body temperature exceeds 100.4 degrees F.

SYMPTOMS AND TREATMENT OF HEAT STRESS

	Heat Syncope	**Heat Rash**	**Heat Cramps**	**Heat Exhaustion**	**Heat Stroke**
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!

9.12.2 Monitoring Heat Stress

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

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

9.12.3 Cold Stress

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in cool weather.

- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council.
- Wind-chill index is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- National Safety Council Guidelines for Work and Warm-Up Schedules can be used with the wind-chill index to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; workers should be monitored for symptoms of cold-related illnesses. If symptoms are not observed, the work duration can be increased.
- Persons who experience initial signs of immersion foot, frostbite, or hypothermia should consult the SSHO/UXOSO to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast— be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS

	Immersion (Trench) Foot	Frostbite	Hypothermia
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm–but not hot water. Have victim drink warm fluids, but not coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but not coffee or alcohol. Get medical attention.

9.13 Crystalline Silica Monitoring Plan

(Reserved)

9.14 Night Operations Lighting Plan

Not authorized on munitions response projects.

9.15 Fire Prevention Plan

Fire prevention will be conducted in accordance with the information identified in Section 9.5.19.

9.16 Wild Land Fire Management Plan

(Reserved)

9.17 Hazardous Energy Control Plan

There are no anticipated conditions in which implementing hazardous energy control will be required for this project. However, because of its importance, it is included herein. This program establishes lock-out practices of energy sources that could cause injury to personnel involved at the work site. The lock-out program covers all employees and subcontractors affected by the cleaning, repairing, servicing, and adjusting of vehicles, machinery, and equipment. Only authorized employees will perform such work.

- Authorized employees will be instructed in lock-out/tag-out procedures by their supervisor. Each new or transferred employee will be instructed by the supervisor in lock-out procedures. A sufficient number of tags and padlocks will be supplied. During each activity, a representative from CH2M HILL will be present while the electrical supervisor begins the lock-out/tag-out process.
- All equipment will be locked out to protect against accidental or inadvertent operation when such operation could cause injury to personnel. Do not attempt to operate any switch, valve, or other energy-isolating device bearing a lock.
- Documented inspections will be made periodically by supervisors to ensure that each procedure is being properly followed. The UXOSO will ensure that these inspections are being performed and that the inspection reports are kept on the job site. The inspection must include a review addressing the employee's responsibilities. Documentation is to include the date of the inspection, equipment on which the procedure was being used, the employees involved, and the person performing the inspection.
- Authorized employees will be certain as to which switch, valve, or other energy isolating devices apply to the equipment being locked out. More than one energy source may be involved. Any questionable identification of sources will be approved by the SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM.
- To begin the lock-out process, use the following items as a guide. If for any reason the following items are in question, contact your immediate supervisor before moving forward. If more than one individual is required to lock out equipment, each person will place his or her own personal lock on the energy isolating device(s). One authorized individual and a competent person from CH2M HILL with the knowledge of the crew may lock out equipment for the whole crew. In such cases, it is the responsibility of the individual to carry out all steps of the lock-out procedure and inform the crew when it is safe to work on the equipment. Additionally, the authorized individual will not remove a crew lock until it has been verified that all individuals are clear and aCH2M HILL competent person is present.
  - Notify all affected employees that a lock-out is required.
  - If the equipment is operating, shut it down by the normal stopping procedure.
  - Operate the switch, valve, or other energy isolating devices so the energy source(s) is disconnected or isolated from the equipment.

  - Stored energy, such as capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure must also be dissipated or restrained by methods such as grounding, repositioning, blocking, or bleeding down.
  - Lock out energy isolating devices with an assigned individual lock. A second lock will be used if possible by the SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM.
  - After ensuring that no personnel are exposed and as a check on having disconnected the energy sources, operate the push button or other normal operating controls to make certain the equipment will not operate. CAUTION: Return operating controls to the neutral position after the test.
  - Attach a completed accident prevention tag and/or sign on the controls of the machine. The identification tag and/or sign will be coordinated with the electrical subcontractor and CH2M HILL. A CH2M HILL representative will then make known to the facility personnel affected by this operation the identification of these tags or signs, the procedures under which the subcontractors will be working, and the electrical supervisor POC.
  - The equipment is now locked out.
- To restore equipment to service, use the following items as a guide. If for any reason the following items are in question, contact your immediate supervisor before moving forward.
  - When the job is complete and equipment is ready for testing or normal service, check the equipment area to see that no one is exposed.
  - When equipment is clear, remove all locks. The energy isolating devices may be operated to restore energy to the equipment. There must be a supervisor from the electrical subcontractor and CH2M HILL present.
- The checklist for lock-out training is a minimum requirement to provide to new employees. The SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM must sign, date, and retain this checklist in their own records. The SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM must also deliver a copy of this training to the SSHO/UXOSO.
  - Explain the significance of why a machine is locked or tagged out.
  - Explain what an employee is to do (and not do) when encountering a tag or lock on a switch or device they want to operate.
  - Explain the importance of notification of affected employees.
  - Show the employee the location of all locks, tags, and lock-out devices.
  - Explain how to recognize the applicable hazardous energy sources.
  - Explain the type(s) and magnitude of energy to be isolated on the machinery and how to control that energy.
  - Explain the proper sequence of locking out.

- All utility outages will follow the contract specifications, EM 385-1-1, and OSHA standards. CH2M HILL personnel will follow the above steps as well as the following:
  - CH2M HILL (or subcontractor as applicable) will supply the required tags and/or locks for each utility outage.
  - Utility outages will be coordinated with the utility provider, CH2M HILL, and the subcontractor.
  - Interior building/facility utility outages will be coordinated with the client, CH2M HILL, and the subcontractor.
  - A preparatory meeting will be held prior to all electrical work and utility outages. This meeting will cover any safety issues that may pertain to the scope of work. The AHA form will be reviewed and any additional concerns will be annotated on the form.

9.18 Critical Lift Plan

(Reserved)

9.19 Contingency for Severe Weather Plan

See Section 9.5.2 and Attachment 8.

9.20 Float Plan

(Reserved)

9.21 Site Specific Fall Protection and Prevention Plan

(Reserved)

9.22 Demolition Plan

(Reserved)

9.23 Excavation/Trenching Plan

Digging of anomalies will not exceed 4 feet.

9.24 Emergency Rescue (Tunneling)

(Reserved)

9.25 Underground Construction Fire Prevention and Protection Plan

(Reserved)

9.26 Compressed Air Plan

(Reserved)

9.27 Formwork Shoring and Removal Plan

(Reserved)

9.28 Precast Concrete Plan

(Reserved)

9.29 Lift Slab Plans

(Reserved)

9.30 Steel Erection Plans

(Reserved)

9.31 Site Safety and Health Plan

9.31.1 Site Description and Contamination Characterization

This component is addressed in Section 2.

9.31.2 Hazard Risk Analysis

This component is addressed in Sections 9.5 and 10.

9.31.3 Staff Organization and Qualifications

This component is addressed in Section 4.1. In addition, qualifications of key safety personnel are included in Attachment 11 of this APP/SSHP.

9.31.4 General and Project Specific Training

This component is addressed in Section 6.

9.31.5 Personal Protective Equipment

This component is addressed in Sections 9.5.12 and 10.6.

9.31.6 Medical Surveillance

This component is addressed in Section 3.4.

9.31.7 Exposure Monitoring

This component is addressed in Section 9.5.12.

9.31.8 Heat and Cold Stress

This component is addressed in Section 9.12.

9.31.9 Standard Operating Procedures

In general, this component is addressed in Section 9.5, but is represented by this entire APP/SSHP.

9.31.10 Site Rules

Use of the "buddy system" is referenced in several contexts in this APP/SSHP and is specifically discussed in Sections 9.2, 9.5.12, 9.5.39, and 10.6.

9.31.11 Permits

Permits will be obtained as needed through Fort Rucker.

9.31.12 Material Handling Procedures

This component is addressed in Section 9.5.43.

9.31.13 Drum Container Handling/Opening

This component is addressed in Sections 9.5.33 and 9.31.13.

9.31.14 Comprehensive AHA of Treatment Technologies

(Reserved)

9.31.15 Site Control Measures

This component is addressed in Section 9.5.37.

9.31.16 Personal Hygiene and Decontamination

This component is addressed in Section 9.5.12 and 9.31.16

9.31.17 Equipment Decontamination

This component is addressed in Section 9.5.12.

9.31.18 Emergency Equipment and First Aid

These components are addressed in Sections 3.6, 3.8, 9.2.2, and 9.2.10, 9.5.6, and 9.31.18.

9.31.19 Emergency Response

This component is addressed in Section 9.2.

9.31.20 Pre-Emergency Planning

This component is addressed in Section 9.2.1.

9.31.21 Personnel and Lines of Authority

This component is addressed in Section 4.4.

9.31.22 Site Evacuation

This component is addressed in Sections 9.2.3 and 9.2.4.

9.31.23 Decontamination Medical Treatment of Injured Personnel

This component is addressed in Section 9.5.12.

9.31.24 Route Map to Emergency Medical Facilities

This component is addressed in Section 9.2.10.

Alerting Local Community Responders

It is anticipated that prior to the start of project site operations, the client will conduct a pre-construction meeting or "partnering meeting" with local stakeholders, which will include local Fire, Military Police, and EMS personnel and at this time, proper procedures will be developed to notify the stakeholders and EMS personnel.

9.32 Blasting Safety Plan

(Reserved)

9.33 Diving Plan

(Reserved)

9.34 Confined Space Program

(Reserved)

10.0 Risk Management Process

CH2M HILL utilizes a BBLPS to support the implementation of a Risk Management Process by identifying, analyzing and controlling certain risks (or liabilities) that may be encountered during the execution of a its assigned projects. The BBLPS is a system to prevent or reduce losses using behavior-based tools and proven management techniques to focus on behaviors or acts that could lead to losses.

The six basic loss prevention tools that will be used to implement the BBLPS on this project include:

- Activity Hazard Analysis (AHA)
- Pre-Task Safety Plan (PTSP)
- Loss Prevention Observations (LPO)
- Loss and Near-loss Investigation (NLI)
- Drug Free Workplace Program (DFWP)
- Project-specific AHAs

The CH2M HILL PM and individuals responsible for site operations (SUXOS/SM and SSHO/UXOSO) are responsible for implementing the BBLPS on the project site. These personnel typically delegate authority to the SSHO/UXOSO for the project specific implementation of the BBLPS, but the CH2M HILL PM and SUXOS/SM or SSHO/UXOSO remain accountable for its implementation.

In an effort to provide a safe and healthy workplace for all participants, CH2M HILL promotes and implements a DFWP. CH2M HILL personnel must participate in and adhere to the requirements of the DFWP.

10.1 Activity Hazard Analysis

One of the key elements in executing the BBLPS, and subsequently reducing project risk, is the use of an AHA for each major phase of work. An AHA defines the activity being performed, the hazards posed, and control measures required to perform the work safely. Workers are briefed on the AHA before doing the work and their input is solicited before, during, and after the performance of work to further identify the hazards posed and control measures required.

An AHA will be implemented before beginning each project activity posing Safety and Health hazards to project personnel using the AHA forms provided in Section 10.6. The AHA will identify the tasks required to perform each activity, along with potential Safety and Health hazards and recommended control measures for each task. In addition, a listing of the equipment to be used to perform the activity, inspection requirements, and training requirements for the safe operation of the equipment listed must be identified.

An AHA will be prepared for all field activities performed by CH2M HILL and subcontractors during the project and must be reviewed and accepted by the Safety and Health Manager or other designated qualified safety professional.

CH2M HILL subcontractors will be required to provide AHAs specific to their scope of work on the project for acceptance by the SSHO/UXOSO. Each subcontractor will submit AHAs for their field activities, as defined in their work plan/scope of work, along with their project-specific APP/SSHP. Additions or changes in CH2M HILL or subcontractor field activities, equipment, tools or material to perform work, or additional/different potential hazards that require additional/different hazard control measures require either a new AHA to be prepared or an existing AHA to be revised.

Table 10-1 lists identified hazards associated with the phases of work anticipated. Table 10-1 provides the basis for the development of AHAs, which must be implemented as part of the CH2M HILL BBLPS.

Section 10.6 contains applicable AHAs, which are intended to reinforce project requirements and present control measures for hazards that may be encountered during the project.

10.2 Pre-Task Safety Plans

Daily safety meetings will be held with all project personnel to review the hazards posed and required Safety and Health procedures/AHAs that apply to each day's activities. The PTSPs serve the same purpose as these general assembly safety meetings, but the PTSPs are discussed between the crew supervisor and their work crews to focus on those hazards posed to individual work crews. At the start of each day's activities, the crew supervisor completes the PTSP (see Attachment 3), with input from the work crew, during the daily safety meeting. The day's tasks, personnel, tools, and equipment that will be used to perform these tasks are listed, along with the hazards posed and required Safety and Health procedures, as identified in the AHA. The use of PTSPs is a common safety practice in the construction industry and promotes worker participation in the hazard recognition and control process, while reinforcing the task-specific hazard and required Safety and Health procedures with the crew each day.

10.3 Loss Prevention Observations

LPOs will be conducted by the CH2M HILL individual responsible for site operations/ safety for specific tasks or operations comparing the actual work process against established safe work procedures identified in the project-specific APP/SSHP and AHAs. LPOs are a tool to be used by supervisors to provide positive reinforcement for work practices performed correctly, while also identifying and eliminating deviations from safe work procedures that could result in a loss. The CH2M HILL individual responsible for site operations/safety will perform at least one LPO each week for tasks/operations addressed in the project-specific APP/SSHP or AHA. The CH2M HILL individual responsible for site operations/safety will complete the LPO form in Attachment 6 for the task/operation being observed.

Table 10-1
Activity Hazard Analysis Basis

Potential Hazards	Mobilization	Site Preparation	Site Survey with MEC avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)	Vegetation Removal with MEC avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)	Instrument-Assisted Surface Clearance (Anti-Tank/ Rocket Grenade Range and Infiltration/ Grenade Range)	Digital Geophysical Mapping (Anti-Tank/ Rocket Grenade Range and Infiltration/ Grenade Range)	Subsurface Anomaly Investigation (Anti-Tank/ Rocket Grenade Range and Infiltration/ Grenade Range)	Detonation/ Disposal of MEC (if necessary) (Anti-Tank/ Rocket Grenade Range and Infiltration/ Grenade Range)	Soil Sampling	Transportation and Disposal of Generated Wastes	Site Restoration	Decontamination	Demobilization
Adverse Weather	X	X	X	X	X	X	X		X	X	X		X
Biological	X	X	X	X	X	X	X		X	X	X		X
Buried Utilities			X	X			X		X				
Brushcutters/Mowers			X	X									
Chemical Hazards			X	X	X	X	X		X				X
Compressed Gas Cylin.													
Concrete and Masonry													
Confined Space Entry													
Cuts/Abrasions	X	X	X	X	X	X	X		X	X	X		X
Cranes													
Demolition/dismantling													
Electrical Safety	X		X	X	X	X	X		X	X	X		X
Excavations							X		X				
Fall Protection													
Forklifts													
Hand & Power Tools	X		X	X	X		X				X		X
Haul Truck Operations	X									X	X		X
Heat Stress	X	X	X	X	X	X	X		X	X	X		X
Heavy Equipment	X		X	X			X			X	X		
Housekeeping	X	X	X	X	X	X	X		X	X	X		X
Ladders & Stairs													
Land Clearing / Stripping			X	X									
Lock-out /Tag-out													
Manual Lifting	X	X	X	X	X	X	X		X	X	X		X
Material Handling													
Machine Guarding			X	X	X								
MEC			X	X	X	X	X	X	X	X			
Noise	X		X	X						X	X		X
Overhead Utilities	X		X						X				
Pinch/Struck by/Caught	X		X	X						X	X		
Pressure Washing											X		X
Pressurized Lines/ Equip.											X		X
Rigging													
Slips/Trips/Falls	X	X	X	X	X	X	X		X	X	X		X
Spill Prevention	X		X	X						X	X		X
Suspended Loads													
Vacuum Truck Ops.													X
Vehicle Traffic	X	X	X	X	X	X	X		X	X	X		X
Visible Lighting	X	X	X	X	X	X	X		X	X	X		X
Welding or cutting													
Working over water		X							X				

ESC = erosion and sediment control

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10.4 Loss/Near-loss Investigations

Loss/near-loss investigations will be performed for all CH2M HILL and subcontractor incidents involving:

- Personal injuries/illnesses and near-miss injuries
- Equipment/property damage
- Spills, leaks, regulatory violations
- Motor vehicle accidents

The causes of loss and near-loss incidents are similar, so by identifying and correcting the causes of near-loss incidents, future loss incidents may be prevented. The following is the loss/near-loss investigation process:

- Gather all relevant facts, focusing on fact-finding, not fault-finding, while answering the who, what, when, where, and how questions.
- Draw conclusions, putting facts together into a probable scenario.
- Determine incident root cause(s), which are basic causes on why an unsafe act/ condition existed.
- Develop and implement solutions, matching all identified root causes with solutions.
- Communicate incident as a lesson learned to all project personnel.
- File follow-up on implemented corrective action to confirm solution is appropriate.

The APP/SSHP/UXOSO or SUXOS/SM will perform an incident investigation as soon as practical after incident occurrence during the day of the incident, for all loss and near-loss incidents that occur on the project. Loss and near-loss incident investigations will be performed using the following incident investigation forms provided in Attachment 7:

- Incident Report Form (IRF)
- Root Cause Investigation (Guidance Document)
- Loss/Near-Loss Investigation Report Form
- Determination of Root Cause(s) (Guidance Document)
- Root Cause Analysis Form
- Root Cause Analysis Flow Chart

All loss and near-loss incidents involving personal injury, property damage in excess of $1,000, or near-loss incidents that could have resulted in serious consequences will be investigated by completing the initial incident investigation forms and submitting them to the CH2M HILL PM and Safety and Health Manager within 24 hours of incident occurrence. A preliminary Incident Investigation and Root Cause Analysis will be submitted to the CH2M HILL PM and Safety and Health Manager within 24 hours of incident occurrence. The final Incident Investigation and Root Cause Analysis will be submitted after completing a comprehensive investigation of the incident

10.5 Drug-Free Workplace Program

CH2M HILL does not tolerate illegal drugs, or any use of drugs, controlled substances, or alcohol that impairs an employees work performance or behavior. CH2M HILL has established a policy that its employees and subcontractors will not be involved in any manner with the unlawful manufacture, distribution, dispensation, possession, sale, or use of illegal drugs in the workplace. The use or possession of alcohol in the workplace is also prohibited. Any violation of these prohibitions may result in discipline or immediate discharge.

10.6 Project-Specific Activity Hazard Analyses

Applicable project AHA documents for each major phase of work anticipated for this contract are presented below. It is the intent of these AHAs to reinforce project or program requirements and present project control measures for anticipated or encountered hazards that may occur during an employee’s assigned tasks.

Additional project-specific hazard control measures are identified in Section 9.5.

CH2M HILL – Fort Rucker
AHA 1 – Mobilization

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Mobilization (set-up of work area & construction facilities)	Adverse Weather	• Check internet, local TV weather or radio channels for daily forecasts and plan daily work activities accordingly. Have a portable radio available onsite to monitoring local weather forecasts. If onsite internet or radio monitoring are not available, for reach-back support check with office personnel, who may be able to verify pending regional severe weather conditions. • Frequently observe the skyline for rain squalls and thunderstorm systems that may be developing. • Bring clothing suitable for anticipated daily weather conditions.Shut down operations during heavy rain/lightning events or high wind conditions. For storms producing lightning, seek safe haven in a grounded structure or rubber-tired vehicle. Implement the 30–30 Rule : Take shelter when you can count 30 seconds or less between lightning and thunder. Remain sheltered for 30 minutes after the last thunder. • . Do not seek refuge under trees during electrical or high wind storm events. • Stay away from ravines and gullies during heavy rain events, because of the possibility of flash flood events. • Do not use telephones during electrical storms, except in the case of emergency.	Standard Level D PPE (see Table 9-2)
	Biological	• Observe ground surfaces, enclosed structures, surrounding vegetation, and other site features for presence of poisonous insects. • Where exposure to poisonous plants that have oils, berries or needle-like projections could cause skin irritations, infections, or allergic reactions, use disposable coveralls for protection. • Observe areas for presence of stinging insects. Prior to starting field activities, notify SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of known allergies to stinging insects and location of antidotes. • Do not approach fresh or brackish water bodies that could contain alligators. • Use insect repellent with DEET or other insect repellent to deter being bit by mosquitoes or other stinging/biting insects. • Tape pant legs to boots and ensure there are no open seams between boots and pant legs. • Avoid exposure to blood borne pathogens. Use universal precautions against exposure.	Standard Level D PPE (see Table 9-2)
	Cuts/Abrasions	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp/cut edges or hand tools. • Avoid use of razor knives. When cutting with knives, cut away from the body and never towards another worker.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 1 – Mobilization

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Mobilization (set-up of work area & construction facilities) (cont.)	Fire Prevention	• Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Keep appropriately sized, easily accessible ABC fire extinguishers in work area. • Fire extinguishers must be inspected monthly (inspection tag) and have an annual maintenance/inspection certification (tag) attached to the extinguisher. • Fire extinguishers will be approved by a nationally recognized testing laboratory and labeled to identify the listing and labeling organization and the fire test and performance standard that the fire extinguisher meets or exceeds. • Secure any applicable client facility/Local Fire Department Hot Work permit as necessary. • Only smoke in designated areas. Designated area must be free of combustible/flammable materials. • ASTs for heavy equipment fuel storage should have secondary containment capabilities.	Standard Level D PPE
	Electric Safety	• Ensure that electric connections to temporary site facilities are performed by qualified/licensed electricians. • Verify electric power sources have been have undergone lock-out/tag-out process before being worked on. • Use double insulated or properly grounded electric power-operated hand tools • Inspect all extension cords daily for structural integrity, ground continuity, and damaged insulation • Keep all plugs and receptacles out of water/liquids. • Inspect all electrical power circuits prior to commencing work. • If/when electrical extension cords are required to complete work, extension cords must be: - Equipped with third-wire grounding. - Covered, elevated, or protected from damage when passing through work areas. - Protected from pinching if routed through doorways. - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools must have GFCIs installed. - Rated to handle the voltage/amperage of equipment.	Standard Level D PPE
	Hand & Power Tools	• Perform daily or more frequent inspections on power tools, as may be needed • Power tools will only be operated by personnel qualified by prior training or experience. • Ensure that a stable, level, dry work surface is available for the operation of power tools. • All required guards are in place, functioning and utilized. • Hand-held power tools equipped with constant pressure switch. Tools inspected before use. Maintain all tools in a safe condition. • Select and use the proper tool for the task. • Do not use tools that have been damaged or repaired in a manner which is not consistent with manufacturer's requirements.	Standard Level D PPE

CH2M HILL – Fort Rucker
AHA 1 – Mobilization

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Mobilization (set-up of work area & construction facilities) (cont.)	Haul Trucks	• Haul truck operators should ensure all persons are clear before operating trucks or equipment. Before moving, operators should sound horn/back-up alarm. All equipment should be equipped with an operational back-up alarm. • Vehicles or equipment with restricted visibility should be equipped with devices that eliminate blind spots or a spotter must be provided. • Employees should stay off access roads. When approaching a haul area, employees should make eye contact and communicate their intentions directly with the equipment operator. • All vehicles must follow the designated access road established for the site.	Standard Level D PPE (see Table 9-2)
	High Ambient Temperature	• Provide and drink fluids to prevent worker dehydration. • Minimize intake of caffeinated fluids. ▪ Institute a proper work-break regimen in a cool area to avoid heat stress symptoms and overexertion. ▪ Monitor for signs and symptoms of heat stress (maintain use of buddy system) when the ambient air temperature exceeds 70˚F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress and especially when wearing disposable or other types of coveralls. 1) Heat Syncope = Sluggishness or fainting while standing erect or immobile in heat. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.* 2) Heat Rash = Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure. *Treatment = Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.* 3) Heat Cramps = Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake.* 4) Heat exhaustion = Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low. *Treatment = Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.* 5) Heat Stroke = Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature. *Treatment = Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!*	Standard Level D PPE (see Table 9-2)
Mobilization (set-up of work area & construction facilities) (cont.)	Heavy Equipment	• Seat belts or other restraint system will be used by heavy equipment operators. • Perform daily maintenance and inspections on operating equipment. Keep documentation onsite. • Use caution around pressurized lines/hoses. Inspect hoses daily for cuts, abrasions and wear. • Equipment will only be operated by personnel qualified by prior training or experience. • Ensure that a stable ground surface is available for the operation of heavy equipment. • Equipment operators will not leave the cab of the equipment while they are lifting/controlling a load unless the load has been delivered to its intended transport location or the load has been fully secured (no potential for rolling onto or crushing ground personnel) and the equipment and controls are fully secured/disengaged and equipment is "de-energized."	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 1 – Mobilization

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Manual Lifting	• **CH2M HILL** and subcontract personnel must notify the SUXOS/SM, SSHO/UXOSO, and/or CH2M HILL PM of pre-existing medical conditions that may be aggravated or re-injured by lifting activities, especially lifting operation involving repetitive motions. • When lifting objects, lift using knees, not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. Use heavy equipment to transfer heavy or awkward loads wherever possible. Have someone assist with the lift— especially for heavy (> 40 lbs.) or awkward loads. Do not attempt to manually lift objects that should be lifted with heavy equipment. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. Avoid carrying heavy objects above shoulder level.	Standard Level D PPE (see Table 9-2)
	Noise	• Personnel exposed to loud working environments must wear hearing protection.	Standard Level D PPE (see Table 9-2)
	Overhead Utilities	• Maintain proper separation between power transmission lines and overhead utilities during the operation of heavy equipment. See Electrical Safety (Section 9.5.16) for references to proper separation between operating equipment and power transmission lines/overhead utilities. • Do not operate or swing heavy equipment booms or other components of operating heavy equipment toward overhead utilities. Be cognizant of utility pole guy wire positions.	Standard Level D PPE (see Table 9-2)
	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes, curbs, utility structures etc). Use sturdy hard-toed work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. Clean work areas as activities proceed. Clear-remove materials and debris from pathways and commonly traveled areas as soon as possible. • Three points of contact when entering/exiting equipment or when using stairways/ladders.	Standard Level D PPE (see Table 9-2)
Mobilization (set-up of work area & construction facilities) (cont.)	Pinched/Struck-by/ Caught-in-between	• Sufficient separation between ground support personnel and any operating heavy equipment must be maintained. • Wear reflective vests or high visibility clothing to promote visibility of ground personnel by equipment operators. • Isolate equipment swing areas from workers, fixed objects or other equipment. Ground personnel will avoid positioning themselves between fixed objects and operating equipment. Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. Stay out of the swing radius of operating heavy equipment. • Understand and review hand signals. Designate one person to provide hand signals to equipment operators performing lifting/hoisting operations. • Ensure equipment has operable back-up alarms. Ensure heavy equipment operator has spotter for obstructed views and backing up. • Step away from heavy equipment when adjustments (positioning) are made.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 1 – Mobilization

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Spill Prevention	• Ensure that spill control and spill clean-up and materials are on hand prior to initiating any heavy equipment or fueling operations to prevent entry into a watershed. • **Understand notification processes in the event a spill occurs. If a spill should occur, implement the following:** – Ensure all unnecessary persons are removed from the hazard area. Determine the major components in the waste at the time of the spill. – Put on protective clothing and equipment (see Table 9-2). – Only properly trained personnel should respond to/mitigate a spill or release. – If a flammable/combustible material is involved, remove all ignition sources, and use spark- and explosion-proof equipment for recovery of material. – Remove all surrounding materials that could be especially reactive with materials in the waste. – If wastes reach a storm or sewer drain, dam the outfall by using sand, earth, sandbags, etc. Pump this material out into a temporary holding tank or drums as soon as possible. – Place all small quantities of recovered liquid wastes (55 gallons or less) and impacted soil into drums for incineration or removal to an approved disposal site. – Apply appropriate spill control media (e.g. clay, sand, lime, etc.) to absorb discharged liquids. – For large spills, establish diking around leading edge of spill using booms, sand, clay or other appropriate material. If possible, use diaphragm pump to transfer discharged liquid to drums or holding tank.	Standard Level D PPE (see Table 9-2)
	Visible Lighting	• Perform tasks in daylight hours Work outside the EZ may be performed during hours of limited visibility.	Standard Level D PPE
Mobilization (set-up of work area & construction facilities) (cont.)	Vehicular Traffic	• Shut off and secure site vehicles prior to exiting them. Park on level ground where possible. If parking on an incline, engage parking brake. If the vehicle has a manual transmission, ensure the transmission is in gear (not neutral) and the parking brake is engaged before exiting the vehicle. • Exercise caution when exiting access road or parking along street— avoid sudden stops, use flashers, etc. • Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier. • All staff working adjacent to access road or within work area must wear reflective/high-visibility safety vests.	Standard Level D PPE
	Overhead Utilities	• Maintain proper separation between power transmission lines and overhead utilities during the operation of heavy equipment. See Electrical Safety (Section 9.5.16) for references to proper separation between operating equipment and power transmission lines/overhead utilities. • Do not operate or swing heavy equipment booms or other components of operating heavy equipment toward overhead utilities. Be cognizant of utility pole guy wire positions.	Standard Level D PPE

CH2M HILL – Fort Rucker
AHA 1 – Mobilization

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Other	• **Verify that EMS services are available and can respond in a prompt manner prior to the start of work.** • Always use a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never use a cell phone or two way radio while driving on military/government facilities due to the distraction these devices pose. • Buddy system maintained for all phases of work. • Base or Local Emergency Medical Service and Fire Dispatch numbers programmed into cellular phones. Have hospital route map readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately.	Standard Level D PPE

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • First Aid/BbPK/CPR shield • Extension cords • Spill Kit • Haul trucks (delivered heavy equipment or materials) • Heavy Equipment (earth moving)	• Visual Inspections of designated work areas to identify and address hazardous conditions. • Equipment inspections and maintenance. • Emergency Response Equipment Inspections (Fire Extinguishers, Eye Wash, First Aid/CPR etc.) • Inspections of hand tools (power) and extension cords if used.	• Review AHA with all task personnel • Review Site Specific Safety and Health Plan for new site personnel. • First Aid/CPR • Supervisors - BBLPS, SSHO/UXOSO or equivalent • Power tool and heavy equipment operators qualified by previous training or experience. • Supervisors – 10 hr Construction Safety Training or equivalent

	PRINT	SIGNATURE	
Supervisor Name:	________________	____________________	**Date/Time:**__________
Safety Officer Name:	________________	____________________	**Date/Time:**__________
Site Personnel:	________________	____________________	**Date/Time:**__________
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CH2M HILL – Fort Rucker
AHA 2 – Site Preparation

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Site Preparation (including Instrument Verification Strip installation)	Buried Utilities or Unknown Objects	• Contact **Fort Rucker One Call** to secure a utility owner verification request number at **(800) 432-4770** for utility clearance verification. Keep copies of any written documentation (faxes, email printouts) regarding utility location verification provided by utility owners in the office project file and in a working field file onsite. • Photo-document owner provided field utility mark-outs as related to proposed limits of ground disturbing activities prior to the start of work. • Conduct "third party" utility clearance when the locations of utilities may be in question and document results of third party utility location. • Determine if client Excavation Permit is required prior to performing any ground disturbing activities. • Hand dig around identified utilities (within 5 ft) or as otherwise required by client Excavation Permit. • Review base engineering records or drawings against utility owner or third party utility mark-out to verify any potential differences. • Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, utilities must be relocated/marked. • Where unknown or unanticipated buried objects are encountered (i.e. drums, tanks, cylinders, MEC, soil with unusual staining or odor) CH2M HILL or subcontractor personnel will 1) secure equipment to the extent possible, without causing bodily injury, 2) evacuate the work area and 3) immediately notify the SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of the encountered condition. Work may resume only with appropriate documentation/notification that exposure hazards (physical or chemical) do not exist and approval to resume work by the CH2M HILL PM.	Standard Level D PPE (see Table 9-2)
	Biological	• Observe ground surfaces, enclosed structures, surrounding vegetation, and other site features for presence of poisonous insects. • Where venomous snakes are known to inhabit or may be present, the use of snake guards must be evaluated. • Do not approach fresh or brackish water bodies that could contain alligators. • Where exposure to poisonous plants that have oils, berries or needle-like projections could cause skin irritations, infections or allergic reactions, use disposable coveralls for protection. • Observe areas for presence of stinging insects. Prior to starting field activities, notify SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of known allergies to stinging insects and location of antidotes. • Use insect repellent with DEET or other insect repellent to deter being bit by mosquitoes or other stinging/biting insects. • Tape pant legs to boots and ensure there are no open seams between boots and pant legs. • Avoid exposure to blood borne pathogens. Use universal precautions against exposure.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 2 – Site Preparation

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Site Preparation (including IVS installation) (cont.)	Adverse Weather	• Check internet, local TV weather or radio channels for daily forecasts and plan daily work activities accordingly. Have a portable radio available onsite to monitoring local weather forecasts. If onsite internet or radio monitoring are not available, for reach-back support check with office staff, who may be able to verify pending regional severe weather conditions. • Frequently observe the skyline for rain squalls and thunderstorm systems that may be developing. • Bring clothing suitable for anticipated daily weather conditions. • Shut down operations during heavy rain/lightning events or high wind conditions. For storms producing lightning, seek safe haven in a grounded structure or rubber-tired vehicle. Implement the 30–30 Rule : Take shelter when you can count 30 seconds or less between lightning and thunder. Remain sheltered for 30 minutes after the last thunder. • • Do not seek refuge under trees during electrical or high wind storm events. • Stay away from ravines and gullies during heavy rain events, because of the possibility of flash flood events. • Do not use telephones during electrical storms, except in the case of emergency.	
	Chainsaws/Wood Chipper Use	• In the event chainsaws and wood chippers must be used to perform vegetation clearing activities, a separate AHA for this task is required.	Develop an AHA for Land Clearing via Chainsaw/ Wood Chipper Use
	Chemical Exposure	• Where installation of ESC measures must disturb surface or subsurface soil impacted by site COCs, an upgrade to Modified Level D PPE will be required in accordance with the APP/SSHP and work will be performed by personnel having appropriate training and enrolled in a medical surveillance program in accordance with 29CFR1910.120. Supervisors also need training in accordance with 29CFR1910.120(e)(4).	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 2 – Site Preparation

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Site Preparation (including IVS installation) (cont.)	Cuts/Abrasions	• Wear cut resistant work gloves, when the possibility of lacerations or other injury may be caused by sharp edges of power or hand tools. • Machetes will be in a leather sheath when carrying and not in use, especially when walking from location to location, except when using the machete for its intended purpose. • Before swinging the machete, check the surrounding area to ensure that other personnel, overhanging brush, limbs, trees, and other obstructions are clear of the swing path. • Cut away from your body, not toward your body or another person. • If you drop your machete, let it fall – don't attempt to catch it. • Do not run with a machete. Do not throw a machete to anyone – hand it to them, handle first, after they have donned appropriate hand protection. • Do not point a machete at yourself or another person. • Avoid sharpening the machete on a power grinder – use a sharpening stone. • Do not use a machete for any other purpose other than cutting brush. • Make sure the handle is clean and free of cracks or splits and the blade is securely fastened to the handle. • The minimum PPE selection for vegetation clearing operations performed with a brush cutter will be as follows. – Long trousers, chainsaw chaps, and appropriate footwear (ANSI rated). – ANSI Z87 approved eyewear with a face shield. – A hardhat with the visor facing forward. – Leather work gloves. – Long-sleeved shirt. – Ear muffs • Verify that the owner's manual is available to personnel using equipment. • Do not distract or disturb someone who is operating a brush cutter or using a machete. Before approaching someone using a brush cutter or machete first establish eye contact with the operator and signal (via hand) that they would like to approach the active work area. Both the brush cutter operator and ground personnel must that it is appropriate to other personnel to access the work area. • Use two hands when operating the brush cutter.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 2 – Site Preparation

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Site Preparation (including IVS installation) (cont.)	Fire Prevention	• Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Appropriately sized, easily accessible ABC fire extinguisher in work area. • Fire extinguishers must be inspected monthly (inspection tag) and have an annual maintenance/inspection certification (tag) attached to the extinguisher. • Fire extinguishers must be approved by a nationally recognized testing laboratory and labeled to identify the listing and labeling organization and the fire test and performance standard that the fire extinguisher meets or exceeds. • Secure any applicable client facility/Local Fire Department Hot Work permit as necessary. • Only smoke in designated areas. Designated area must be free of combustible/flammable materials. • ASTs for heavy equipment fuel storage should have secondary containment capabilities.	Standard Level D PPE (see Table 9-2)
	Hand & Power Tools	• Perform daily or more frequent inspections on power tools, as may be needed • Power tools will only be operated by personnel qualified by prior training or experience. • Ensure that a stable, level, dry work surface is available for the operation of power tools. • All required guards are in place, functioning and utilized. • Hand-held power tools equipped with constant pressure switch. Tools inspected before use. Maintain all tools in a safe condition. • Select and use the proper tool for the task. • Do not use tools that have been damaged or repaired in a manner which is not consistent with manufacturer's requirements.	Standard Level D PPE
	Heavy Equipment	• Seat belts or other restraint system will be used by heavy equipment operators. • Perform daily maintenance and inspections on operating equipment. Keep documentation onsite. • Use caution around pressurized lines/hoses. Inspect hoses daily for cuts, abrasions and wear. • Equipment will only be operated by personnel qualified by prior training or experience. • Ensure that a stable ground surface is available for the operation of heavy equipment. • Equipment operators will not leave the cab of the equipment while they are lifting/controlling a load unless the load has been delivered to its intended transport location or the load has been fully secured (no potential for rolling onto or crushing ground personnel) and the equipment and controls are fully secured/disengaged and equipment is "de-energized."	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 2 – Site Preparation

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Site Preparation (including IVS installation) (cont.)	High Ambient Temperature	• Provide and drink fluids to prevent worker dehydration. • Minimize intake of caffeinated fluids. ▪ Institute a proper work-break regimen in a cool area to avoid heat stress symptoms and overexertion. ▪ Monitor for signs and symptoms of heat stress (maintain use of buddy system) when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress and especially when wearing disposable or other types of coveralls. 1) Heat Syncope = Sluggishness or fainting while standing erect or immobile in heat. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.* 2) Heat Rash = Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure. *Treatment = Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.* 3) Heat Cramps = Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake.* 4) Heat exhaustion = Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low. *Treatment = Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.* 5) Heat Stroke = Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature. *Treatment = Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!*	Standard Level D PPE (light colored clothing)
	Overhead Utilities	• When using an excavator to install ESC measures, maintain proper separation between power transmission lines and overhead utilities during the operation of heavy equipment. See Electrical Safety (Section 9.5.16) for references to proper separation between operating equipment and power transmission lines/overhead utilities. Do not operate or swing heavy equipment booms or other components of operating heavy equipment toward overhead utilities. Be cognizant of utility pole guy wire positions.	Standard Level D PPE (see Table 9-2)
Site Preparation (including IVS installation) (cont.)	Manual Lifting	• CH2M HILL and subcontract personnel must notify the SUXOS/SM, SSHO/UXOSO, and/or CH2M HILL PM of pre-existing medical conditions that may be aggravated or re-injured by lifting activities, especially lifting operation involving repetitive motions. • When lifting objects, lift using knees, not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. Use heavy equipment to transfer heavy or awkward loads wherever possible. Have someone assist with the lift— especially for heavy (> 40 lbs.) or awkward loads. Do not attempt to manually lift objects that should be lifted with heavy equipment. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 2 – Site Preparation

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Noise	• Personnel exposed to loud working environments must wear hearing protection.	Standard Level D PPE (see Table 9-2)
	Pinched/Struck-by/ Caught-in-between	• Sufficient separation between ground support personnel and any operating heavy equipment must be maintained. • Wear reflective vests or high visibility clothing to promote visibility of ground personnel by equipment operators. • Isolate equipment swing areas from workers, fixed objects or other equipment. Ground personnel will avoid positioning themselves between fixed objects and operating equipment. Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. Stay out of the swing radius of operating heavy equipment. • Understand and review hand signals. Designate one person to provide hand signals to equipment operators performing lifting/hoisting operations. • Ensure equipment has operable back-up alarms. • Step away from heavy equipment when adjustments (positioning) are made. • Ensure heavy equipment operator has spotter for obstructed views and backing up. • If using trenching equipment, keep hands, feet and arms away from activated drive chains or belts of trenching equipment. Stop trenching operations if personnel approach active trenching equipment. • Ensure that all machine guards are in place to prevent contact with drive belts rotary action devices/blades of trenching machine etc. Do not modify safety features of the trenching machine.	Standard Level D PPE (see Table 9-2)
Site Preparation (including IVS installation) (cont.)	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes, curbs, utility structures etc). Use sturdy hard-toed work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. Clean work areas as activities proceed. Clear-remove materials and debris from pathways and commonly traveled areas as soon as possible. • Three points of contact when entering/exiting equipment or when using stairways/ladders.	Standard Level D PPE (see Table 9-2)
	Vehicular Traffic	• Shut off and secure site vehicles prior to exiting them. Park on level ground where possible. If parking on an incline, engage parking brake. If the vehicle has a manual transmission, ensure the transmission is in gear (not neutral) and the parking brake is engaged before exiting the vehicle. • Exercise caution when exiting access road or parking along street— avoid sudden stops, use flashers, etc. • Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier. • All staff working adjacent to access road or within work area must wear reflective/high-visibility safety vests.	Standard Level D PPE
	Visible Lighting	• Perform tasks in daylight hours whenever possible. If dawn, dusk or dark work is to be performed, portable light must be provided to sufficiently illuminate work area(s).	Standard Level D PPE

CH2M HILL – Fort Rucker
AHA 2 – Site Preparation

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Other	• **Verify that EMS services are available and can respond in a prompt manner prior to the start of work.** • Always use a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never use a phone or two way radio while driving due to the distraction these devices pose. • Buddy system maintained for all phases of work. • Base or Local Emergency Medical Service and Fire Dispatch numbers programmed into cellular phones. Have hospital route map readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately.	Standard Level D PPE

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • First Aid/BbPK/CPR shield, Spill Kit • Track excavator or chain drive trencher • Brush cutter/Hydraulic mower • Communication devices	• Visual Inspections of designated work areas to identify and address hazardous conditions. • Equipment inspections and maintenance. • Emergency Response Equipment Inspections (Fire Extinguishers, Eye Wash, First Aid/CPR etc.) • Inspections of hand tools (power) and extension cords if used.	• Review AHA with all task personnel • Review Site Specific Safety and Health Plan for new site personnel. • First Aid/CPR • Supervisors – 10 hr Construction Safety Training or equivalent • Power tool and heavy equipment operators qualified by previous training or experience.

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Safety Officer Name:	____________________	_________________________	**Date/Time:**____________
Site Personnel:	____________________	_________________________	**Date/Time:**____________
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CH2M HILL – Fort Rucker
AHA 3 –Site Survey with MEC Avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Land and Utility Surveys	Adverse Weather	• Check internet, local TV weather or radio channels for daily forecasts and plan daily work activities accordingly. Have a portable radio available onsite to monitoring local weather forecasts. If onsite internet or radio monitoring are not available, for reach-back support check with office staff, who may be able to verify pending regional severe weather conditions. • Frequently observe the skyline for rain squalls and thunderstorm systems that may be developing. • Bring clothing suitable for anticipated daily weather conditions. • Shut down operations during heavy rain/lightning events or high wind conditions. For storms producing lightning, seek safe haven in a grounded structure or rubber-tired vehicle. No work will be performed within the EZ when lightning is reported within 5 miles of the project site. Do not seek refuge under trees during electrical or high wind storm events. • Stay away from ravines and gullies during heavy rain events, because of the possibility of flash flood events. • Do not use telephones during electrical storms, except in the case of emergency.	Standard Level D PPE (see Table 9-2)
	Biological	• Observe ground surfaces, enclosed structures, surrounding vegetation, and other site features for presence of poisonous insects. • Where venomous snakes are known to inhabit or may be present, the use of snake guards must be evaluated • Do not approach fresh or brackish water bodies that could contain alligators. • Where exposure to poisonous plants that have oils, berries or needle-like projections could cause skin irritations, infections or allergic reactions use disposable coveralls for protection. • Observe areas for presence of stinging insects. Prior to starting field activities, notify SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of known allergies to stinging insects and location of antidotes. • Use insect repellent with DEET or other insect repellent to deter being bit by mosquitoes or other stinging/biting insects. • Tape pant legs to boots and ensure there are no open seams between boots and pant legs. • Avoid exposure to blood borne pathogens. Use universal precautions against exposure.	Standard Level D PPE (see Table 9-2)
	Fire Prevention	• Only smoke in designated areas. Designated area must be free of combustible/flammable materials.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 3 –Site Survey with MEC Avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Land and Utility Surveys (cont.)	High Ambient Temperature	• Provide and drink fluids to prevent worker dehydration. • Minimize intake of caffeinated fluids. ▪ Institute a proper work-break regimen in a cool area to avoid heat stress symptoms and overexertion. ▪ Monitor for signs and symptoms of heat stress (maintain use of buddy system) when the ambient air temperature exceeds 70˚F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress and especially when wearing disposable or other types of coveralls. 1) Heat Syncope = Sluggishness or fainting while standing erect or immobile in heat. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.* 2) Heat Rash = Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure. *Treatment = Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.* 3) Heat Cramps = Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake.* 4) Heat exhaustion = Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low. *Treatment = Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.* 5) Heat Stroke = Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature. *Treatment = Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!*	Standard Level D PPE (light colored clothing)
Land and Utility Surveys (cont.)	Manual Lifting	• CH2M HILL and subcontract personnel must notify the SUXOS/SM, SSHO/UXOSO, and/or CH2M HILL PM of pre-existing medical conditions that may be aggravated or re-injured by lifting activities, especially lifting operation involving repetitive motions. • When lifting objects, lift using knees, not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. Use heavy equipment to transfer heavy or awkward loads wherever possible. Have someone assist with the lift— especially for heavy (> 40 lbs.) or awkward loads. Do not attempt to manually lift objects that should be lifted with heavy equipment. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 3 –Site Survey with MEC Avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes, curbs, utility structures etc). Use sturdy hard-toed work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. Clean work areas as activities proceed. Clear-remove materials and debris from pathways and commonly traveled areas as soon as possible. • Three points of contact when entering/exiting equipment or when using stairways/ladders.	Standard Level D PPE (see Table 9-2)
	Visible Lighting	• Perform tasks in daylight hours..	Standard Level D PPE
	Vehicular Traffic	• Shut off and secure site vehicles prior to exiting them. Park on level ground where possible. If parking on an incline, engage parking brake. If the vehicle has a manual transmission, ensure the transmission is in gear (not neutral) and the parking brake is engaged before exiting the vehicle. • Exercise caution when exiting access road or parking along street— avoid sudden stops, use flashers, etc. • Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier. • All staff working adjacent to access road or within work area must wear reflective/high-visibility safety vests.	Standard Level D PPE
Land and Utility Surveys (cont.)	MEC Hazards (Areas of Concern [AOCs] F and G)	• Conduct MEC identification/familiarization training at project start-up and throughout project. • All non-MEC qualified persons should be under the supervision of a UXO technician per DDESB-TP-18 • Use Schonstedt Magnetic Locator to locate and avoid anomalies. • Limit the exposure to the minimum number of personnel, minimum amount of time. Only essential personnel within the EZ. • Contact with MEC/MPPEH is not authorized • Awareness (3R) Training for non-UXO qualified personnel • All work to be conducted IAW approved ESP and WP (includes safety & quality plans). • Daily safety briefing to cover anticipated hazards.	

CH2M HILL – Fort Rucker
AHA 3 –Site Survey with MEC Avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Other	• Verify that EMS services are available and can respond in a prompt manner prior to the start of work. • Personnel using survey equipment containing lasers will be trained to utilize that equipment properly. Personnel operating laser equipped survey equipment must avoid exposing their eyes to direct or indirect laser light energy sources. • Always use a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never use a phone or two way radio while driving Due to the distraction these devices pose. • Buddy system maintained for all phases of work. • Base or Local Emergency Medical Service and Fire Dispatch numbers programmed into cellular phones. Have hospital route map readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately.	Standard Level D PPE

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Eye wash (small portable type) • Miscellaneous power and manual hand tools. • First Aid/BbPK/CPR shield • Communication devices • Land Survey or electromagnetic (EM)/ ground-penetrating radar (GPR) utility locating equipment, as applicable to task	• Visual Inspections of designated work areas to identify and address hazardous conditions. • Emergency Response Equipment Inspections (Fire Extinguishers, Eye Wash, First Aid/CPR etc.) •	• Review AHA with all task personnel • Review Site Specific Safety and Health Plan for new site personnel. • First Aid/CPR • Supervisors – 10 hr Construction Safety Training or equivalent

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CH2M HILL – Fort Rucker
AHA 4 – Vegetation Removal with MEC Avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Vegetation Clearance	Adverse Weather	• Check internet, local TV weather or radio channels for daily forecasts and plan daily work activities accordingly. Have a portable radio available onsite to monitoring local weather forecasts. If onsite internet or radio monitoring are not available, for reach-back support check with office staff, who may be able to assist with checking internet sources and identifying any severe weather developments that may be projected in the region. • Frequently observe the skyline for rain squalls and thunderstorm systems that may be developing. • Bring clothing suitable for anticipated daily weather conditions. • Shut down operations during heavy rain/lightning events or high wind conditions. For storms producing lightning, seek safe haven in a grounded structure or rubber-tired vehicle. No work will be performed within the EZ if lightning is reported within 5 miles of project site. Do not seek refuge under trees during electrical or high wind storm events. • Stay away from ravines and gullies during heavy rain events, because of the possibility of flash flood events. • Do not use telephones during electrical storms, except in the case of emergency.	Standard Level D or Modified Level D PPE (see Table 9-2)
	Cuts and Abrasions	• Use leather gloves when cutting or rolling up fence fabric. • During fence pulling operations, personnel will not position themselves between the pulling device and the fence fabric being pulled taught.	Standard Level D or Modified Level D PPE (see Table 9-2)
Vegetation Clearance (Cont.)	Biological	• Observe ground surfaces, enclosed structures, surrounding vegetation, and other site features for presence of poisonous insects. • Where exposure to poisonous plants that have oils, berries or needle-like projections could cause skin irritations, infections or allergic reactions use dedicated or disposable coveralls for protection. • Observe areas for presence of stinging insects. Prior to starting field activities, notify SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of known allergies to stinging insects and location of antidotes. • Use insect repellent with DEET or other insect repellent to deter being bit by mosquitoes or other stinging/biting insects. • Tape pant legs to boots and ensure there are no open seams between boots and pant legs. • Where venomous snakes may be present, use snake guards for ground work. • Avoid exposure to blood borne pathogens. Use universal precautions against exposure.	Standard Level D or Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 4 – Vegetation Removal with MEC Avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Chemical Exposure	• Where activities result in ground disturbance and exposure to contaminated materials may occur, then all personnel performing this task will be trained in accordance with 29CFR1910.120 and have been enrolled in a medical monitoring program. • Always exercise good hygiene practices regardless of the potential for contact with site contaminants. Always wash hands before eating, drinking, smoking and leaving site. Only eat, drink, smoke or chew tobacco in designated areas. • Do not allow incidental dermal contact or incidental ingestion of sediment or contaminated water during this activity. Where contact with these materials cannot be avoided or controlled Modified Level D PPE will be used. • Do not breathe cement dust or come in contact with mixed concrete. Liquid resistant gloves will be used when placing wet concrete to avoid chemical burns.	Standard Level D or Modified Level D PPE (see Table 9-2)
Vegetation Clearance (cont.)	Buried Utilities or Unknown Objects	• Contact Fort Rucker Department of Public Works for utility clearance verification. Keep copies of any written documentation (faxes, email printouts) regarding utility location verification provided by utility owners in the office project file and in a working field file onsite. • Photo-document owner provided field utility mark-outs as related to proposed limits of ground disturbing activities prior to the start of work. • Conduct "third party" utility clearance when the locations of utilities may be in question and document results of third party utility location. • Determine if a client Excavation Permit is required prior to performing any ground disturbing activities. • Hand dig around identified utilities (within 5 ft) or as otherwise required by client-issued Excavation Permit. • Review base engineering records or drawings against utility owner or third party utility mark-out to verify any potential differences. • Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, utilities must be relocated/marked. • Where unknown or unanticipated buried objects are encountered (i.e. drums, tanks, cylinders, MEC, soil with unusual staining or odor) CH2M HILL or subcontractor personnel will 1) secure equipment to the extent possible, without causing bodily injury, 2) evacuate the work area, and 3) immediately notify the SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of the encountered condition. Work may resume only with appropriate documentation/notification that exposure hazards (physical or chemical) do not exist and approval to resume work by the CH2M HILL PM.	Standard Level D or Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 4 – Vegetation Removal with MEC Avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Vegetation Clearance (cont.)	Fire Prevention	• Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Appropriately sized, easily accessible ABC fire extinguisher in work area. • Fire extinguishers must be inspected monthly (inspection tag) and have an annual maintenance/inspection certification (tag) attached to the extinguisher. • Fire extinguishers will be approved by a nationally recognized testing laboratory and labeled to identify the listing and labeling organization and the fire test and performance standard that the fire extinguisher meets or exceeds. • Only smoke in designated areas. Designated area must be free of combustible/flammable materials.	Standard Level D or Modified Level D PPE (see Table 9-2)
	Hand and Power Tools	• Wear eye, face, hand & hearing protection when operating power equipment • Shut-off / idle power tools walking between work areas • Store flammable liquids in well ventilated areas, away from work areas • Shut off equipment during re-fueling • Prohibit smoking while operating equipment • Provide ABC (or equivalent) fire extinguishers for all work	Standard Level D or Modified Level D PPE (see Table 9-2)
	MEC Hazards (AOCs F and G)	• Conduct MEC identification/familiarization training at project start-up and throughout project. • All non-MEC qualified persons should be under the supervision of a UXO technician per DDESB-TP-18 • Use Schonstedt Magnetic Locator to locate and avoid anomalies. • Limit the exposure to the minimum number of personnel, minimum amount of time. Only essential personnel within the EZ. • Contact with MEC/MPPEH is not authorized • Awareness (3R) Training for non-UXO qualified personnel • All work to be conducted IAW approved ESP and WP (includes safety & quality plans). • Daily safety briefing to cover anticipated hazards.	Standard Level D or Modified Level D PPE (see Table 9-2)
	Slips/Trips/Falls	• Clear walkways, work areas of equipment and tools • Mark, identify, or barricade other obstructions	Standard Level D or Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 4 – Vegetation Removal with MEC Avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Vegetation Clearance (cont.)	High Ambient Temperature	• Provide and drink fluids to prevent worker dehydration. • Minimize intake of caffeinated fluids. ▪ Institute a proper work-break regimen in a cool area to avoid heat stress symptoms and overexertion. ▪ Monitor for signs and symptoms of heat stress (maintain use of buddy system) when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress and especially when wearing disposable or other types of coveralls. 1) Heat Syncope = Sluggishness or fainting while standing erect or immobile in heat. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.* 2) Heat Rash = Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure. *Treatment = Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.* 3) Heat Cramps = Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake.* 4) Heat exhaustion = Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low. *Treatment = Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.* 5) Heat Stroke = Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature. *Treatment = Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!*	Standard Level D or Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 4 – Vegetation Removal with MEC Avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Vegetation Clearance (cont.)	Material Handling	• Only one person will signal the equipment operator during material handling operations. This person will be able to communicate with the operator(s) with the appropriate hand signals. • No one will walk under or in front of suspended loads. Loads will not be lifted over ground personnel. • Any rigging used will be inspected prior to use and will be load rated (tagged or labeled). User will familiarize themselves with design load rate capacities (i.e. vertical, basket/cradle or choker applications) for the selected rigging. • Equipment operators will not leave the cab of the equipment while they are lifting a load unless the load has been delivered to its intended transport location or the load has been fully secured (no potential for rolling onto or crushing ground personnel) and the equipment and controls are fully secured.	Standard Level D or Modified Level D PPE (see Table 9-2)
	Manual Lifting	• Use heavy equipment to lift • CH2M HILL and subcontract personnel must notify the SUXOS/SM, SSHO/UXOSO, and/or CH2M HILL PM of pre-existing medical conditions that may be aggravated or re-injured by lifting activities, especially lifting operation involving repetitive motions. • When lifting objects, lift using knees, not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. Use heavy equipment to transfer heavy or awkward loads wherever possible. Have someone assist with the lift— especially for heavy (> 40 lbs.) or awkward loads. Do not attempt to manually lift objects that should be lifted with heavy equipment. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level.	Standard Level D or Modified Level D PPE (see Table 9-2)
	Overhead Utilities	• When using heavy equipment, maintain proper separation between power transmission lines and overhead utilities. • Do not operate or swing heavy equipment booms or other components of operating heavy equipment toward overhead utilities. • Be cognizant of utility pole guy wire positions.	Standard Level D or Modified Level D PPE (see Table 9-2)
Vegetation Clearance (cont.)	Noise	• Personnel will wear hearing protection for concrete pad demolition operations or for other loud working environments.	Standard Level D or Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 4 – Vegetation Removal with MEC Avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Pinched/Struck-by/ Caught-in-between	• Sufficient separation between ground support personnel and any operating heavy equipment/ must be maintained. • Wear reflective vests or high visibility clothing to promote visibility of ground personnel by equipment operators. • Isolate equipment swing areas from workers, fixed objects or other equipment. Ground personnel will avoid positioning themselves between fixed objects and operating equipment. Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. Stay out of the swing radius of operating heavy equipment. • During the removal of fence fabric, personnel must position themselves in a way which will eliminate the potential for being struck by fencing being dropped to the ground surface. • Understand and review hand signals. Designate one person to provide hand signals to equipment operators performing lifting/hoisting operations. • Ensure equipment has operable back-up alarms. • Step away from heavy equipment when adjustments (positioning) are made. • Ensure heavy equipment operator has spotter for obstructed views and backing up. • Use a manual winch, with sufficiently rated cable, to stretch fence fabric taught during the reinstallation of fence fabric. Stretching of the fabric should only be done in conjunction with a pull post.	Standard Level D PPE or (see Table 9-2)
	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes, curbs, utility structures etc). Use sturdy hard-toed work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. Clean work areas as activities proceed. Clear-remove materials and debris from pathways and commonly traveled areas as soon as possible. • Three points of contact when entering/exiting equipment.	Standard Level D or Modified Level D PPE (see Table 9-2)
Vegetation Clearance (cont.)	Visible Lighting	• Perform tasks in daylight hours.	Standard Level D or Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 4 – Vegetation Removal with MEC Avoidance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Other	• Verify that EMS services are available and can respond in a prompt manner prior to the start of work. • Always use a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never use a phone or two way radio while driving on due to the distraction these devices pose. • Buddy system maintained for all phases of work. • Base or Local Emergency Medical Service and Fire Dispatch numbers programmed into cellular phones. Have hospital route map readily available. • Report all unsafe conditions and acts, injury/illness or property damage to SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM immediately.	Standard Level D or Modified Level D PPE (see Table 9-2)

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • First Aid/BbPK/CPR shield • Bush hog • Skid Steer with trenching attachment (silt fence installation) • Spill Kit • Communication devices • Schonstedt Magnetic Locator • Gasoline Weed Trimmer w/ or w/o brush blade attachment • Bush Mower	• Visual Inspections of designated work areas to identify and address hazardous conditions. • Equipment inspections and maintenance. • Emergency Response Equipment Inspections (Fire Extinguishers, Eye Wash, First Aid/CPR etc.) • Daily inspection of hand/power tools.	• Review AHA with all task personnel • Review Site Specific Safety and Health Plan for new site personnel. • First Aid/CPR for Supervisors • Supervisors - BBLPS, SC-HW (29CFR1910.120(e)(4) • Power tool and heavy equipment operators qualified by previous training or experience. • Training and medical surveillance per 29CFR1910.120 • Heavy equipment operators qualified by previous training or experience. • For Schonstedts, operators qualified per DDESB TP-18

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Safety Officer Name:	____________________	____________________	**Date/Time:**____________________
Site Personnel:	____________________	____________________	**Date/Time:**____________________
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CH2M HILL – Fort Rucker
AHA 5 – Instrument-Assisted Surface Clearance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
MEC Surface Clearance (Anti-Tank/Grenade Range, Infiltration/Grenade Range)	Adverse Weather	• Check internet, local TV weather or radio channels for daily forecasts and plan daily work activities accordingly. Have a portable radio available onsite to monitoring local weather forecasts. If onsite internet or radio monitoring are not available, for reach-back support check with office staff, who may be able to verify pending regional severe weather conditions. • Frequently observe the skyline for rain squalls and thunderstorm systems that may be developing. • Bring clothing suitable for anticipated daily weather conditions. • Shut down operations during heavy rain/lightning events or high wind conditions. For storms producing lightning, seek safe haven in a grounded structure or rubber-tired vehicle. Now work will be performed within the EZ when lightning is reported with 5 miles of the project site. Do not seek refuge under trees during electrical or high wind storm events. • Stay away from ravines and gullies during heavy rain events, because of the possibility of flash flood events. • Do not use telephones during electrical storms, except in the case of emergency.	Standard Level D PPE (see Table 9-2)
	Biological	• Observe ground surfaces, enclosed structures, surrounding vegetation, and other site features for presence of poisonous insects. • Where venomous snakes are known to inhabit or may be present, the use of snake guards must be evaluated • Do not approach fresh or brackish water bodies that could contain alligators. • Where exposure to poisonous plants that have oils, berries or needle-like projections could cause skin irritations, infections or allergic reactions use disposable coveralls for protection. • Observe areas for presence of stinging insects. Prior to starting field activities, notify SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of known allergies to stinging insects and location of antidotes. • Use insect repellent with DEET or other insect repellent to deter being bit by mosquitoes or other stinging/biting insects. • Tape pant legs to boots and ensure there are no open seams between boots and pant legs. • Avoid exposure to blood borne pathogens. Use universal precautions against exposure.	Standard Level D PPE (see Table 9-2)
	MEC Hazards	• Surface clearance will only be accomplished by UXO Technicians. • All non-MEC qualified persons should be under the supervision of a UXO technician per DDESB-TP-18 • Use Schonstedt Magnetic Locator to locate metallic objects. • Enforce team separation distances. • All work will be performed IAW approved ESP and WP (includes Safety & Quality Plan). • MD will be processed IAW DoD 4140.62.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 5 – Instrument-Assisted Surface Clearance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
MEC Surface Clearance (Cont.)	Cuts/Abrasions	• Wear cut resistant work gloves, when the possibility of lacerations or other injury may be caused by sharp edges of hand tools, concrete chutes, rebar, lumber etc. • Protect against cuts and abrasions by protecting personnel against rebar ends. • Maintain all power tools in a safe operating condition. • Make sure all power tool guards are in-place and operational. • Use the proper tool to complete the task. • Ensure that all tool/equipment machine guards are in place to prevent contact with drive lines, belts, chains, blades pinch points or other sources of injury from mechanical tool use. • Keep hands and feet away from the rotating blade of the concrete cutting saw.	Standard Level D PPE (see Table 9-2)
	Fire/Explosion Prevention	• Maintain appropriately sized, easily accessible ABC fire extinguishers in work area. • Fire extinguishers must be inspected monthly (inspection tag) and have an annual maintenance/inspection certification (tag) attached to the extinguisher. • Secure a Hot Work permit from client/facility/Local Fire Department when cutting with a gas powered demolition saw. • Ensure that sparks discharged from gas powered demolition saws are not directed toward flammable or combustible materials or personnel. • Fire extinguishers will be approved by a nationally recognized testing laboratory and labeled to identify the listing and labeling organization and the fire test and performance standard that the fire extinguisher meets or exceeds. • Maintain a fire watch 1 hour after cutting operations (gas powered chop saw) have ceased. • Removal all combustible or flammable materials from the cutting areas. • Ensure that the discharge of sparks during cutting operations is not directed toward flammable or combustible materials or personnel. • Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Only smoke in designated areas. Designated areas must be free of combustible/flammable materials. • ASTs for heavy equipment fuel storage should have secondary containment capabilities.	Standard Level D PPE (see Table 9-2)
	Hand & Power Tools	• Perform daily or more frequent inspections on power tools, as may be needed • Power tools will only be operated by personnel qualified by prior training or experience. • Ensure that a stable, level, dry work surface is available for the operation of power tools. • All required guards are in place, functioning and utilized. • Hand-held power tools equipped with constant pressure switch. Tools inspected before use. Maintain all tools in a safe condition. • Select and use the proper tool for the task. • Do not use tools that have been damaged or repaired in a manner which is not consistent with manufacturer's requirements.	Standard Level D PPE

CH2M HILL – Fort Rucker
AHA 5 – Instrument-Assisted Surface Clearance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
MEC Surface Clearance (Cont.)	Haul trucks	• All vehicles must follow the designated access road established for the site. • Haul truck operators should ensure all persons are clear before operating trucks or equipment. Before moving, operators should sound horn or alarm. All equipment should be equipped with an operational back-up alarm. • Haul trucks or equipment with restricted visibility should be equipped with devices that eliminate blind spots. • Employees should stay off access roads. When approaching a haul area, employees should make eye contact and communicate their intentions directly with the equipment operator. • Stay out of the operating envelope of vehicles. Do not walk in front of or in back of vehicles. Ensure you are in the vehicle operator's field of vision.	Standard Level D PPE (see Table 9-2)
	High Ambient Temperature	• Provide and drink fluids to prevent worker dehydration. • Minimize intake of caffeinated fluids. ▪ Institute a proper work-break regimen in a cool area to avoid heat stress symptoms and overexertion. ▪ Monitor for signs and symptoms of heat stress (maintain use of buddy system) when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress and especially when wearing disposable or other types of coveralls. 1) Heat Syncope = Sluggishness or fainting while standing erect or immobile in heat. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.* 2) Heat Rash = Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure. *Treatment = Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.* 3) Heat Cramps = Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake.* 4) Heat exhaustion = Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low. *Treatment = Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.* 5) Heat Stroke = Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature. *Treatment = Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!*	Standard Level D PPE (light colored clothing)

CH2M HILL – Fort Rucker
AHA 5 – Instrument-Assisted Surface Clearance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
MEC Surface Clearance (Cont.)	Heavy Equipment	• Seat belts or other restraint system will be used by heavy equipment operators. • Perform daily maintenance and inspections on operating equipment. Keep documentation onsite. • Use caution around pressurized lines/hoses. Inspect hoses daily for cuts, abrasions and wear. • Equipment will only be operated by personnel qualified by prior training or experience. • Ensure that a stable ground surface is available for the operation of heavy equipment. • **Equipment operators will not leave the cab of the equipment while they are lifting/controlling a load unless the load has been delivered to its intended transport location or the load has been fully secured (no potential for rolling onto or crushing ground personnel) and the equipment and controls are fully secured/disengaged and equipment is "de-energized."**	Standard Level D PPE (see Table 9-2)
	Manual Lifting	• CH2M HILL and subcontract personnel must notify the SUXOS/SM, SSHO/UXOSO, and/or CH2M HILL PM of pre-existing medical conditions that may be aggravated or re-injured by lifting activities, especially lifting operation involving repetitive motions. • When lifting objects, lift using knees, not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. Use heavy equipment to transfer heavy or awkward loads wherever possible. Have someone assist with the lift— especially for heavy (> 40 lbs.) or awkward loads. Do not attempt to manually lift objects that should be lifted with heavy equipment. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level.	Standard Level D PPE (see Table 9-2)
	Machine Guarding	• Direct concrete cutting saws in straight line paths only. Do not attempt to arch, curve or bend that path of the concrete asphalt saw. If path of saw needs to be redirected, stop movement, lift saw blade and reset/redirect saw path. • Ensure that all machine guards are in place to prevent contact with drive lines, belts, blades, pinch points or any other sources of mechanical injury. • Maintenance and repair of equipment that results in the removal of guards or would otherwise put anyone at risk requires lock-out of that equipment prior to work. • Only qualified personnel (by training/experienced) should operate asphalt cutting equipment.	Standard Level D PPE (see Table 9-2)
	Noise	• Personnel exposed to loud working environments must wear hearing protection.	Standard Level D PPE (see Table 9-2)
	Overexertion	• Perform tasks at a steady reasonable pace. • Institute proper work break regimens. • Secure extra personnel for concrete placement and finishing activities, especially when ambient temperatures are high. • Use the right tool for a specific task. • Proper planning relative to the completion of forms and scheduled delivery of concrete.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 5 – Instrument-Assisted Surface Clearance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
MEC Surface Clearance (Cont.)	Overhead Utilities	• When using heavy equipment, maintain proper separation between power transmission lines and overhead utilities. See Electrical Safety (Section 9.5.16) for references to proper separation between operating equipment and power transmission lines/overhead utilities. Do not operate or swing heavy equipment booms or other components of operating heavy equipment toward overhead utilities. • Be cognizant of utility pole guy wire positions.	Standard Level D PPE (see Table 9-2)
	Visible Lighting	• Perform tasks in daylight hours.	Standard Level D PPE
	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes, curbs, utility structures etc). Use sturdy hard-toed work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. Clean work areas as activities proceed. Clear-remove materials and debris from pathways and commonly traveled areas as soon as possible. • Three points of contact when entering/exiting equipment or when using stairways/ladders.	Standard Level D PPE (see Table 9-2)
	Struck-by/ Pinched/ Caught-in-between	• Sufficient separation between ground support personnel and any operating heavy equipment must be maintained especially during the removal of concrete pads or aprons. Isolate equipment swing areas from workers, fixed objects or other equipment. Ground personnel will avoid positioning themselves between fixed objects and operating equipment. Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. Stay out of the swing radius of operating heavy equipment. • Wear reflective vests or high visibility clothing to promote visibility of ground personnel by equipment operators. • Understand and review hand signals. Designate one person to provide hand signals to equipment operators performing lifting/hoisting operations. • Ensure equipment has operable back-up alarms. • Step away from heavy equipment when adjustments (positioning) are made. • Ensure heavy equipment operator has spotter for obstructed views and backing up. • When a concrete saw is in use, non-essential personnel will place themselves at a sufficient distance away from pavement cutting and removal operations (~25 ft). • Removed concrete will not be swung over the heads of ground personnel. • Ground personnel will not walk under overhead loads.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 5 –Instrument-Assisted Surface Clearance (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
MEC Surface Clearance (Cont)	Other	• **Verify that EMS services are available and can respond in a prompt manner prior to the start of work.** • Always use a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never use a phone or two way radio while driving due to the distraction these devices pose. • Buddy system maintained for all phases of work. • Base or Local EMS and Fire Dispatch numbers programmed into cellular phones. Have hospital route map readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately.	Standard Level D PPE

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Track excavator with hydraulic hammer attachment • Fire Extinguishers • First Aid Kits • Walk behind concrete saw w/ diamond blade • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • First Aid/BbPK/CPR shield • Gas powered cut-off saw • Communication devices • Schonstedt Magnetic Locator	• Visual Inspections of designated work areas to identify and address hazardous conditions. • Equipment inspections and maintenance. • Emergency Response Equipment Inspections (Fire Extinguishers, Eye Wash, First Aid/CPR etc.) • Inspections of hand tools (power) and extension cords if used. • Daily calibration of Schonstedt prior to use to ensure proper sensitivity and ability to detect target items at target depths	• Review AHA with all task personnel • Review Site Specific Safety and Health Plan for new site personnel. • First Aid/CPR • Supervisors - BBLPS, SSHO/UXOSO or equivalent • Power tool and heavy equipment operators qualified by previous training or experience. • Schonstedt operators will have access to the equipment operators manual.

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AHA 6 - Digital Geophysical Mapping (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

EXHIBIT 1 TO FORM 408 HS - ACTIVITY HAZARD ANALYSIS FORM

Activity:	Digital Geophysical Mapping for the Remedial Investigation (RI) of two MRSs at Fort Rucker, Alabama	**Date:**	01/19/2010
		Project:	RI of two MRSs at Fort Rucker, Alabama Contract # W91ZLK-05-D-0014 Subcontract # 813307
Description of the Services:	Digital geophysical mapping (DGM) using Geonics EM61 MK2 of approx. 14,000 linear feet of transects by a two-person crew.	**Site Supervisor:**	
		Site Safety Officer:	

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	**Potential Health and Safety Hazards** (Analyze each principal step for potential hazards)	**Hazard Controls** **(Develop specific controls for each potential hazard)**
Driving to and from work area.	Parked cars in roadway as well as pedestrians	Defensive driving, do not exceed speed limit, Yield to oncoming traffic and pedestrians, communicate when required for travel clearance through work area.
Loading and unloading of geophysical equipment.	Improper and over weight lifting	A practice of bending at the knees and lifting with the legs will be used for at all times. Items over 40 lbs will be lifted with the support of two individuals.
Performance of DGM.	Heat Related Hazards (Heat Stroke)	In hot weather take regular breaks in a cool shady area, regular consumption of water to remain hydrated, use of sunglasses and sunscreen
Performance of DGM.	Biological Hazards (soisonous plants, bees, variety of insects)	Pre-screening of personnel for allergic reactions to stings, minimize exposed skin, use of insect repellants, avoid use of fragrant products, avoid brightly colored clothing, maintain first aid kit, use of bug suits in extreme cases.

Performance of DGM.	Encountering MEC	Surface will be swept by UXO Technicians prior to entry into area by NAEVA personnel, field teams escorted by UXO Technician while in the field; any MEC encountered will be avoided and reported to the SUXOS by the UXO Technician..
Performance of DGM.	Extreme weather conditions	Weather conditions will be monitored and if such conditions develop (e.g., lightning, heavy rain) the field team will immediately cease work and seek shelter.
Performance of DGM.	Slips, trips, and falls related to stumps, brush, gullies, and uneven terrain	Work will be conducted in daylight hours only, attention will be paid to ground conditional immediately in front of path, where possible ground hazards will be relocated from the area prior to initiating work, a reasonable walking pace will be maintained (i.e. no running)
Performance of DGM.	Sharp or pointed objects such as cut-off vegetation, thorns, and shrapnel	Keep a look-out and avoid object that could penetrate the skin or footwear, wear boots that have dense soles to help prevent penetration of the foot while providing breathability and good ankle support.

CH2M HILL – Fort Rucker
AHA 7 – Subsurface Anomaly Investigation (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
MEC Intrusive Investigation (Anti-Tank/Grenade Range, Infiltration/Grenade Range)	Buried Utilities or Unknown Objects	• Contact Fort Rucker One Call to secure a utility owner verification request number at (800) 432-4770 for utility clearance verification. Keep copies of any written documentation (faxes, email printouts) regarding utility location verification provided by utility owners in the office project file and in a working field file onsite. • Photo-document owner provided field utility mark-outs as related to proposed limits of ground disturbing activities prior to the start of work. • Conduct "third party" utility clearance when the locations of utilities may be in question and document results of third party utility location. • Determine if a client Excavation Permit is required prior to performing any ground disturbing activities. • Hand dig around identified utilities (within 5 ft) or as otherwise required by client Excavation Permit. • Review base engineering records or drawings against utility owner or third party utility mark-out to verify any potential differences. • Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, utilities must be relocated/marked. • Where unknown or unanticipated buried objects are encountered (i.e. drums, tanks, cylinders, MEC, soil with unusual staining or odor), CH2M HILL or subcontractor personnel will 1) secure equipment to the extent possible, without causing bodily injury, 2) evacuate the work area, and 3) immediately notify the SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of the encountered condition. Work may resume only with appropriate documentation/notification that exposure hazards (physical or chemical) do not exist and approval to resume work by the CH2M HILL PM.	Modified Level D PPE Modified (see Table 9-2)
	Adverse Weather	• Check internet, local TV weather or radio channels for daily forecasts and plan daily work activities accordingly. Have a portable radio available onsite to monitoring local weather forecasts. If onsite internet or radio monitoring are not available, for reach-back support check with office staff, who may be able to verify pending regional severe weather conditions. • Frequently observe the skyline for rain squalls and thunderstorm systems that may be developing. • Bring clothing suitable for anticipated daily weather conditions. • Shut down operations during heavy rain/lightning events or high wind conditions. For storms producing lightning, seek safe haven in a grounded structure or rubber-tired vehicle. No work will be performed within the EZ when lightning is observed or reported within 5 miles of the project site. Do not seek refuge under trees during electrical or high wind storm events. • Stay away from ravines and gullies during heavy rain events, because of the possibility of flash flood events. • Do not use telephones during electrical storms, except in the case of emergency.	Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 7 – Subsurface Anomaly Investigation (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
MEC Intrusive Investigation (cont.)	Biological	• Observe ground surfaces, enclosed structures, surrounding vegetation, and other site features for presence of poisonous insects. • Where venomous snakes are known to inhabit or may be present, the use of snake guards must be evaluated. • Do not approach fresh or brackish water bodies that could contain alligators. • Where exposure to poisonous plants that have oils, berries or needle-like projections could cause skin irritations, infections or allergic reactions use disposable coveralls for protection. • Observe areas for presence of stinging insects. Prior to starting field activities, notify SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of known allergies to stinging insects and location of antidotes. • Use insect repellent with DEET or other insect repellent to deter being bit by mosquitoes or other stinging/biting insects. • Tape pant legs to boots and ensure there are no open seams between boots and pant legs. • Avoid exposure to blood borne pathogens. Use universal precautions against exposure.	Modified Level D PPE (see Table 9-2)
	Cuts/Abrasions	• Wear cut resistant work gloves, when the possibility of lacerations or other injury may be caused by sharp edges of power or hand tools.	Modified Level D PPE (see Table 9-2)
	Chemical Exposure	• All personnel performing this task will be trained in accordance with 29CFR1910.120 and be enrolled in a medical monitoring program. • Do not allow dermal contact or incidental ingestion of impacted soil. Skin contact with contaminated water, soils, debris, or equipment will be avoided at all times. Do not kneel or step in potentially contaminated media (soil) without first donning proper PPE. • Exercise good hygiene practices. Always wash hands before eating, drinking, smoking and leaving site. Only eat, drink, smoke or chew tobacco in designated areas. • Do not allow onsite vehicle operators to climb into dump bed bodies without proper PPE. • Adhere to PPE and monitoring requirements identified in Section 9.5.12.	Modified Level D PPE (see Table 9-2)
	Fire Prevention	• Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Appropriately sized, easily accessible ABC fire extinguishers in work area. • Fire extinguishers must be inspected monthly (inspection tag) and have an annual maintenance/inspection certification (tag) attached to the extinguisher. • Fire extinguishers will be approved by a nationally recognized testing laboratory and labeled to identify the listing and labeling organization and the fire test and performance standard that the fire extinguisher meets or exceeds. • Secure any applicable client facility/Local Fire Department Hot Work permit as necessary. • Only smoke in designated areas. Designated area must be free of combustible/flammable materials. • ASTs for heavy equipment fuel storage should have secondary containment capabilities.	Modified Level D PPE (see Table 9-2)
	Excavations	• Maximum depth of animally investigation is 4 feet. • All holes will be back filled at the end of each day. • Daily safety briefing to cover the hazards of excavations on the job site.	Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 7 – Subsurface Anomaly Investigation (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
MEC Intrusive Investigation (cont.)	High Ambient Temperature	• Provide and drink fluids to prevent worker dehydration. • Minimize intake of caffeinated fluids. ▪ Institute a proper work-break regimen in a cool area to avoid heat stress symptoms and overexertion. ▪ Monitor for signs and symptoms of heat stress (maintain use of buddy system) when the ambient air temperature exceeds 70˚F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress and especially when wearing disposable or other types of coveralls. 1) Heat Syncope = Sluggishness or fainting while standing erect or immobile in heat. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.* 2) Heat Rash = Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure. *Treatment = Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.* 3) Heat Cramps = Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake.* 4) Heat exhaustion = Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low. *Treatment = Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.* 5) Heat Stroke = Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature. *Treatment = Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!*	Modified Level D PPE (see Table 9-2)
	MEC Hazards (Striking MEC with EMM)	• Excavate from a point offset from the anomaly. Do not dig directly on top of the anomaly. • Utilize the instrument that initially detected the anomaly to determine the location of the anomaly from the side of the excavation. • Utilize hand excavation when approaching the anomaly from the side. • Conduct MEC identification/familiarization training at project start-up and periodically. • All intrusive investigations should be performed by UXO technician per DDESB-TP-18 • Use Schonstedt Magnetic Locator to locate the anomaly.	Modified Level D PPE (see Table 9-2)
	Heavy Equipment	• Seat belts or other restraint system will be used by heavy equipment operators. • Perform daily maintenance and inspections on operating equipment. Keep documentation onsite. • Use caution around pressurized lines/hoses. Inspect hoses daily for cuts, abrasions and wear. • Equipment will only be operated by personnel qualified by prior training or experience. • Ensure that a stable ground surface is available for the operation of heavy equipment. • Equipment operators will not leave the cab of the equipment while they are lifting/controlling a load unless the load has been delivered to its intended transport location or the load has been fully secured (no potential for rolling onto or crushing ground personnel) and the equipment and controls are fully secured/disengaged and equipment is "de-energized."	Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 7 – Subsurface Anomaly Investigation (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
MEC Intrusive Investigation (cont.)	Noise	• Personnel exposed to loud working environments must wear hearing protection.	Modified Level D PPE (see Table 9-2)
	Overhead Utilities	• When using an excavator to install ESC measures, maintain proper separation between power transmission lines and overhead utilities during the operation of heavy equipment. See Electrical Safety (Section 9.5.16) for references to proper separation between operating equipment and power transmission lines/overhead utilities. Do not operate or swing heavy equipment booms or other components of operating heavy equipment toward overhead utilities. Be cognizant of utility pole guy wire positions. • Do not allow vehicles to raise their beds while underneath overhead utilities.	Modified Level D PPE (see Table 9-2)
	Pinched/Struck-by/ Caught-in-between	• Sufficient separation between ground support personnel and any operating heavy equipment must be maintained. • Wear reflective vests or high visibility clothing to promote visibility of ground personnel by equipment operators. • Isolate equipment swing areas from workers, fixed objects or other equipment. Ground personnel will avoid positioning themselves between fixed objects and operating equipment. Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. Stay out of the swing radius of operating heavy equipment. • Understand and review hand signals. Designate one person to provide hand signals to equipment operators performing lifting/hoisting operations. • Ensure equipment has operable back-up alarms. • Step away from heavy equipment when adjustments (positioning) are made. • Ensure heavy equipment operator has spotter for obstructed views and backing up. • If using trenching equipment, keep hands, feet and arms away from activated drive chains or belts of trenching equipment. Stop trenching operations if personnel approach active trenching equipment. • Ensure that all machine guards are in place to prevent contact with drive belts rotary action devices/blades of trenching machine etc. Do not modify safety features of the trenching machine. • Stay out of the "flip over radius" of operating vehicles.	Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 7 – Subsurface Anomaly Investigation (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
MEC Intrusive Investigation (cont.)	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes, curbs, utility structures etc). Use sturdy hard-toed work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. Clean work areas as activities proceed. Clear-remove materials and debris from pathways and commonly traveled areas as soon as possible. • Avoid walking on polyethylene sheeting, especially when wet. • Use sufficient number of personnel to cover and stockpile soil. Consider 3-4 personnel for this activity during windy conditions (>10 mph). At a minimum use buddy system for soil stockpile covering activities. • Three points of contact when entering/exiting equipment or when using stairways/ladders.	Modified Level D PPE (see Table 9-2)
	Suspended loaded	• Suspended loads will not be passed over ground personnel. • Ground personnel will not walk under or in front of suspended loads.	Modified Level D PPE (see Table 9-2)
	Visible Lighting	• Perform tasks in daylight hours.	Modified Level D PPE (see Table 9-2)
	Other	• Verify that EMS services are available and can respond in a prompt manner prior to the start of work. • Always use a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never use a phone or two-way radio <u>while driving</u> due to the distraction these devices pose. • Buddy system maintained for all phases of work. • Base or Local Emergency Medical Service and Fire Dispatch numbers programmed into cellular phones. Have hospital route map readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately.	Modified Level D PPE (see Table 9-2)

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • First Aid/BbPK/CPR shield • Track excavator • Spill Kit • Communication devices • Mechanical excavator • Schonstedt Magnetic Locator • Backhoe/Loader • Hand Excavation Tools	• Visual Inspections of designated work areas to identify and address hazardous conditions. • Equipment inspections and maintenance. • Emergency Response Equipment Inspections (Fire Extinguishers, Eye Wash, First Aid/CPR etc.) • Inspections of hand tools (power) and extension cords if used. • Daily calibration of Schonstedt	• Review AHA with all task personnel • Review Site Specific Safety and Health Plan for new Site personnel. • First Aid/CPR • Supervisors – Competent Person Excavation, 29CFR1910.120(e)(4). • Heavy equipment operators qualified by previous training or experience. • Training and medical surveillance per 29CFF1910.120. • For Schonstedt, operators qualified per DDESB TP-18

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ERRG – Fort Rucker
AHA 8 – Detonation/Disposal of MEC (if necessary) (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown: UXO Demolition Operations/Transportation

Principal Steps	Potential Hazards	Recommended Controls
▪ Explosives handling and transportation ▪ Preparing and placing charges ▪ Blow (detonation) in place (BIP)	▪ Explosives ▪ UXO ▪ Noise ▪ Fire ▪ Fragmentation ▪ Vehicle Accident ▪ Accidental detonation ▪ Slip, trip, and fall ▪ Heat stress ▪ Dangerous plants	▪ Apply USACE safety concepts and basic considerations ▪ Proper footing and footwear ▪ Remove obstacles in planned path of travel for explosives transport vehicle on disposal site ▪ Know heat stress warning signs and proper action to take, including drinking water frequently ▪ Use Technical Manual (TM)-60 series for specific UXO ▪ Have first-aid kits and fire extinguishers ▪ Educate personnel to stay beyond fragmentation distance from disposal site ▪ Conduct operations and safety briefing prior to beginning operation ▪ No smoking ▪ Maintain minimum separation distance (MSD), tamping: control of shot
Equipment To Be Used	**Inspection Requirements**	**Training Requirements**
▪ Demolition supplies ▪ Level D PPE with leather boots, leather gloves, safety glasses and reflective vest ▪ Electrical firing system/Non-EL ▪ Hand tools ▪ First aid kit ▪ Fire Extinguisher	▪ Ensure demolition equipment and hand tools are serviceable ▪ Equipment to be inspected daily prior to use ▪ Fire extinguisher certification ▪ Inspect first-aid kit	▪ EOD School graduate ▪ HAZWOPER 40-hour and refresher ▪ Site-specific training ▪ Review and comply with SSHP ▪ Training people in use of tools ▪ Valid State Driver's License; current ▪ OSHA 40 Hour HAZWOPER, OSHA 8 Hour Refresher Qualifications. ▪ CPR/ First Aid ▪ Current CDL with Hazmat Endorsement

ERRG – Fort Rucker
AHA 8 – Detonation/Disposal of MEC (if necessary) (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown: **Inert Ordnance/MEC Scrap Recovery**

Principal Steps	Potential Hazards	Recommended Controls
▪ Picking up scrap ▪ Loading onto truck ▪ Lifting ▪ Transport	▪ Lifting heavy objects ▪ Vehicle accident ▪ Vehicle fire	▪ Inspect vehicle for suitability to travel over terrain ▪ Use proper lifting techniques (use a buddy if the object weighs more than 50 pounds, bend with the knees and not the back, and do not twist side-to-side when lifting heavy objects) ▪ Use only qualified drivers ▪ Have appropriate first-aid kits and fire extinguishers ▪ Properly secure load for transport
Equipment To Be Used	**Inspection Requirements**	**Training Requirements**
▪ Vehicle with rate load capacity of 1/2 ton or greater, suitable for off-road travel ▪ Level D PPE with leather boots, leather gloves, safety glasses and reflective vest ▪ First aid kit ▪ Fire extinguisher	▪ In accordance with DOT requirements per Title 49 CFR ▪ Fire Extinguisher certification ▪ Inspect first-aid kit	▪ IAW DOT, state, and local laws ▪ HAZWOPER initial 40-hour training ▪ Site-specific training ▪ Review and comply with SSHP ▪ CPR/ First Aid

ERRG – Fort Rucker
AHA 8 – Detonation/Disposal of MEC (if necessary) (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Activity Hazard Analysis
Fort Rucker Munitions Response Services
Task Breakdown: Demilitarization Operations

Principal Steps	Potential Hazards	Recommended Controls
▪ Segregate suspect MEC/UXO items for MPPEH assessment ▪ Segregate metal scrap and items for MD assessment ▪ Segregate non-munitions metal and non-metal scrap items assessment	▪ MEC/UXO (Unintentional Detonation) ▪ Heat stress ▪ Weather-related hazards: Wind, rain, sun ▪ Contact with potential hazardous, toxic chemicals ▪ Walking surfaces: Unimproved land, range land, sand, rocks, gravel, mud ▪ Ergonomic Hazards ▪ Pinch, crush and cut hazard ▪ Vehicle and heavy equipment traffic in work area ▪ Biological hazards ▪ Slips, trips and falls ▪ Lifting hazards and back injury ▪ Noise ▪ Hand tools	▪ During inspections/demilitarization of MEC/UXO/MD, workers will observe EM 385-1-97, and DODI 4140.62 and DOD 4160.21-M. ▪ Non-essential personnel, in the immediate vicinity of operations, will be kept to the minimum safe distance necessary for operations. If non-essential personnel are in the EZ, operations will cease. ▪ SSHO will check weather forecasts to assure that optimum conditions and time frames exist to complete all MPPEH/MD operations. MPPEH/MD operations will be not be scheduled or conducted during conditions that pose static electrical charges. ▪ Personnel that encounter biological hazards will adhere to procedures described in the WP, and take precautions to prevent injuries from biological hazards. ▪ MPPEH/MD workers aware of potential exposure to corrosive and/or flammable liquids when conducting Inspections of hard targets. Any visible leaking will be immediately reported and any spills (anti-freeze, oil, hydraulic fluids, etc.) will be cleaned up immediately. UXOSO will provide proper decontamination for workers. ▪ Hearing protection to be worn when noise levels at 85 dBA or greater. ▪ Know heat stress warning signs/proper action. Drink water frequently. SSHO will implement heat stress/cold injury program. ▪ Tool users will inspect tools, assure good working order, damaged equipment will not be used until repaired or replaced. ▪ After items are identified as being free of explosives or energetic materials they will be classified as MD. MD will be considered contaminated metals (non-energetic) and handled with the proper PPE (i.e. gloves). ▪ The potential for lead exposure from small arms constituents (.50 call and smaller) may exist, lead in

		this form poses only a dermal contact threat therefore the UXOSO will provide proper decontamination materials. ■ Reduce bending, twisting, and kneeling, by using alternating work, rotating workers and periodic stretching break to reduce static or awkward postures. Use team lifting, and lifting aids to minimize lifting weights over 25-lbs above the shoulders, below the knees, or at arm length. ■ Have first-aid kits and fire extinguishers. ■ Level D PPE and task appropriate eye protection are to be used. ■ Workers are to use proper lifting techniques, proper footing, awareness of potential slippery surfaces and tripping hazards. ■ Operation of heavy equipment IAW SSHP. Be alert during heavy equipment ops, ground guide when backing.
Equipment To Be Used	**Inspection Requirements**	**Training Requirements**
■ Heavy equipment (i.e. front end loader, forklift); and project vehicles, ■ Hand tools and power tools, ■ Level D PPE with leather boots, leather gloves, safety glasses, face shield when appropriate and reflective vest	■ Daily check of heavy equipment ■ Radio check ■ Inspect first-aid kit and fire extinguisher certification ■ PPE and equipment/tools inspected daily, equipment turned in for repair/ replacement as needed.	■ Demilitarization Techs to be EOD/UXO School graduates ■ HAZWOPER initial 40-hour training ■ Site-specific and task training ■ All heavy equipment operators to provide proof of training to the SSHO prior to operating the equipment. ■ Review and comply with SSHP ■ CPR/ First Aid Training

ERRG – Fort Rucker
AHA 8 – Detonation/Disposal of MEC (if necessary) (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range)

Task Breakdown: Moving Group of Horses*

Principal Steps	Potential Hazards	Recommended Controls
Walk to site where animals are located Round-up animals into a group Herd animals to pre-determined site	Contact with animal manure Animal contact = kick, bite, step on, runover, or other Slippery or uneven surface	Non-skid shoes Carry stick to guide animals
Equipment To Be Used	**Inspection Requirements**	**Training Requirements**
Non-skid shoes Guide stick	N/A	Training on animal behavior

*Stable personnel will be responsible for movement of horses should evacuation be required.

Task Breakdown:: MEC Avoidance

Principle Steps	Potential Safety/Health Hazard	Recommended Controls
MEC Area Visual Survey Assure safe paths and operating areas Conducting Construction Support	MEC/UXO (explosion, fire) Unintentional detonation Fragmentation Weather extremes Slip, trip, fall	Apply USACE safety concepts and basic considerations Use TM 60-A-1-1-22 for specific EOD precautions (available on site) Conduct safety briefing prior to operations MEC/UXO familiarization training for all field personnel UXO Technician III to provide escort and avoidance services Located MEC/UXO shall not be moved until deemed acceptable to move by the UXO Tech III The appropriate exclusion zone (EZ) will be enforced at all times during construction support and demolition operations. No smoking Evacuate the area in the event lightning approaches within 5-miles of the working area Watch for burrows and uneven/slippery terrain Keep hydrated (one quart of water per hour) and take rest breaks in shaded area. Wear sunscreen and appropriate attire. If escorting equipment operators, equipment operators and UXO Technicians will wear inner and outer ear protection during mechanized operations Wear appropriate PPE

Equipment to be Used	Inspection requirements	Training Requirements
▪ 1st aid kit ▪ Radio and cell phone ▪ Fire extinguisher	▪ Inspect at the start of the tasking and weekly thereafter. Replenish items as used. ▪ Inspect daily prior to accessing the site	▪ UXO Technician II and III must be graduate of EOD School (Refer to DDESB TP-18) ▪ HAZWOPER 40-hour and refresher ▪ Site specific training ▪ One-1st aid/CPR trained individual will always be on site with the field team.

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CH2M HILL – Fort Rucker
AHA 9 – Soil Sampling

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Limited Site Waste Characterization or Confirmation Soil Sampling	Adverse Weather	• Sampling performed within the EZ will be done under the direct supervision of a UXO Technician providing avoidance support.. • Check internet, local TV weather or radio channels for daily forecasts and plan daily work activities accordingly. Have a portable radio available onsite to monitoring local weather forecasts. If onsite internet or radio monitoring are not available, for reach-back support check with office staff, who may be able to verify pending regional severe weather conditions. • Frequently observe the skyline for rain squalls and thunderstorm systems that may be developing. • Bring clothing suitable for anticipated daily weather conditions. • Shut down operations during heavy rain/lightning events or high wind conditions. For storms producing lightning, seek safe haven in a grounded structure or rubber-tired vehicle. No work will be performed within the EZ when lightning is reported or observed within 5 miles of the project site. Do not seek refuge under trees during electrical or high wind storm events. • Stay away from ravines and gullies during heavy rain events, because of the possibility of flash flood events. • Do not use telephones during electrical storms, except in the case of emergency.	Modified Level D PPE Modified (see Table 9-2)
	Biological	• Observe ground surfaces, enclosed structures, surrounding vegetation, and other site features for presence of poisonous insects. • Where venomous snakes are known to inhabit or may be present, the use of snake guards must be evaluated. • Do not approach fresh or brackish water bodies that could contain alligators. • Where exposure to poisonous plants that have oils, berries or needle-like projections could cause skin irritations, infections or allergic reactions use disposable coveralls for protection. • Observe areas for presence of stinging insects. Prior to starting field activities, notify SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of known allergies to stinging insects and location of antidotes. • Use insect repellent with DEET or other insect repellent to deter being bit by mosquitoes or other stinging/biting insects. • Tape pant legs to boots and ensure there are no open seams between boots and pant legs. • Avoid exposure to blood borne pathogens. Use universal precautions against exposure.	Modified Level D PPE (see Table 9-2)
	Chemical Exposure	• All personnel performing this task will be trained in accordance with 29CFR1910.120 and be enrolled in a medical monitoring program. • Do not allow dermal contact or incidental ingestion of impacted soil. Skin contact with contaminated water, soils, debris, or equipment will be avoided at all times. Do not kneel or step in potentially contaminated media (soil) without first donning proper PPE. • Exercise good hygiene practices. Always wash hands before eating, drinking, smoking and leaving site. Only eat, drink, smoke or chew tobacco in designated areas. • Do not allow onsite vehicle operators to climb into dump bed bodies without proper PPE. • Adhere to PPE and monitoring requirements identified in Section 9.5.12.	Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker AHA 9 – Soil Sampling			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Limited Site Waste Characterization or Confirmation Soil Sampling (cont.)	Buried Utilities or Unknown Objects	• Contact Fort Rucker One Call to secure a utility owner verification request number at (800) 432-4770 for utility clearance verification. Keep copies of any written documentation (faxes, email printouts) regarding utility location verification provided by utility owners in the office project file and in a working field file onsite. • Photo-document owner provided field utility mark-outs as related to proposed limits of ground disturbing activities prior to the start of work. • Conduct "third party" utility clearance when the locations of utilities may be in question and document results of third party utility location. • Determine if a client Excavation Permit is required prior to performing any ground disturbing activities. • Hand dig around identified utilities (within 5 ft) or as otherwise required by client Excavation Permit. • Review base engineering records or drawings against utility owner or third party utility mark-out to verify any potential differences. • Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, utilities must be relocated/marked. • Where unknown or unanticipated buried objects are encountered (i.e. drums, tanks, cylinders, MEC, soil with unusual staining or odor) CH2M HILL or subcontractor personnel will 1) secure equipment to the extent possible, without causing bodily injury, 2) evacuate the work area and 3) immediately notify the SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of the encountered condition. Work may resume only with appropriate documentation/notification that exposure hazards (physical or chemical) do not exist and approval to resume work by the CH2M HILL PM.	Modified Level D PPE (see Table 9-2)
	Excavations	• Inspect the excavation every day and after every hazard increasing event. Documentation of this inspection must be maintained daily (i.e. daily production or QC report) and available as part of the project record. Documentation should be available onsite for inspection. • Where excavation edges are exposed to public, excavations will be identified and protected from inadvertent access by the public.	Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 9 – Soil Sampling

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	XRF Operation	• These instruments produce ionizing radiation and should ONLY be operated by individuals, who have been trained by Austin AI and received a manufacturer's training certificate. • Operators should limit their activities to the area designated by the facility. • Operators should try to stay as a group while on the site. • The x-rays emitted from the XRF are capable of passing straight through many different materials (such as wood) without loosing strength. Therefore it is very important for operators and employees to be mindful to keep hands away from the entrance and exits of the x-ray housing, where x-rays have the potential to scatter. • All operators will be given the following, which should be worn at all times while on the site: o Bright Vest with Convenient Pockets o While on site all operators should wear long pants such as denim jeans. o There should be no loose clothing or jewelry dangling from the body. This could cause body parts to be pulled into machines such as the conveyer. o Hair should also be pulled back. • Any safety equipment that is not working properly or malfunctioning should be reported at once. • These devices should never be used to analyze people. While in use they should only be used to test soils and similar materials. Refer to XRF safety document in prior appendix and to radiation safety information provided by instrument manufacturer. • If any equipment appears to not be working correctly or malfunctioning, a supervisor should be alerted at once. •	Modified Level D PPE (see Table 9-2)
	Fire Prevention	• Only smoke in designated areas. Designated area must be free of combustible/flammable materials.	Modified Level D PPE (see Table 9-2)
	Hand Tools	• Ensure that a stable, level, dry work surface is available for the operation of hand auger tools. • Select and use the proper tool for the task. • Do not use tools that have been damaged or repaired in a manner which is not consistent with manufacturer's requirements. • If rotary augers are used, include or discuss additional safe operating procedures for the use of these tools.	Modified Level D PPE (see Table 9-2)
Limited Site Waste Characterization or Confirmation Soil Sampling (cont.)	Heavy Equipment	• Seat belts or other restraint system will be used by heavy equipment operators. • Perform daily maintenance and inspections on operating equipment. Keep documentation onsite. • Use caution around pressurized lines/hoses. Inspect hoses daily for cuts, abrasions and wear. • Equipment will only be operated by personnel qualified by prior training or experience. • Ensure that a stable ground surface is available for the operation of heavy equipment. • Equipment operators will not leave the cab of the equipment while they are lifting/controlling a load unless the load has been delivered to its intended transport location or the load has been fully secured (no potential for rolling onto or crushing ground personnel) and the equipment and controls are fully secured/disengaged and equipment is "de-energized."	Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 9 – Soil Sampling

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	High Ambient Temperature	• Provide and drink fluids to prevent worker dehydration. • Minimize intake of caffeinated fluids. ▪ Institute a proper work-break regimen in a cool area to avoid heat stress symptoms and overexertion. ▪ Monitor for signs and symptoms of heat stress (maintain use of buddy system) when the ambient air temperature exceeds 70˚F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress and especially when wearing disposable or other types of coveralls. 1) Heat Syncope = Sluggishness or fainting while standing erect or immobile in heat. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.* 2) Heat Rash = Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure. *Treatment = Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.* 3) Heat Cramps = Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake.* 4) Heat exhaustion = Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low. *Treatment = Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.* 5) Heat Stroke = Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature. *Treatment = Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!*	Modified Level D PPE (see Table 9-2)
Limited Site Waste Characterization or Confirmation Soil Sampling (cont.)	Manual Lifting	• CH2M HILL and subcontract personnel must notify the SUXOS/SM, SSHO/UXOSO, and/or CH2M HILL PM of pre-existing medical conditions that may be aggravated or re-injured by lifting activities, especially lifting operation involving repetitive motions. • When lifting objects, lift using knees, not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. Use heavy equipment to transfer heavy or awkward loads wherever possible. Have someone assist with the lift— especially for heavy (> 40 lbs.) or awkward loads. Do not attempt to manually lift objects that should be lifted with heavy equipment. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level.	Modified Level D PPE (see Table 9-2)
	Noise	• Personnel exposed to loud working environments must wear hearing protection.	Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 9 – Soil Sampling

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Pinched/Struck-by/ Caught-in-between	• Where sampling personnel must in the area of operating heavy equipment: – Sufficient separation between ground support personnel and any operating heavy equipment must be maintained. – Wear reflective vests or high visibility clothing to promote visibility of ground personnel by equipment operators. – Isolate equipment swing areas from workers, fixed objects or other equipment. Ground personnel will avoid positioning themselves between fixed objects and operating equipment. Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. Stay out of the swing radius of operating heavy equipment. – Ensure equipment has operable back-up alarms. – Suspended loads will not be passed over ground personnel. – Ground personnel will not walk under or in front of suspended loads.	Modified Level D PPE (see Table 9-2)
	Sample Handling	• Skin contact with water, soil, sediment, or debris of undetermined chemical characterization will be avoided at all times. • Caution should be exercised when filling bottles containing acid or base preservatives. Both liquid and vapor phases of acid can cause severe burns. • Wipe down the outsides of sample containers that may have residual liquid or soil on them before labeling and placing them in the cooler for shipment to the laboratory. • Following sample collection, sample container lids should be tightened securely to prevent leaks, and the containers should be rinsed with clean water to ensure that they are free of chemical constituents. • Follow proper decontamination procedures for sample equipment. Properly containerize, label, store and dispose of any decontamination wastes.	Modified Level D PPE (see Table 9-2)
Limited Site Waste Characterization or Confirmation Soil Sampling (cont.)	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes, curbs, utility structures etc). Use sturdy hard-toed work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. Clean work areas as activities proceed. Clear-remove materials and debris from pathways and commonly traveled areas as soon as possible. • Three points of contact when entering/exiting equipment or when using stairways/ladders.	Modified Level D PPE (see Table 9-2)
	Visible Lighting	• Perform tasks in daylight.	Modified Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 9 – Soil Sampling

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Other	• Verify that EMS services are available and can respond in a prompt manner prior to the start of work. • Always use a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never use a phone or two way radio while driving due to the distraction these devices pose. • Buddy system maintained for all phases of work. • Base or Local Emergency Medical Service and Fire Dispatch numbers programmed into cellular phones. Have hospital route map readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately.	Modified Level D PPE (see Table 9-2)

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous hand tools. • First Aid/BbPK/CPR shield • Backhoe and or hand auger • Sample equipment, coolers and glassware • Communication devices	• Visual Inspections of designated work areas to identify and address hazardous conditions. • Emergency Response Equipment Inspections (Fire Extinguishers, Eye Wash, First Aid/CPR etc.) • Inspections of hand tools if used.	• Review AHA with all task personnel • Review Site Specific Safety and Health Plan for new site personnel. • First Aid/CPR • Supervisors - BBLPS, SC-HW (29CFR 1910.120(e)(4) • Power tool and heavy equipment operators qualified by previous training or experience. • Training and medical surveillance per 29CFF1910.120.

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Safety Officer Name:	________________	____________________	**Date/Time:**________________
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AHA 10 -- Transportation and Disposal of Generated Wastes

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CH2M HILL – Fort Rucker
AHA 11 – Site Restoration

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Site Restoration	Adverse Weather	• Check internet, local TV weather or radio channels for daily forecasts and plan daily work activities accordingly. Have a portable radio available onsite to monitoring local weather forecasts. If onsite internet or radio monitoring are not available, for reach-back support check with office staff, who may be able to verify pending regional severe weather conditions. • Frequently observe the skyline for rain squalls and thunderstorm systems that may be developing. • Bring clothing suitable for anticipated daily weather conditions. • Shut down operations during heavy rain/lightning events or high wind conditions. For storms producing lightning, seek safe haven in a grounded structure or rubber-tired vehicle. Implement the 30–30 Rule : Take shelter when you can count 30 seconds or less between lightning and thunder. Remain sheltered for 30 minutes after the last thunder. • • Do not seek refuge under trees during electrical or high wind storm events. • Stay away from ravines and gullies during heavy rain events, because of the possibility of flash flood events. • Do not use telephones during electrical storms, except in the case of emergency.	Standard Level D PPE (see Table 9-2)
	Biological	• Observe ground surfaces, enclosed structures, surrounding vegetation, and other site features for presence of poisonous insects. • Where venomous snakes are known to inhabit or may be present, the use of snake guards must be evaluated. • Do not approach fresh or brackish water bodies that could contain alligators. • Where exposure to poisonous plants that have oils, berries or needle-like projections could cause skin irritations, infections or allergic reactions use disposable coveralls for protection. • Observe areas for presence of stinging insects. Prior to starting field activities, notify SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of known allergies to stinging insects and location of antidotes. • Use insect repellent with DEET or other insect repellent to deter being bit by mosquitoes or other stinging/biting insects. • Tape pant legs to boots and ensure there are no open seams between boots and pant legs. • Avoid exposure to bloodborne pathogens. Use universal precautions against exposure.	Standard Level D PPE (see Table 9-2)
	Excavations	• Inspect the excavation every day and after every hazard increasing event. Documentation of this inspection must be maintained daily and available as part of the project record. Documentation should be available onsite for inspection. • Personnel may not enter excavations greater than 5 ft in depth unless shoring and sloping precautions have been implemented. Personnel entering excavations 4' or greater where hazardous atmospheres may exist must first verify hazardous atmospheric conditions do not exist in the excavation. • Where excavation edges are exposed to public, excavations will be identified and protected from inadvertent access by the public.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 11 – Site Restoration

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Site Restoration (cont.)	Fire Prevention	• Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Appropriately sized, easily accessible ABC fire extinguisher in work area. • Fire extinguishers must be inspected monthly (inspection tag) and have an annual maintenance/inspection certification (tag) attached to the extinguisher. • Fire extinguishers will be approved by a nationally recognized testing laboratory and labeled to identify the listing and labeling organization and the fire test and performance standard that the fire extinguisher meets or exceeds. • Only smoke in designated areas. Designated area must be free of combustible/flammable materials. • ASTs for heavy equipment fuel storage should have secondary containment capabilities.	Standard Level D PPE (see Table 9-2)
	High Ambient Temperature	• Provide and drink fluids to prevent worker dehydration. • Minimize intake of caffeinated fluids. ▪ Institute a proper work-break regimen in a cool area to avoid heat stress symptoms and overexertion. ▪ Monitor for signs and symptoms of heat stress (maintain use of buddy system) when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress and especially when wearing disposable or other types of coveralls. 1) Heat Syncope = Sluggishness or fainting while standing erect or immobile in heat. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.* 2) Heat Rash = Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure. *Treatment = Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.* 3) Heat Cramps = Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake.* 4) Heat exhaustion = Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low. *Treatment = Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.* 5) Heat Stroke = Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature. *Treatment = Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!*	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 11 – Site Restoration

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Site Restoration - (cont.)	Haul trucks	• All vehicles must follow the designated access road established for the site. • Haul truck operators should ensure all persons are clear before operating trucks or equipment. Before moving, operators should sound horn or alarm. All equipment should be equipped with an operational back-up alarm. • Vehicles or equipment with restricted visibility should be equipped with devices that eliminate blind spots. • Employees should stay off access roads. When approaching a haul area, employees should make eye contact and communicate their intentions directly with the equipment operator. • Haul trucks should be loaded evenly for proper weight distribution and on stable competent ground. • Stay out of the operating envelope of vehicles. Do not walk in front of or in back of vehicles. Ensure you are in the vehicle operator's field of vision.	Standard Level D PPE (see Table 9-2)
	Heavy Equipment	• Seat belts or other restraint system will be used by heavy equipment operators. • Perform daily maintenance and inspections on operating equipment. Keep documentation onsite. • Use caution around pressurized lines/hoses. Inspect hoses daily for cuts, abrasions and wear. • Equipment will only be operated by personnel qualified by prior training or experience. • Ensure that a stable ground surface is available for the operation of heavy equipment. • Equipment operators will not leave the cab of the equipment while they are lifting/controlling a load unless the load has been delivered to its intended transport location or the load has been fully secured (no potential for rolling onto or crushing ground personnel) and the equipment and controls are fully secured/disengaged and equipment is "de-energized."	Standard Level D PPE (see Table 9-2)
	Manual Lifting	• CH2M HILL and subcontract personnel must notify the SUXOS/SM, SSHO/UXOSO, and/or CH2M HILL PM of pre-existing medical conditions that may be aggravated or re-injured by lifting activities, especially lifting operation involving repetitive motions. • When lifting objects, lift using knees, not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. Use heavy equipment to transfer heavy or awkward loads wherever possible. Have someone assist with the lift— especially for heavy (> 40 lbs.) or awkward loads. Do not attempt to manually lift objects that should be lifted with heavy equipment. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level.	Standard Level D PPE (see Table 9-2)
	Material Handling	• No loads (excavator bucket/boom) will be passed over ground personnel. • No ground personnel will walk under or in front of a suspended load.	Standard Level D PPE (see Table 9-2)
	Noise	• Personnel exposed to loud working environments must wear hearing protection.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker AHA 11 – Site Restoration			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Site Restoration - (cont.)	Overhead Utilities	• When using an excavator to install ESC measures, maintain proper separation between power transmission lines and overhead utilities during the operation of heavy equipment. See Electrical Safety (Section 9.5.16) for references to proper separation between operating equipment and power transmission lines/overhead utilities. Do not operate or swing heavy equipment booms or other components of operating heavy equipment toward overhead utilities. Be cognizant of utility pole guy wire positions. • Do not allow vehicles to raise their beds while underneath overhead utilities.	Standard Level D PPE (see Table 9-2)
	Pinched/Struck-by/ Caught-in-between	• Sufficient separation between ground support personnel and any operating heavy equipment must be maintained. • Wear reflective vests or high visibility clothing to promote visibility of ground personnel by equipment operators. • Isolate equipment swing areas from workers, fixed objects or other equipment. Ground personnel will avoid positioning themselves between fixed objects and operating equipment. Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. Stay out of the swing radius of operating heavy equipment. • Understand and review hand signals. Designate one person to provide hand signals to equipment operators performing lifting/hoisting operations. • Ensure equipment has operable back-up alarms. • Step away from heavy equipment when adjustments (positioning) are made. • Ensure heavy equipment operator has spotter for obstructed views and backing up. • If using trenching equipment, keep hands, feet and arms away from activated drive chains or belts of trenching equipment. Stop trenching operations if personnel approach active trenching equipment. • Ensure that all machine guards are in place to prevent contact with drive belts rotary action devices/blades of trenching machine etc. Do not modify safety features of the trenching machine. • Stay out of the "flip over radius" of operating vehicles. Do not stand on truck runner board when collecting fill delivery ticket from vehicle driver while the dump bed body of the vehicle is being raised or lowered.	Standard Level D PPE (see Table 9-2)
	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes, curbs, utility structures etc). Use sturdy hard-toed work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. Clean work areas as activities proceed. Clear-remove materials and debris from pathways and commonly traveled areas as soon as possible. • Three points of contact when entering/exiting equipment or when using stairways/ladders.	Standard Level D PPE (see Table 9-2)
	Suspended loaded	• Suspended loads will not be passed over ground personnel. • Ground personnel will not walk under or in front of suspended loads.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 11 – Site Restoration

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Site Restoration - (cont.)	Visible Lighting	• Perform tasks in daylight hours whenever possible. If dawn, dusk or dark work is to be performed, portable light must be provided to sufficiently illuminate work area(s).	Standard Level D PPE (see Table 9-2)
	Spill Prevention	• Ensure that spill control and spill clean-up and materials are on hand prior to initiating any heavy equipment or fueling operations to prevent entry into a watershed. • Only properly trained personnel should respond to/mitigate a spill or release with proper protective clothing and equipment. (Modified Level D or C).	Standard Level D PPE (see Table 9-2)
	Other	• Verify that EMS services are available and can respond in a prompt manner prior to the start of work. • Always use a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never use a phone or two way radio while driving due to the distraction these devices pose. • Buddy system maintained for all phases of work. • Base or Local Emergency Medical Service and Fire Dispatch numbers programmed into cellular phones. Have hospital route map readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately.	Standard Level D PPE (see Table 9-2)

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • First Aid/BbPK/CPR shield • Track excavator and/or bulldozer or loader • Vibratory compactor (~1 T or less) • Haul trucks • Spill Kit • Communication devices	• Visual Inspections of designated work areas to identify and address hazardous conditions. • Equipment inspections and maintenance. • Emergency Response Equipment Inspections (Fire Extinguishers, Eye Wash, First Aid/CPR etc.) • Inspections of hand tools (power) and extension cords if used.	• Review AHA with all task personnel • Review Site Specific Safety and Health Plan for new Site personnel. • First Aid/CPR • Supervisors - Construction Safety Training or equivalent • Heavy equipment operators qualified by previous training or experience.

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Safety Officer Name:	________________	____________________	**Date/Time:**________________
Site Personnel:	________________	____________________	**Date/Time:**________________
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CH2M HILL – Fort Rucker AHA 12 – Decontamination			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Equipment Cleaning & Management of Generated Waste	Adverse Weather	• Check internet, local TV weather or radio channels for daily forecasts and plan daily work activities accordingly. Have a portable radio available onsite to monitoring local weather forecasts. If onsite internet or radio monitoring are not available, for reach-back support check with office staff, who may be able to verify pending regional severe weather conditions. • Frequently observe the skyline for rain squalls and thunderstorm systems that may be developing. • Bring clothing suitable for anticipated daily weather conditions. • Shut down operations during heavy rain/lightning events or high wind conditions. For storms producing lightning, seek safe haven in a grounded structure or rubber-tired vehicle. Implement the 30–30 Rule : Take shelter when you can count 30 seconds or less between lightning and thunder. Remain sheltered for 30 minutes after the last thunder. • • Do not seek refuge under trees during electrical or high wind storm events. • Stay away from ravines and gullies during heavy rain events, because of the possibility of flash flood events. • Do not use telephones during electrical storms, except in the case of emergency.	Modified Level D or Level C (see Table 9-2)
	Biological	• Observe ground surfaces, enclosed structures, surrounding vegetation, and other site features for presence of spiders, bee/wasp hives, etc. • Where venomous snakes are known to inhabit or may be present, the use of snake guards must be evaluated. • Do not approach fresh or brackish water bodies that could contain alligators. • Where exposure to poisonous plants that have oils, berries or needle-like projections could cause skin irritations, infections or allergic reactions use disposable coveralls for protection. • Observe areas for presence of stinging insects. Prior to starting field activities, notify SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of known allergies to stinging insects and location of antidotes. • Use insect repellent with DEET or other insect repellent to deter being bit by mosquitoes or other stinging/biting insects. • Use permethrin or permanone on clothing only to deter tick bites. If this is ineffective, use light weight, white disposable clothing. • Tape pant legs to boots and ensure there are no open seams between boots and pant legs. • Avoid exposure to bloodborne pathogens. Use universal precautions against exposure.	Modified Level D or Level C (see Table 9-2)
	Cuts & Abrasions	• Wear cut resistant work gloves, when the possibility of lacerations or other injury may be caused by sharp edges of hand tools.	Modified Level D or Level C (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 12 – Decontamination

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Equipment Cleaning & Management of Generated Waste (cont.)	Chemical Exposure	• All personnel performing this task will be trained in accordance with 29CFR1910.120 and be enrolled in a medical monitoring program. • Do not allow dermal contact or incidental ingestion of impacted soil. Skin contact with contaminated water, soils, debris, or equipment will be avoided at all times. Do not kneel or step in potentially contaminated media (soil) without first donning proper PPE. • Exercise good hygiene practices. Always wash hands before eating, drinking, smoking and leaving site. Only eat, drink, smoke or chew tobacco in designated areas. • Do not allow onsite vehicle operators to climb into dump bed bodies without proper PPE. • Adhere to PPE and monitoring requirements identified in Section 9.5.12.	Modified Level D or Level C (see Table 9-2)
	Electrical Safety	• Do not connect car batteries directly to sampling devices for power. Use a generator, GCFI or other protected circuit. • If/when electrical extension cords are required to complete work, extension cords must be: • - Equipped with third-wire grounding. - Covered, elevated, or protected from damage when passing through work areas. - Protected from pinching if routed through doorways. - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools must have GFCIs installed. – Inspect all extension cords daily for structural integrity, ground continuity, and damaged insulation. – Kept out of water/liquids. – Electrical power circuits should be inspected before plugging in extension cords.	Modified Level D or Level C (see Table 9-2)
	Hand Tools	• Select and use the proper tool for the task. • Do not use tools that have been damaged or repaired in a manner which is not consistent with manufacturer's requirements.	Modified Level D or Level C (see Table 9-2)
	Fire Prevention	• Only smoke in designated areas. Designated area must be free of combustible/flammable materials. • Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Appropriately sized, easily accessible ABC fire extinguisher in work area. Fire extinguishers must be inspected monthly (inspection tag) and have an annual maintenance/inspection certification (tag) attached to the extinguisher. • Fire extinguishers will be approved by a nationally recognized testing laboratory and labeled to identify the listing and labeling organization and the fire test and performance standard that the fire extinguisher meets or exceeds.	Modified Level D or Level C (see Table 9-2)

CH2M HILL – Fort Rucker AHA 12 – Decontamination			
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**
Equipment Cleaning & Management of Generated Waste (cont.)	High Ambient Temperature	• Provide and drink fluids to prevent worker dehydration. • Minimize intake of caffeinated fluids. • Institute a proper work-break regimen in a cool area to avoid heat stress symptoms and overexertion. • Monitor for signs and symptoms of heat stress (maintain use of buddy system) when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress and especially when wearing disposable or other types of coveralls. 1) Heat Syncope = Sluggishness or fainting while standing erect or immobile in heat. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.* 2) Heat Rash = Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure. *Treatment = Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.* 3) Heat Cramps = Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake.* 4) Heat exhaustion = Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low. *Treatment = Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.* 5) Heat Stroke = Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature. *Treatment = Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!*	Modified Level D or Level C (see Table 9-2)
	Manual Lifting	• CH2M HILL and subcontract personnel must notify the SUXOS/SM, SSHO/UXOSO, and/or CH2M HILL PM of pre-existing medical conditions that may be aggravated or re-injured by lifting activities, especially lifting operation involving repetitive motions. • When lifting objects, lift using knees, not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. Use heavy equipment to transfer heavy or awkward loads wherever possible. Have someone assist with the lift— especially for heavy (> 40 lbs.) or awkward loads. Do not attempt to manually lift objects that should be lifted with heavy equipment. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. • Avoid carrying heavy objects above shoulder level. • Use drum dollies for the movement of drums used for the storage of wastes generated on the project.	Modified Level D or Level C (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 12 – Decontamination

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Equipment Cleaning & Management of Generated Waste (cont.)	Sample Handling	• Skin contact with contaminated water will be avoided at all times. • Caution should be exercised when filling bottles containing acid or base preservatives. Both liquid and vapor phases of acid can cause severe burns. • Following sample collection, sample container lids should be tightened securely to prevent leaks, and the containers should be rinsed with clean water to ensure that they are free of chemical constituents before labeling and placing them in the cooler for shipment to the laboratory. • Sample or open only labeled drums or drums known to contain generated waste materials. Unknown drums or drums that show evidence of excessive buckling/bulging, corrosion, vapors, crystallization, unusual discoloration or other abnormalities may not be sampled without the evaluation of engineering controls, proper PPE, air monitoring equipment and the use properly trained personnel familiar with the sampling of unknown drum contents. If there is any question about the proper handling or opening of drums, consult the SUXOS/SM, SSHO/UXOSO, and/or CH2M HILL PM. • Minimize transportation of drums or other containers with waste materials. • Follow proper decontamination procedures for sample equipment. Properly containerize, label, store and dispose of any decontamination wastes.	Modified Level D or Level C (see Table 9-2)
	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes, curbs, utility structures etc). Use sturdy hard-toed work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. Clean work areas as activities proceed. Clear-remove materials and debris from pathways and commonly traveled areas as soon as possible.	Modified Level D or Level C (see Table 9-2)
	Pressure Washing	• Inspect pressure washer before use and confirm “dead man switch” fully operational. • The wand must always be pointed at the work area. • The wand trigger should never be tied down in the open position. • Never point the wand at yourself or another worker. • The wand must be at least 42 inches from the trigger to the tip. • The operator must maintain good footing. • Non-operators must remain a safe distance from the operator. • No unauthorized attachment may be made to the unit. • Do not modify the wand. • All leaks or malfunctioning equipment must be repaired immediately or the unit taken out-of-service. • Rain gear (disposable coated chemical suits for HAZWOPER operations), 16-inch-high steel-toed rubber boots, safety glasses, hard hat with face shield, and inner and outer nitrile gloves should be worn, at a minimum during pressure washing operations.	Modified Level D or Level C (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 12 – Decontamination

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Equipment Cleaning & Management of Generated Waste (cont.)	Visible Lighting	• Perform tasks in daylight hours whenever possible. If dawn, dusk or dark work is to be performed, portable light must be provided to sufficiently illuminate work area(s).	Modified Level D or Level C (see Table 9-2)
	Vehicular Traffic	• Shut off and secure site vehicles prior to exiting them. Park on level ground where possible. If parking on an incline, engage parking brake. If the vehicle has a manual transmission, ensure the transmission is in gear (not neutral) and the parking brake is engaged before exiting the vehicle. • Exercise caution when exiting access road or parking along street— avoid sudden stops, use flashers, etc. • Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier. • All staff working adjacent to access road or within work area must wear reflective/high-visibility safety vests.	Modified Level D or Level C (see Table 9-2)
	Other	• Verify that EMS services are available and can respond in a prompt manner prior to the start of work. • Always use a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never use a phone or two way radio while driving due to the distraction these devices pose. • Buddy system maintained for all phases of work. • Base or Local Emergency Medical Service and Fire Dispatch numbers programmed into cellular phones. Have hospital route map readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately.	Modified Level D or Level C (see Table 9-2)

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Fire extinguisher (with fuel and electrical sources) • CSE Equipment Eye wash (small portable type) • Miscellaneous hand tools. • Pressure Washer • Drum Dolly • First Aid/BbPK/CPR shield • Communication devices	• Visual Inspections of designated work areas to identify and address hazardous conditions. • Emergency Response Equipment Inspections (Fire Extinguishers, Eye Wash, First Aid/CPR etc.) • Inspections of hand tools, generator and power cords, if used.	• Review AHA with all task personnel • Review Site Specific Safety and Health Plan for new site personnel. • First Aid/CPR • Supervisors - BBLPS, SC-HW (29 CFR 1910.120(e)(4) or equivalent • Training and medical surveillance in accordance with 29 CFR 1910.120

	PRINT	SIGNATURE	
Supervisor Name:	______________________	____________________________	**Date/Time:** ________________
Safety Officer Name:	______________________	____________________________	**Date/Time**________________
Site Personnel:	______________________	____________________________	**Date/Time:**________________
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CH2M HILL – Fort Rucker
AHA 13 – Demobilization

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
Demobilization (breakdown of work area & construction facilities)	Adverse Weather	• Check internet, local TV weather or radio channels for daily forecasts and plan daily work activities accordingly. Have a portable radio available onsite to monitoring local weather forecasts. If onsite internet or radio monitoring are not available, for reach-back support check with office personnel, who may be able to verify pending regional severe weather conditions. • Frequently observe the skyline for rain squalls and thunderstorm systems that may be developing. • Bring clothing suitable for anticipated daily weather conditions. • Shut down operations during heavy rain/lightning events or high wind conditions. For storms producing lightning, seek safe haven in a grounded structure or rubber-tired vehicle. Implement the 30–30 Rule : Take shelter when you can count 30 seconds or less between lightning and thunder. Remain sheltered for 30 minutes after the last thunder. • • Do not seek refuge under trees during electrical or high wind storm events. • Stay away from ravines and gullies during heavy rain events, because of the possibility of flash flood events. • Do not use telephones during electrical storms, except in the case of emergency.	Standard Level D PPE (see Table 9-2)
	Biological	• Observe ground surfaces, enclosed structures, surrounding vegetation, and other site features for presence of poisonous insects. • Where exposure to poisonous plants that have oils, berries or needle-like projections could cause skin irritations, infections, or allergic reactions, use disposable coveralls for protection. • Observe areas for presence of stinging insects. Prior to starting field activities, notify SUXOS/SM, SSHO/UXOSO, or CH2M HILL PM of known allergies to stinging insects and location of antidotes. • Do not approach fresh or brackish water bodies that could contain alligators. • Use insect repellent with DEET or other insect repellent to deter being bit by mosquitoes or other stinging/biting insects. • Tape pant legs to boots and ensure there are no open seams between boots and pant legs. • Avoid exposure to bloodborne pathogens. Use universal precautions against exposure.	Standard Level D PPE (see Table 9-2)
	Cuts/Abrasions	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp/cut edges or hand tools. • Avoid use of razor knives. When cutting with knives, cut away from the body and never towards another worker.	Standard Level D PPE (see Table 9-2)
Demobilization (breakdown of work area & construction facilities) (cont.)	Fire Prevention	• Use only metal safety cans for storage and transfer of fuel. • Use funnels and nozzles during fueling operations. • Keep appropriately sized, easily accessible ABC fire extinguishers in work area. • Fire extinguishers must be inspected monthly (inspection tag) and have an annual maintenance/inspection certification (tag) attached to the extinguisher. • Fire extinguishers will be approved by a nationally recognized testing laboratory and labeled to identify the listing and labeling organization and the fire test and performance standard that the fire extinguisher meets or exceeds. • Secure any applicable client facility/Local Fire Department Hot Work permit as necessary. • Only smoke in designated areas. Designated area must be free of combustible/flammable materials. • ASTs for heavy equipment fuel storage should have secondary containment capabilities.	Standard Level D PPE

CH2M HILL – Fort Rucker
AHA 13 – Demobilization

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Electric Safety	• Ensure that electric connections to temporary site facilities are performed by qualified/licensed electricians. • Verify electric power sources have been have undergone lock-out/tag-out process before being worked on. • Use double insulated or properly grounded electric power-operated hand tools • Inspect all extension cords daily for structural integrity, ground continuity, and damaged insulation • Keep all plugs and receptacles out of water/liquids. • Inspect all electrical power circuits prior to commencing work. • If/when electrical extension cords are required to complete work, extension cords must be: - Equipped with third-wire grounding. - Covered, elevated, or protected from damage when passing through work areas. - Protected from pinching if routed through doorways. - Not fastened with staples, hung from nails, or suspended with wire. - Extension cords and electrical power tools must have GFCIs installed. - Rated to handle the voltage/amperage of equipment.	Standard Level D PPE
	Hand & Power Tools	• Perform daily or more frequent inspections on power tools, as may be needed • Power tools will only be operated by personnel qualified by prior training or experience. • Ensure that a stable, level, dry work surface is available for the operation of power tools. • All required guards are in place, functioning and utilized. • Hand-held power tools equipped with constant pressure switch. Tools inspected before use. Maintain all tools in a safe condition. • Select and use the proper tool for the task. • Do not use tools that have been damaged or repaired in a manner which is not consistent with manufacturer's requirements.	Standard Level D PPE
Demobilization (breakdown of work area & construction facilities) (cont.)	Haul Trucks	• Haul truck operators should ensure all persons are clear before operating trucks or equipment. Before moving, operators should sound horn/back-up alarm. All equipment should be equipped with an operational back-up alarm. • Vehicles or equipment with restricted visibility should be equipped with devices that eliminate blind spots or a spotter must be provided. • Employees should stay off access roads. When approaching a haul area, employees should make eye contact and communicate their intentions directly with the equipment operator. • All vehicles must follow the designated access road established for the site.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 13 – Demobilization

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	High Ambient Temperature	• Provide and drink fluids to prevent worker dehydration. • Minimize intake of caffeinated fluids. ▪ Institute a proper work-break regimen in a cool area to avoid heat stress symptoms and overexertion. ▪ Monitor for signs and symptoms of heat stress (maintain use of buddy system) when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress and especially when wearing disposable or other types of coveralls. 1) Heat Syncope = Sluggishness or fainting while standing erect or immobile in heat. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.* 2) Heat Rash = Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure. *Treatment = Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.* 3) Heat Cramps = Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours. *Treatment = Remove to cooler area. Rest lying down. Increase fluid intake.* 4) Heat exhaustion = Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low. *Treatment = Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.* 5) Heat Stroke = Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature. *Treatment = Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!*	Standard Level D PPE (see Table 9-2)
Demobilization (breakdown of work area & construction facilities) (cont.)	Heavy Equipment	• Seat belts or other restraint system will be used by heavy equipment operators. • Perform daily maintenance and inspections on operating equipment. Keep documentation onsite. • Use caution around pressurized lines/hoses. Inspect hoses daily for cuts, abrasions and wear. • Equipment will only be operated by personnel qualified by prior training or experience. • Ensure that a stable ground surface is available for the operation of heavy equipment. • Equipment operators will not leave the cab of the equipment while they are lifting/controlling a load unless the load has been delivered to its intended transport location or the load has been fully secured (no potential for rolling onto or crushing ground personnel) and the equipment and controls are fully secured/disengaged and equipment is "de-energized."	Standard Level D PPE (see Table 9-2)
	Manual Lifting	• CH2M HILL and subcontract personnel must notify the SUXOS/SM, SSHO/UXOSO, and/or CH2M HILL PM of pre-existing medical conditions that may be aggravated or re-injured by lifting activities, especially lifting operation involving repetitive motions. • When lifting objects, lift using knees, not back. For repetitive lifting tasks, the use of lifting braces/supports may be considered. Use heavy equipment to transfer heavy or awkward loads wherever possible. Have someone assist with the lift— especially for heavy (> 40 lbs.) or awkward loads. Do not attempt to manually lift objects that should be lifted with heavy equipment. • Plan storage and staging to minimize lifting or carrying distances. Make sure the path of travel is clear prior to the lift. Avoid carrying heavy objects above shoulder level.	Standard Level D PPE (see Table 9-2)
	Noise	• Personnel exposed to loud working environments must wear hearing protection.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 13 – Demobilization

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Overhead Utilities	• Maintain proper separation between power transmission lines and overhead utilities during the operation of heavy equipment. See Electrical Safety (Section 9.5.16) for references to proper separation between operating equipment and power transmission lines/overhead utilities. • Do not operate or swing heavy equipment booms or other components of operating heavy equipment toward overhead utilities. Be cognizant of utility pole guy wire positions.	Standard Level D PPE (see Table 9-2)
	Slips, Trips, Falls	• Be aware of poor footing, potential slipping/tripping hazards in the work area, such as wet/steep slopes, stumps/roots, unprotected holes, ditches, rip rap, utilities, ground protrusions. Observe and avoid areas of unprotected holes, ramps and ground penetrations or protrusions (stumps, roots, holes, curbs, utility structures etc). Use sturdy hard-toed work boots with sufficient ankle support. • Institute and maintain good housekeeping practices. Clean work areas as activities proceed. Clear-remove materials and debris from pathways and commonly traveled areas as soon as possible. • Three points of contact when entering/exiting equipment or when using stairways/ladders.	Standard Level D PPE (see Table 9-2)
Demobilization (breakdown of work area & construction facilities) (cont.)	Pinched/Struck-by/ Caught-in-between	• Sufficient separation between ground support personnel and any operating heavy equipment must be maintained. • Wear reflective vests or high visibility clothing to promote visibility of ground personnel by equipment operators. • Isolate equipment swing areas from workers, fixed objects or other equipment. Ground personnel will avoid positioning themselves between fixed objects and operating equipment. Make/maintain eye contact with operators before approaching equipment. Do not approach equipment from rear or from blind spot of operator. Stay out of the swing radius of operating heavy equipment. • Understand and review hand signals. Designate one person to provide hand signals to equipment operators performing lifting/hoisting operations. • Ensure equipment has operable back-up alarms. Ensure heavy equipment operator has spotter for obstructed views and backing up. • Step away from heavy equipment when adjustments (positioning) are made.	Standard Level D PPE (see Table 9-2)

CH2M HILL – Fort Rucker
AHA 13 – Demobilization

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment
	Spill Prevention	• Ensure that spill control and spill clean-up and materials are on hand prior to initiating any heavy equipment or fueling operations to prevent entry into a watershed. • **Understand notification processes in the event a spill occurs. If a spill should occur, implement the following:** – Ensure all unnecessary persons are removed from the hazard area. Determine the major components in the waste at the time of the spill. – Put on protective clothing and equipment (see Table 9-2). – Only properly trained personnel should respond to/mitigate a spill or release. – If a flammable/combustible material is involved, remove all ignition sources, and use spark- and explosion-proof equipment for recovery of material. – Remove all surrounding materials that could be especially reactive with materials in the waste. – If wastes reach a storm or sewer drain, dam the outfall by using sand, earth, sandbags, etc. Pump this material out into a temporary holding tank or drums as soon as possible. – Place all small quantities of recovered liquid wastes (55 gallons or less) and impacted soil into drums for incineration or removal to an approved disposal site. – Apply appropriate spill control media (e.g. clay, sand, lime, etc.) to absorb discharged liquids. – For large spills, establish diking around leading edge of spill using booms, sand, clay or other appropriate material. If possible, use diaphragm pump to transfer discharged liquid to drums or holding tank.	Standard Level D PPE (see Table 9-2)
	Visible Lighting	• Perform tasks in daylight hours whenever possible. If dawn, dusk or dark work is to be performed, portable light must be provided to sufficiently illuminate work area(s).	Standard Level D PPE
Demobilization (breakdown of work area & construction facilities) (cont.)	Vehicular Traffic	• Shut off and secure site vehicles prior to exiting them. Park on level ground where possible. If parking on an incline, engage parking brake. If the vehicle has a manual transmission, ensure the transmission is in gear (not neutral) and the parking brake is engaged before exiting the vehicle. • Exercise caution when exiting access road or parking along street— avoid sudden stops, use flashers, etc. • Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier. • All staff working adjacent to access road or within work area must wear reflective/high-visibility safety vests.	Standard Level D PPE
	Overhead Utilities	• Maintain proper separation between power transmission lines and overhead utilities during the operation of heavy equipment. See Electrical Safety (Section 9.5.16) for references to proper separation between operating equipment and power transmission lines/overhead utilities. • Do not operate or swing heavy equipment booms or other components of operating heavy equipment toward overhead utilities. Be cognizant of utility pole guy wire positions.	Standard Level D PPE
	Other	• **Verify that EMS services are available and can respond in a prompt manner prior to the start of work.** • Always use a seat belt while driving on military/government facilities. Always observe posted speed limits, traffic signs and signals. Never use a cell phone or two way radio while driving due to the distraction these devices pose. • Buddy system maintained for all phases of work. • Base or Local Emergency Medical Service and Fire Dispatch numbers programmed into cellular phones. Have hospital route map readily available. • Report all unsafe conditions and acts, injury/illness or property damage to supervisors immediately.	Standard Level D PPE

CH2M HILL – Fort Rucker
AHA 13 – Demobilization

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Fire extinguisher (with fuel and electrical sources) • Eye wash (small portable type) • Miscellaneous power and manual hand tools. • First Aid/BbPK/CPR shield • Extension cords • Spill Kit • Haul trucks (delivered heavy equipment or materials) • Heavy Equipment (earth moving)	• Visual Inspections of designated work areas to identify and address hazardous conditions. • Equipment inspections and maintenance. • Emergency Response Equipment Inspections (Fire Extinguishers, Eye Wash, First Aid/CPR etc.) • Inspections of hand tools (power) and extension cords if used.	• Review AHA with all task personnel • Review Site Specific Safety and Health Plan for new site personnel. • First Aid/CPR • Supervisors - BBLPS, SSHO/UXOSO or equivalent • Power tool and heavy equipment operators qualified by previous training or experience. • Supervisors – 10 hr Construction Safety Training or equivalent

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Supervisor Name:	______________	______________	**Date/Time:**__________
Safety Officer Name:	______________	______________	**Date/Time:**__________
Site Personnel:	______________	______________	**Date/Time:**__________
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11.0 Plans, Programs, and Procedures

11.1 Layout Plans

Site location maps and figures are included in the Work Plan and are not duplicated herein.

11.1.1 Emergency Response Plans

Procedures and Tests

It is the intention of the project team to verify that emergency response processes are in place and capable of being executed, prior to the start of field assignments. However, because response to medical or fire emergencies will be by Fort Rucker personnel or even by outside public responders, it may be impractical and disruptive to the primary mission of these responders to perform procedural response testing. In this case, the designated responsible party (SUXOS/SM or SSHO/UXOSO) will verify that emergency services are available for response, that contact information is appropriate, and that responders know how to access anticipated work areas.

Spill Plans

The initial response to any spill or discharge will be to protect human safety and health, and then the environment. Identification, containment, treatment, and disposal assessment will be the secondary response.

If for some reason a chemical spill is not contained within a dike or sump area, an area of isolation will be established around the spill. The size of the area will generally depend on the size of the spill and the materials involved. If the spill is large (greater than 55 gallons) and involves a tank or a pipeline rupture, an initial isolation of at least 100 ft in all directions will be used. Small spills (less than or equal to 55 gallons) or leaks from a tank or pipe will require evacuation of at least 50 ft in all directions to allow cleanup and repair and to prevent exposure. When any spill occurs, only those persons involved in overseeing or performing emergency operations will be allowed within the designated hazard area. If possible, the area will be roped off or otherwise blocked.

If the spill results in the formation of a toxic vapor cloud (by reaction with surrounding materials or by outbreak of fire) and its release (due to high vapor pressures under ambient conditions), further evacuation must be engaged. In general, an area at least 500 ft wide and 1,000 ft long will be evacuated downwind if volatile materials are spilled. (Consult the DOT Emergency Response Guide for isolation distances for listed hazardous materials.)

If an incident may threaten the health or safety of the surrounding community, the public will be informed (via proper local and state emergency management planning agencies) and possibly evacuated from the area. The onsite emergency coordinator will inform the proper agencies in the event this is necessary. A Project Emergency Contact List is provided in Attachment 9.

Spills or releases of oil or hazardous materials to appropriate agencies and stakeholders (i.e. USEPA, ADEM) must be reported when spilled or released quantities of oil or hazardous materials are in excess of established Reportable Quantities (RQs) for the material in question**.** It is understood that appropriate stakeholder notification contacts will be identified at the project Pre-Construction Conference and incorporated for reference, herein in the Emergency Contact List, in the final executed version of this APP/SSHP.

In a spill or release response/containment, personnel will take the following measures:

- Immediately warn any nearby workers and notify individual responsible for site operations.
- Assess the spill area to ensure that it is safe to respond.
- Evacuate area if spill presents an emergency.
- Provide notification to project stakeholders.
- Ensure all unnecessary persons are removed from the hazard area.
- Put on protective clothing and equipment.
- If a flammable material is involved, remove all ignition sources, and use only spark- and explosion-proof equipment for recovery of material.
- Remove all surrounding materials that could be especially reactive with materials in the waste. Determine the major components in the waste at the time of the spill.
- Stop the source of spill.
- Establish site control for the spill area.
- If wastes reach a storm sewer, dam the outfall by using sand, earth, sandbags, etc. Pump this material out into a temporary holding tank or drums as soon as possible.
- Place all small quantities of recovered liquid wastes (55 gallons or less) and impacted soil into drums for incineration or removal to an approved disposal site.
- Spray the spill area with foam, if available, if volatile emissions may occur.
- Apply appropriate spill control media (e.g., clay, sand, lime) to absorb discharged liquids.
- For large spills, establish diking around leading edge of spill using booms, sand, clay, or other appropriate material. If possible, use diaphragm pump to transfer discharged liquid to drums or holding tank. Follow proper ground and bonding procedures of equipment during recovery efforts. Intrinsically safe equipment must be used in recovery operations.

11.1.1.1 Anticipated Hazardous Materials

The following is a list of hazardous materials or chemicals that may be brought onsite and incorporated as part of the final completion of the work, generated during the execution of the work for offsite disposal or recycling or otherwise used to facilitate site work. These hazardous materials or chemicals may require spill prevention, control, and countermeasures to ensure that watersheds are not adversely impacted in the event of a spill or release of these materials.

- Gasoline (small metal safety containers for fueling small engine equipment).
- Diesel fuel in heavy equipment and potentially in a 550-gallon AST.
- Minor quantities of sample preservatives (e.g., nitric acid, hydrochloric acid, sulfuric acid, sodium hydroxide/zinc acetate, phosphoric acid).
- Stockpiled contaminated debris
- Marking Paint
- Minor quantities of grease, motor oil and hydraulic fluid
- Insect repellent(s)

11.1.1.2 Notification

In the event a spill occurs that requires notification, personnel will follow the CH2M HILL Incident Notification Process and Chain of Command structure identified in Section 4.

In addition, the CH2M HILL PM will make notification to Fort Rucker such that additional appropriate community and/or federal/state agencies may be engaged and notified, as applicable. The CH2M HILL PM will coordinate with Fort Rucker for support with regard to adhering to local, state, or federal regulations for spill notification, clean-up, and closure requirements.

11.1.1.3 Firefighting Plan

CH2M HILL personnel are not considered firefighters. Only small/containable (incipient) fires that are containable by the use of first response fire protection equipment may be controlled by CH2M HILL personnel. All other response will be considered firefighting measures and will be conducted by facility-provided or public agency firefighting teams.

Fire prevention measures and first response fire protection equipment training will be conducted in accordance with the information in Sections 9.2 and 9.5.19.

11.1.1.4 Posting of Emergency Telephone Numbers

Emergency contact numbers appropriate to project operations are included in Attachment 9 of this APP/SSHP in the Emergency Contact List. Where temporary site facilities are established at the project site, this Emergency Contact List will be posted in a conspicuous location. Where temporary site facilities are not allowed or provided, the list will be available for quick reference by the individual(s) responsible for site operations and location will also be made known to other site personnel.

11.1.1.5 Wild Land Fire Prevention Plan

N/A - Project activities at Fort Rucker will not involve prescribed or planned burning of wild lands and, therefore, a wild land fire prevention plan is not required.

11.1.1.6 Man Overboard / Abandon Ship

N/A -Project activities at Fort Rucker will not involve water craft and, therefore, a man overboard/abandon ship plan is not required.

11.1.2 Hazard Communication Program

Details on hazard communication training are presented in Section 9.6.

11.1.3 Respiratory Protection Program

N/A –Levels and characteristics of site MC do not require a respiratory protection program. If unexpected conditions are encountered, the need for a respiratory protection program will be evaluated.

11.1.4 Health Hazard Control Program

The health hazard controls for the project are described in Section 9.5.

11.1.5 Lead Abatement Plan

N/A – historical data from the site does not indicate significant lead levels in soil. Additionally, there will be limited disturbance of surface and subsurface media. If unexpected conditions are encountered, the need for a lead abatement plan will be evaluated.

11.1.6 Asbestos Abatement Plan

N/A - Contact with asbestos-containing materials is not anticipated as part of the operations to be conducted at Fort Rucker.

11.1.7 Abrasive Blasting Plan

N/A - Project activities at Fort Rucker will not involve abrasive blasting and, therefore, an abrasive blasting plan is not required.

11.1.8 Confined Space Entry

N/A – Project activities at Fort Rucker will not require CSE.

11.1.9 Hazardous Energy Control Plan

N/A – Project activities at Fort Rucker will not require hazardous energy control measures (e.g., lock-out and tag-out procedures).

11.1.10 Critical Lift Procedures

N/A - Project activities at Fort Rucker will not involve critical lifting.

11.1.11 Contingency Plan for Severe Weather

Severe weather is defined as high winds, electrical storms, tornadoes, extremely hot weather (> 100°F), or extremely cold weather (< 0°F). In the event that such conditions arise, it will likely be necessary to cease operations and possibly evacuate the site. The SSHO/UXOSO is responsible for monitoring the weather and, should severe weather conditions threaten, the SSHO/UXOSO is responsible for deciding whether site operations should be halted. More information involving severe weather is detailed in Section 9.5.2 and Attachment 8.

11.1.12 Access and Haul Road Plan

All roads used at Fort Rucker will be maintained in a safe working condition to reduce potential hazards involving vehicles or heavy equipment. Though not anticipated, the construction of any new roadways at Fort Rucker will require a plan to be submitted to USACE. The submitted plan will address requirements outlined in EM 385-1-1.

11.1.13 Structural Demolition Plan

N/A - Project activities at Fort Rucker will not involve the demolition of any structures or improvements and, therefore, a structural demolition plan is not required.

11.1.14 Emergency Rescue (Tunneling)

N/A - Project activities at Fort Rucker will not involve tunneling and, therefore, emergency rescue procedures for tunneling are not required.

11.1.15 Underground Construction Fire Prevention and Protection Plan

N/A - Project activities at Fort Rucker will not involve underground construction and, therefore, an underground construction fire prevention and protection plan is not required.

11.1.16 Compressed Air Plan

N/A - Project activities at Fort Rucker will not involve compressed air and, therefore, a compressed air plan is not required

11.1.17 Formwork and Shoring Erection and Removal Plan

N/A - Project activities at Fort Rucker will not involve concrete and masonry construction and, therefore, a formwork and shoring erection and removal plan is not required.

11.1.18 Jacking Plan (Lift)

N/A - Project activities at Fort Rucker will not involve lift-slab operations and, therefore, a jacking plan is not required.

11.1.19 Blasting Plan

N/A - Project activities at Fort Rucker will not involve blasting operations and, therefore, a blasting plan is not required.

11.1.20 Diving Plan

N/A - Project activities at Fort Rucker will not involve diving operations and, therefore, a diving plan is not required.

11.1.21 Prevention of Alcohol and Drug Abuse

CH2M HILL is committed to ensuring a safe and healthy work environment for all of its employees. Employees who work under the influence of controlled substances, drugs, or alcohol may prove to be dangerous or otherwise harmful to themselves, other employees, clients, the company, the company's assets and interests, or the public. CH2M HILL does not tolerate illegal drug use, or any use of drugs, controlled substances, or alcohol that impairs an employee's work performance or behavior.

CH2M HILL has established a policy that its employees and subcontractors will not be involved in any manner with the unlawful manufacture, distribution, dispensation, possession, sale, or use of illegal drugs in the workplace. The use or possession of alcohol in the workplace is also prohibited. Any violation of these prohibitions may result in discipline or immediate discharge.

11.1.22 Fall Protection Plan

N/A - Project activities at Fort Rucker will not involve working at elevation and, therefore, a fall protection plan is not required.

11.1.23 Steel Erection Plan

N/A - Project activities at Fort Rucker will not involve steel erection and, therefore, a steel erection plan is not required.

11.1.24 Night Operations Lighting Plan

All field operations at Fort Rucker will be performed during daylight hours (dawn to dusk) and, therefore, a night operations lighting plan is not required.

11.1.25 Site Sanitation Plan

Site sanitation measures are addressed in Section 9.4.

11.1.26 Fire Prevention Plan

11.1.26.1 General

Sources

Although fires and explosions may arise spontaneously, they are more commonly the result of carelessness during the conduct of site activities, such as moving drums, mixing/bulking of site chemicals, and during refueling of heavy or hand-held equipment. Other potential causes of explosions and fires include:

- Mixing of incompatible chemicals, which cause reactions that spontaneously ignite due to the production of both flammable vapors and heat.
- Ignition of explosive or flammable chemical gases or vapors by external ignition sources.
- Ignition of materials due to oxygen enrichment.
- Agitation of shock- or friction-sensitive compounds.
- Sudden release of materials under pressure.

To ensure adequate fire protection, the SSHO/UXOSO will inspect the site to ensure all flammable and combustible materials are being safely stored in appropriately configured storage areas and containers. The SSHO/UXOSO will also ensure that no flammable/ combustible materials are stored near any sources of ignition, and that sources of ignition are removed a safe distance from storage areas. If needed, storage areas will be segregated from the remainder of the site through the use of flagging. Portable fire extinguishers will be located onsite.

Explosions and fires not only pose the obvious hazards of intense heat, open flames, smoke inhalation, and flying objects, but may also cause the release of toxic chemicals into the environment. Such releases can threaten both personnel onsite and members of the general public living or working nearby. Site personnel involved with potentially flammable material or operations will follow the guidelines listed below and in EM 385-1-1, Section 9, to prevent fires and explosions:

- Potentially explosive/flammable atmospheres involving gases or vapors will be monitored using a combustible gas indicator.
- Prior to initiation of site activities involving explosive/flammable materials, all potential ignition sources will be removed or extinguished.
- Non-sparking and explosion-proof equipment will be used whenever the potential exists for ignition of flammable/explosive gases/vapors/liquids.
- Dilution or induced ventilation may be used to decrease the airborne concentration of explosive/flammable atmospheres.
- Smoking will be prohibited at, or in the vicinity of, operations which may present a fire hazard, and the area will be conspicuously posted with signs stating "No Smoking or Open Flame within 50 Feet."
- Flammable and/or combustible liquids must be handled only in approved, properly labeled metal safety cans equipped with flash arrestors and self-closing lids.
- Transfer of flammable liquids from one metal container to another will be done only when the containers are bonded.
- The motors of all equipment being fueled will be shut off during the fueling operations.
- Metal drums used for storing flammable/combustible liquids will be equipped with self-closing safety faucets, vent bung fittings, grounding cables and drip pans, and will be stored outside buildings in an area approved by the SSHO/UXOSO.
- Outdoor flammable/combustible materials storage areas will be: lined and surrounded by a dike of 12 inches in height, and of sufficient volume to contain 110 percent of the stored materials; located 50 ft from buildings; and kept free of weeds, debris, and other combustible materials.

11.1.26.2 Fire Extinguishers

At minimum, a 20-lb or two 10-lb portable ABC fire extinguishers will be located onsite.

The four classes of fire, along with their constituents, are as follows:

- Class A - Wood, cloth, paper, rubber, many plastics, and ordinary combustible materials.
- Class B - Flammable liquids, gases, and greases.
- Class C - Energized electrical equipment.
- Class D - Combustible metals such as magnesium, titanium, sodium, and potassium.

Examples of proper extinguishing agents are as follows:

- Class A Water or ABC Dry Chemical
- Class B ABC Dry Chemical
- Class C ABC Dry Chemical
- Class D Metal-X Dry Chemical (not anticipated onsite.)

11.1.27 CH2M HILL Information

Exposure to certain project specific hazards in the work place may include injury/accidents, occupational illnesses or property damage due to execution of a variety of assigned tasks or as a result of existing site conditions. This section is provided to aid in the recognition of potential specific and general project hazards and identify procedures and practices to be implemented on the job site that may reduce or eliminate accidents/injuries/occupational illnesses and property damage that may be attributed to identified project hazards. All CH2M HILL personnel are required to contact the SSHO/UXOSO or Safety and Health Manager regarding any questions or concerns to ensure the execution of this task order in a healthy and safe manner.

The following areas/activities are not specifically covered under this APP/SSHP and must not be performed unless this APP/SSHP is amended and approved accordingly.

- Areas presenting exposed energized electrical equipment.
- Areas where there is an unprotected (e.g., no guardrail) fall exposure greater than 4'.
- Activities where potential radiological exposure hazards may exist
- Exposure to chemicals not identified by this APP/SSHP.

The assumption set for the development of this APP/SSHP is that CH2M HILL site personnel and subcontractors controlled by CH2M HILL who may be covered by this APP/SSHP, will not be exposed to chemical products that may be used in operational processes, in excess of established OELs while executing their assigned tasks. This assumption is based on the following:

- Site personnel will execute good personal hygiene practices to facilitate a negative exposure to identified site MC via incidental dermal or ingestion exposure vectors.
- Where use of PPE is specified, it will be used in accordance with Sections 9.5.12 and 10.6.
- Work is being performed in an open air, well ventilated environment, and there is overall low risk potential for exposure to site MC at levels exceeding OELs based on the following:
  - the relatively low overall concentrations of identified site MC in as related to the established OELs associated with identified site MC.

  - low volatilization "potential" of identified site MC that may be encountered during the execution of intrusive site operations is not anticipated to generate worker exposures to site MC in excess of established OELs while performing their assigned duties.
- There is no potential worker exposure to radiological hazards, biological waste or CWA in connection with this project.

In the event that the above assumption set is not verified, the conditions of this APP/SSHP will be re-evaluated and amended as necessary to address applicable hazards that may be associated with newly encountered project conditions or newly defined project tasks. In the event that recorded air monitoring data indicates that site workers are or may be exposed to site MC concentrations in excess of established OELs, work will cease until such engineering or administrative control measures and/or PPE are implemented to reduce potential worker exposures to acceptable levels.

11.1.28 Regulatory Compliance Policy

It is the intention of CH2M HILL to adhere to federal, state, local, DoD, US Army, USACE, and client (Fort Rucker) requirements that are applicable to assigned contract work regarding the Safety and Health of employees. It is the responsibility of all personnel to perform all work in accordance with established program requirements. All project personnel will immediately bring any condition regarding safety and health compliance to the attention of supervisory personnel.

CH2M HILL will also endeavor to ensure that its procured subcontractors adhere to applicable regulatory compliance, by verifying safety performance records, relevant training, and medical surveillance, as applicable.

11.1.29 Medical Surveillance

All employees who perform work at hazardous waste sites or perform emergency response in accordance with 29 CFR 1910.120(a)(1)(i)-(v)/29 CFR 1926.65(a)(1)(i)-(v) will be subject to the CH2M HILL medical surveillance program requirements. This program conforms to the requirements established by 29 CFR 1910.120/1926.65 (f), medical surveillance.

11.1.30 State, OSHA, and Other Regulations

Where state regulations or other requirements differ from federal regulation cited in this plan, the more stringent regulation will apply.

11.1.31 Changes

Any user of this plan is welcome to recommend changes. Changes normally result from finding errors, regulatory changes, equipment modification, new equipment purchases, and changes to operation procedures or site conditions. Following is the format for making a recommended change:

Submit a written recommendation to the project Safety and Health Manager via your immediate supervisor. The Safety and Health Manager will review the recommendation and approve as necessary.

After review, the Safety and Health Manager will determine if the suggestions should be included as an amendment or as new procedure in this plan. Changes to this plan will be distributed immediately upon approval.

11.1.32 Site-Specific Hazards and Controls

Requirements for completing Pre-Task Safety Plans, Daily Tailgate Safety Meetings, and health analyses for onsite work must be, at a minimum, in accordance with Sections 4.3 and 6.4of this APP/SSHP. AHA documents applicable to this project are included in Section 10.6.

The SUXOS/SM or SSHO/UXOSO will conduct Daily Site Safety Meetings at the start of each work shift for onsite personnel and periodic work phase meetings. The SUXOS/SM or SSHO/UXOSO must require subcontractors to follow similar meeting procedures or participate in CH2M HILL's daily safety meetings or work phase meetings, as necessary.

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Attachment 1
APP/SSHP Acknowledgement Form

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Accident Prevention Plan/Health and Safety Plan

ACKNOWLEGEMENT FORM

CH2M HILL Contract W91ZLK-05-D-0014

Contractor project employees and subcontractors listed below have been provided with a copy of this Health and Safety Plan, have read or been briefed on its contents and agree to abide by its provisions.

Project Name: MEC RFI, Fort Rucker, AL **Task Order:** 0001

EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

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Attachment 2
Project Safety and Health Tracking and Deficiency Forms

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Subcontractor S&H Tracking Form

Project Name: MEC RFI, Fort Rucker, AL **Contract #: W91ZLK-05-D-0014, TO 0001** **Date:**

Subcontractor		**Completed as Needed**						**Completed Within the Last 12 Months**		
Name	Company	40-hour Training	8-hour Site Supervisor Training	Confined Space Entry Training	FA/CPR /BBP	Hazard Specific Training	Equipment Specific Training	Med Clearance	Fit Test	8-hour Refresher Training
		Enter “√” if Completed						Enter Date Last Completed		

Hazard Specific Training may include Hazcom, asbestos, lead, fall protection, electrical, lock-out tag-out, drilling, demolition, etc.
Equipment Specific Training may include Industrial (fork) truck, aerial lift, crane, portable extinguisher, respirator, scaffolding, etc.
Medical Clearance documents must **not** include actual medical reports. Only accept a signed physician’s statement of fitness to work.

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Safety and Occupational Health Deficiency Tracking Log

Project Name: MEC RFI, Fort Rucker, AL **Contract: W91ZLK-05-D-0014, TO 0001**

Item	Date Identified	Identified By	Deficiency Description	Resolution Date	Corrected By	Actual Correction Date
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

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Attachment 3
Pre-Task Safety Plan (example only)

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DAILY PRE-TASK SAFETY PLAN (PTSP)
Page 1 of 3

Project:____________________ Location: _______________________________ Date:__________
Site Safety & Health Officer: ______________ Job Activity: ____________________ Site #:_________

Task Personnel:
____
____
____

List Tasks:
____
____

Tools/Equipment/Materials required (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools, cords, generators, compressed gases, regulated chemical products, etc.):
____
____
____

Potential H&S Hazards, including chemical, physical, safety, biological and environmental (Check all that apply):

_X_ Chemical burns/contact Dermal protection (hands), eye protection. See HSP for PPE requirements per task.	__ Trench, excavations, cave-ins	__Ergonomics
__ Pressurized lines/equipment	X_ Overexertion Work/break regiment as dictated by task. Maintain fluid intake for hydration	_X_ Chemical splash Use PPE in accordance with HSP. Protect hands from splash during decon. activities.
_X_Thermal burns Watch for warm engine/muffler components on generators.	__ Pinch points	X Poisonous plants/insects Review HSP for identification of poisonous snakes in the geographic area. Long sleeves in areas where poison ivy, sumac or oak may exist. Use insect repellent. Tape pant legs to boots (ticks).
X_ Electrical GCFIs for generators, Inspect. & protect extension cords, cords rated for use & have 3rd wire grounding	X_Cuts/abrasions Do not use razor knives. Cut away from body. Identify and avoid rusty/jagged or sharp surfaces from above ground features (brush, pipe chases/supports, utility structures, doors)	X_ Eye hazards/flying projectile Use eye protection at all times. Ensure head protection is used in areas where heavy brush, trees, thorns, vines exist when accessing well heads.
__ Weather conditions Foul and cold weather clothing as dictated by expected conditions	X_ Spills Use funnels & nozzles during fueling of generators.	__ Inhalation hazard
__Heights/fall> 6'	__ Overhead Electrical hazards	X_ **Heat**/cold stress Work/break regiment as dictated by heat exposure Provide sufficient fluids for employee intake. Recommended employees begin with 16 oz. of water before initiating field work.
X_Noise Use hear protection in loud work environments	__ Elevated loads	__ Water/drowning hazard
X_Explosion/fire Metal safety cans for fuel storage, No open flame, sparks ignition in hazardous/flammable/ combustible storage areas. Let engine surfaces cool before fueling.	X_ Slips, trip and falls Exercise good general housekeeping practices Identify/remove slip/trip falls hazards in work area. Watch for and avoid holes, ground protrusions. Watch for entanglement of feet around vines and brush.	__ Heavy equipment
X_ Radiation Solar. UV protection on skin and UV eye protection. ANSI rated safety eye protection only.	X_Manual lifting >50 lbs or awkward loads, get assistance. If employee not capable of lifting 40 lbs. seek assistance.	__ Aerial lifts/platforms
__ Confined space entry	__Welding/cutting	__ Demolition

Continue on page 3 of 3 (if necessary)

Hazard Control Measures (Check all that apply):

PPE
X_ Head protection
__ Face protection
X_Hard toe work boots
__ Thermal/lined
X_ Eye
X_Dermal/hand
__ Hearing
__ Respiratory
X_Reflective vests

Protective Systems
__ Locate buried utilities
__ Competent person
__ Daily inspections
__ Sloping
__ Shoring
__ Trench box
__ Barricades

Fire Protection
__ Fire extinguishers
__ Fire watch
__ Non-spark tools
__ Grounding/bonding
__ Intrinsically safe equipment
__Combustible materials storage
__Chemical Storage

Electrical
__ Lock-out/tag-out
__ Grounded
__ Panels covered
X_GFCI/extension cords
__ Power tools/cord inspected
__Insulated tools/gloves

Fall Protection
__ Harness/lanyards
__ Adequate anchorage
__ Guardrail system
__ Covered opening
__ Fixed barricades
__ Warning system

Air Monitoring
__ PID/FID
__ Detector tubes
__ Radiation
__ Personnel sampling
__ LEL/O2
__ Other

Proper Equipment
__ Aerial lift/ladders/scaffolds
__ Forklift/ Heavy equipment
__ Backup alarms
__ Hand/power tools
__ Crane w/current inspection
__ Proper rigging
__ Operator qualified

Welding & Cutting
__ Cylinders secured/capped
__ Cylinders separated/upright
__ Flash-back arrestors
__ No cylinders in CSE
__ Flame retardant clothing
__ Appropriate goggles

Confined Space Entry
__ Isolation
__ Air monitoring
__ Trained personnel
__ Permit completed
__ Rescue provisions

Medical/Emerg. Response
X_ First-aid & BBP kit
X_Eye wash
X_FA-CPR training
X_Route to hospital

Heat/Cold Stress
X_Work/rest regime
X_ Rest area
X_Liquids available
X_Monitoring
__ Training

Vehicle/Traffic
__ Traffic Awareness
__Traffic control
__ Barricades
__ Flags
__ Signs

Permits
__ Hot work
__ Confined space
__ Lock-out/tag-out
__ Excavation
__ Demolition
__ Energized work
__Local/Environmental

Demolition
__ Pre-demolition survey
__ Structure condition
__ Isolate area/utilities
__ Competent person
__ Hazmat present

Inspections
__ Ladders/aerial lifts
__ Lanyards/harness
__ Scaffolds
__ Heavy equipment
__Cranes and rigging
__Other per Field Safety Plan

Training
X_ Hazwaste
__ Construction
__Equipment
__ Competent person
X_Task-specific (AHA)
X_ Hazcom

FieldNotes:____

Additional Space for Project Specific Hazard Awareness (if necessary):

1) Observe facility posted speed limits.
2) Wear seat belts in vehicles while on Client facilities. military facility access privileges
3) Do not use cell phones or two way radios while driving or actively operating equipment on government/militaryfacilities.
4) Failure to do so may result in loss of driving privileges on client facilities.
5) Report all accidents/injuries and property damage to the Site Manager and Project Manager immediately
6) Maintain hospital route maps in site vehicles. Know facility EMS, Fire and Security dispatch #s.
7) Secure any loads to hauling vehicle (pick-up truck) with appropriate rated tie down straps.
8) Use reflective vests/ high visibility clothing in high traffic areas or in areas were material handling operations are occurring.
9)

Attendees:

Name (Printed): Signature:

Meeting Conducted By:

Name Printed Signature

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Attachment 4
Stop Work Order Form

CH2MHILL
Constructors, Inc.

Stop Work Order Form

REPORT PREPARED BY:

Name:	Title:	Signature:	Date:

ISSUE OF NONPERFORMANCE

Description:______________________________	**Date of Nonperformance:** ______________

SUBCONTRACTOR SIGNATURE OF NOTIFICATION:

Name:	Title:	Signature:	Date:

** Corrective action is to be taken immediately. Note below the action taken, sign and return to CCI.**

SUBCONTRACTOR'S CORRECTIVE ACTION

Description:______________________________	**Date of Corrective Actions:** ______________

SUBCONTRACTOR SIGNATURE OF CORRECTION:

Name:	Title:	Signature:	Date:

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Attachment 5
Chemical-Specific Training Form and Project-Specific Chemical Product Hazard Communication Form

CHEMICAL-SPECIFIC TRAINING FORM

Refer to Standard of Practice HS-05

Location: Fort Rucker, AL

HCC: ___________________________________

Trainer: _____________________________________

TRAINING PARTICIPATES:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

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

☐ Physical and health hazards

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

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

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

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

CH2MHILL

Project-Specific Chemical Product Hazard Communication Form

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

Project Name: MEC RFI, Fort Rucker, AL **Contract Number:** W91ZLK-05-D-0014

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

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels	
				Identity	Hazard

Refer to SOP HSE-107, *Hazard Communication* for more detailed information.

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Attachment 6
Loss Prevention Observation (LPO) Form (Safe Behavior Observation Form)

CH2MHILL

Safe Behavior Observation Form

Project Number:	Client/Program: USAEC/USACE	☐CCI ☐INC
Project Name: MEC RFI, Fort Rucker	Observer:	Date:
Position/Title of worker observed:	Background Information/ comments:	
Task/Observation Observed:		

- ❖ Identify and reinforce safe work practices/behaviors
- ❖ Identify and improve on at-risk practices/acts
- ❖ Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- ❖ Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- ❖ Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	**Safe**	**At-Risk**	**Observations/Comments**
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's Corrective Actions/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's Corrective Actions/Comments:**
Other…			

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Attachment 7
Loss/Near-loss Incident Report Forms

Incident Report Form

Type of Incident (Select at least one)

☐ Injury/Illness
☐ Environmental/Permit Issue
☐ Property Damage
☐ Near Miss
☐ Spill/Release
☐ Other

General Information (Complete for all incident types)

Preparer's Name: ______________________________________ Preparer's Employee Number: _________________
Date of Report: ___________________ Date of Incident: _________________ Time of Incident: ___________ am/pm

Type of Activity (Provide activity being performed that resulted in the incident)

☐ Asbestos Work
☐ Confined Space Entry
☐ Construction Mgmt- Haz Waste
☐ Construction Mgmt - Non-Haz Waste
☐ Demolition
☐ Drilling-Haz Waste
☐ Drilling-Non Haz Waste
☐ Drum Handling
☐ Electrical Work
☐ Excavation Trench-Haz Waste
☐ Excavation Trench-Non Haz
☐ Facility Walk Through
☐ General Office Work
☐ Keyboard Work
☐ Laboratory
☐ Lead Abatement
☐ Motor Vehicle Operation
☐ Moving Heavy Object
☐ Other (Specify) ______________________
☐ Process Safety Management
☐ Tunneling
☐ Welding
☐ Wetlands Survey
☐ Working from Heights
☐ Working in Roadways
☐ WWTP Operation

Location of Incident (Select one)

☐ Company Premises (identify location): ________________________
☐ Field (Project #: _______________ Project/Site Name: _________________ Client: _______________)
☐ In Transit (Traveling from: _______________________ Traveling to: _____________________________)
☐ At Home

Geographic Location of Incident (Select region where the incident occurred)

☐ Northeast
☐ Southeast
☐ Northwest
☐ Southwest
☐ Corporate
☐ Canadian
☐ Asia Pacific
☐ Europe Middle East
☐ Latin America

If a subcontractor was involved in the incident, provide their company name and phone number:
____

Describe the Incident (Provide a brief description of the incident): __________________________________

____

____

•

Injured Employee Data (Complete for Injury/Illness incidents only)

If **Contractor** employee injured
Employee Name: ____ Employee Number: _________________

If **Contractor** Subcontractor employee injured
Employee Name: _________________________ Company: ___________________________________

Injury Type

☐ Allergic Reaction
☐ Amputation
☐ Asphyxia
☐ Bruise/Contusion/Abrasion
☐ Burn (Chemical)
☐ Burn/Scald (Heat)
☐ Cancer
☐ Carpal Tunnel
☐ Concussion
☐ Cut/Laceration
☐ Dermatitis
☐ Dislocation
☐ Electric Shock
☐ Foreign Body in eye
☐ Fracture
☐ Freezing/Frost Bite
☐ Headache
☐ Hearing Loss
☐ Heat Exhaustion
☐ Hernia
☐ Infection
☐ Irritation to eye
☐ Ligament Damage
☐ Multiple (Specify) ____________________
☐ Muscle Spasms
☐ Other (Specify) ____________________
☐ Poisoning (Systemic)
☐ Puncture
☐ Radiation Effects
☐ Strain/Sprain
☐ Tendonitis
☐ Wrist Pain

Part of Body Injured

☐ Abdomen
☐ Ankle(s)
☐ Arms (Multiple)
☐ Back
☐ Blood
☐ Body System
☐ Buttocks
☐ Chest/Ribs
☐ Ear(s)
☐ Elbow(s)
☐ Eye(s)
☐ Face
☐ Finger(s)
☐ Foot/Feet
☐ Hand(s)
☐ Head
☐ Hip(s)
☐ Kidney
☐ Knee(s)
☐ Leg(s)
☐ Liver
☐ Lower (arms)
☐ Lower (legs)
☐ Lung
☐ Mind
☐ Multiple (Specify)
☐ Neck
☐ Nervous System
☐ Nose
☐ Other (Specify) ____________________
☐ Reproductive System
☐ Shoulder(s)
☐ Throat
☐ Toe(s)
☐ Upper Arm(s)
☐ Upper Leg(s)
☐ Wrist(s)

Nature of Injury

☐ Absorption
☐ Bite/Sting/Scratch
☐ Cardio-Vascular/Respiratory System Failure
☐ Caught In or Between
☐ Fall (From Elevation)
☐ Fall (Same Level)
☐ Ingestion
☐ Inhalation
☐ Lifting
☐ Mental Stress
☐ Motor Vehicle Accident
☐ Multiple (Specify) ____________________
☐ Other (Specify) ____________________
☐ Overexertion
☐ Repeated Motion/Pressure
☐ Rubbed/Abraded
☐ Shock
☐ Struck Against
☐ Struck By
☐ Workplace Violence

- Initial Diagnosis/Treatment Date: ______________

Type of Treatment

☐ Admission to hospital/medical facility
☐ Application of bandages
☐ Cold/Heat Compression/Multiple Treatment
☐ Cold/Heat Compression/One Treatment
☐ First Degree Burn Treatment
☐ Heat Therapy/Multiple treatment
☐ Multiple (Specify) ____
☐ Heat Therapy/One Treatment
☐ Non-Prescriptive medicine
☐ None
☐ Observation
☐ Other (Specify) ____
☐ Prescription- Multiple dose
☐ Prescription- Single dose
☐ Removal of foreign bodies
☐ Skin Removal
☐ Soaking therapy- Multiple Treatment
☐ Soaking Therapy- One Treatment
☐ Stitches/Sutures
☐ Tetanus
☐ Treatment for infection
☐ Treatment of 2nd /3rd degree burns
☐ Use of Antiseptics – multiple treatment
☐ Use of Antiseptics – single treatment
☐ Whirlpool bath therapy/multiple treatment
☐ Whirlpool therapy/single treatment
☐ X-rays negative
☐ X-rays positive/treatment of fracture

Number of days doctor required employee to be off work: _________
Number of days doctor restricted employee's work activity: _________
Equipment Malfunction: Yes ☐ No ☐ Activity was a Routine Task: Yes ☐ No ☐
Describe how you may have prevented this injury:
____
____
____

Physician Information	Hospital Information
Name: ______________________	Name: ______________________
Address: ______________________	Address: ______________________
City: ______________________	City: ______________________
Zip Code: ______________________	Zip Code: ______________________
Phone: ______________________	Phone: ______________________

Property Damage (Complete for Property Damage incidents only)

Property Damaged: ______________________ Property Owner: ______________________
Damage Description: ____
Estimated Amount: $ ____________________

Spill or Release (Complete for Spill/Release incidents only)

Substance (attach MSDS): ______________________ Estimated Quantity: ________________
Facility Name, Address, Phone No.:
____
Did the spill/release move off the property where work was performed?: ______________________
Spill/Release From: ______________________ Spill/Release To: ______________________

Environmental/Permit Issue (Complete for Environmental/Permit Issue incidents only)

Describe Environmental or Permit Issue:
____
Permit Type:
____
Permitted Level or Criteria (e.g., discharge limit):
____
Permit Name and Number (e.g., NPDES No. ST1234):
____
Substance and Estimated Quantity:
____
Duration of Permit Exceedance:
____

Verbal Notification (Complete for all incident types)(Provide names, dates and times)

Contractor Personnel Notified:
____
Client Notified:
____

Root Cause Investigation

This attachment is provided to assist in accessing, completing, and reviewing an incident investigation. It is important to remember the following when conducting an investigation:

Gather relevant facts, focusing on fact-finding, not fault-finding.
Draw conclusions, pitting facts together into a probable scenario.
Determine incident root cause(s), the basic causes why an unsafe act/condition existed.
Develop and implement solutions, matching all identified root causes with solutions.

Documentation
The following should be included in the IRF to document the incident.

Description

Provide a description of the event and the sequence of events and actions that took place prior to the incident. Start with the incident event and work backwards in time through all the preceding events that directly contributed to the incident. The information should identify why the event took place, who was involved, when and where the event took place, and what actions were taken.

Cause Analysis

Using the form and flowchart in this attachment, the root cause of the incident will be determined. This form must be retained in the project and/or regional H&S files.

Immediate Causes—List the substandard actions or conditions that directly affected the incident. The following are examples of immediate causes:

> ***Substandard Actions*:** Operating equipment without authority; failure to warn; failure to secure; operating at improper speed; making safety device inoperable; using defective equipment; failing to use PPE; improper loading; improper lifting; improper position for task; under influence of alcohol or drugs; horseplay.
>
> ***Substandard Conditions:*** Exposure to hazardous materials; exposure to extreme temperatures; improper lighting; improper ventilation; congestion; exposure to fire and explosive hazard; defective tools, equipment or materials; exposure to extreme noise; poor ventilation; poor visibility; poor housekeeping.

Basic Causes—List the personal and job factors that caused the incident. The following are examples of basic causes:

> ***Personal Factors:*** Capability; knowledge; skill; stress; motivation.
>
> ***Job Factors:*** Abuse or misuse; engineering; maintenance; purchasing; supervision; tools and equipment; wear and tear; work standards.

Corrective Action Plan

Include all corrective actions taken or those that should be taken to prevent recurrence of the incident. Include the specific actions to be taken, the employer and personnel responsible for implementing the actions, and a time frame for completion. Be sure the corrective actions address the causes. For example, training may prevent recurrence of an incident caused by a lack of knowledge, but it may not help an incident caused by improper motivation.

The following are examples of management programs that may be used to control future incidents. These programs should be considered when determining specific corrective actions.

Management Programs: Accident/incident analysis; emergency preparedness; engineering controls; general promotion; group meetings; health control; hiring and placement; leadership and administration; management training; organizational rules; personal protective equipment; planned inspections; program audits; program controls; purchasing controls; task analysis and procedures; task observation.

INSERT CONTRACTOR LOGO HERE

Loss/Near-Loss Investigation Report Form

Employer Information

Company Name: ____

Project Name: ______________________________ Task Order: ____________

Project Location: ____

Task Location: ____

Job Assignment: ____

Preparer's Name: ____________________ Preparer's Employee Number: __________

Incident Specific Information

Date of Incident: ____________ Time of Incident: ____________ a.m./p.m.

Location of incident:
☐Company premises ☐Field ☐In Transit ☐Other:____________

Address where the incident occurred: ________________________________

Equipment Malfunction: Yes ☐ No ☐ Activity was a Routine Task: Yes ☐ No ☐

Describe any property damage: _____________________________________

Specific activity the employee was engaged in when the incident occurred:

____
____

All equipment, materials, or chemicals the employee was using when the incident occurred:

____
____

Describe the specific incident and how it occurred:

____
____
____
____
____
____
____
____
____
____
____
____
____
____
____
____
____
____

Describe how this incident may have been prevented:

____

____

____

____

____

____

____

____

Contributing Factors (Describe in detail why incident occurred):

____

____

____

____

____

Date employer notified of incident: ____________________ To whom reported: ________________________________

Witness Information (First Witness)

Name: ____
Employee Number__________________________________
Address:____
City: ____
Zip Code: _______________________________________
Phone: ____

Witness Information (Second Witness)

Name: ____
Employee Number__________________________________
Address:____
City: ____
Zip Code: _______________________________________
Phone: ____

Additional information or comments:____

____

____

A ROOT CAUSE ANALYSIS FORM MUST BE COMPLETED FOR ALL INJURIES AND ILLNESSES OR ACTUAL LOSSES.

COMPLETION OF THE ROOT CAUSE ANALYSIS FORM FOR NEAR LOSSES IS OPTIONAL, AT THE DISCRETION OF THE HSM.

Determination of Root Cause(s)

For losses or near losses, the information may be gathered by the supervisor or other personnel immediately following the loss or near loss. Based on the complexity of the situation, this information may be all that is necessary to enable the investigation team to analyze the loss, to determine the root cause, and to develop recommendations. More complex situations may require the investigation team to revisit the loss Site or re-interview key witnesses to obtain answers to questions that may arise during the investigation process.

Photographs or videotapes of the scene and damaged equipment should be taken from all sides and from various distances. This point is especially important when the investigation team will not be able to review the loss scene.

The investigation team must use the Root Cause Analysis Flow Chart to assist in identifying the root cause(s) of a loss. Any loss may have one or more “root causes” and “contributing factors”. The root cause is the primary or immediate cause of the incident, while a contributing factor is a condition or event that contributes to the incident happening, but is not the primary cause of the incident. Root causes and contributing factors that relate to the *person* involved in the loss, his or her peers, or the supervisor should be referred to as “personal factors”. Causes that pertain to the *system* within which the loss or injury occurred should be referred to as “job factors”.

Personal Factors

1. Lack of skill or knowledge, lack of motivation
2. Correct way takes more time and/or requires more effort
3. Short-cutting standard procedures is positively reinforced or tolerated
4. Person thinks there is no personal benefit to always doing the job according to standards

Job Factors

5. Lack of or inadequate operational procedures or work standards.
6. Inadequate communication of expectations regarding procedures or standards
7. Inadequate tools or equipment

Other

8. Uncontrollable Factors *****

The root cause(s) could be any one or a combination of these seven possibilities or some other “uncontrollable factor”. In the vast majority of losses, the root cause is very much related to one or more of these seven factors. * **Uncontrollable factors should be used rarely and only after a thorough review eliminates all seven other factors.**

Root Cause Analysis Form

Root Cause Analysis (RCA)

Root Cause Categories (RCC): Select the RCC numbered below that applies for the root cause (RC) and/or contributing factor (CF) in the first column, then describe the specific root cause and corrective actions in each column.

1. **Lack of skill or knowledge**
2. **Lack of or inadequate operational procedures or work standards**
3. **Inadequate communication of expectations regarding procedures or work standards**
4. **Inadequate tools or equipment**
5. **Correct way takes more time and/or requires more effort**
6. **Short-cutting standard procedures is positively reinforced or tolerated**
7. **Person thinks there is no personal benefit to always doing the job according to standards**
8. **Uncontrollable Factor (Note: Uncontrollable factors should be used rarely and only after a thorough review eliminates all seven other factors.)**

RCC #	Root Cause(s)	Corrective Actions	RC[1]	CF[2]	Due Date	Completion Date	Date Verified

[1] RC = Root Cause; [2] CF = Contributing Factors (check which applies)

Investigation Team Members

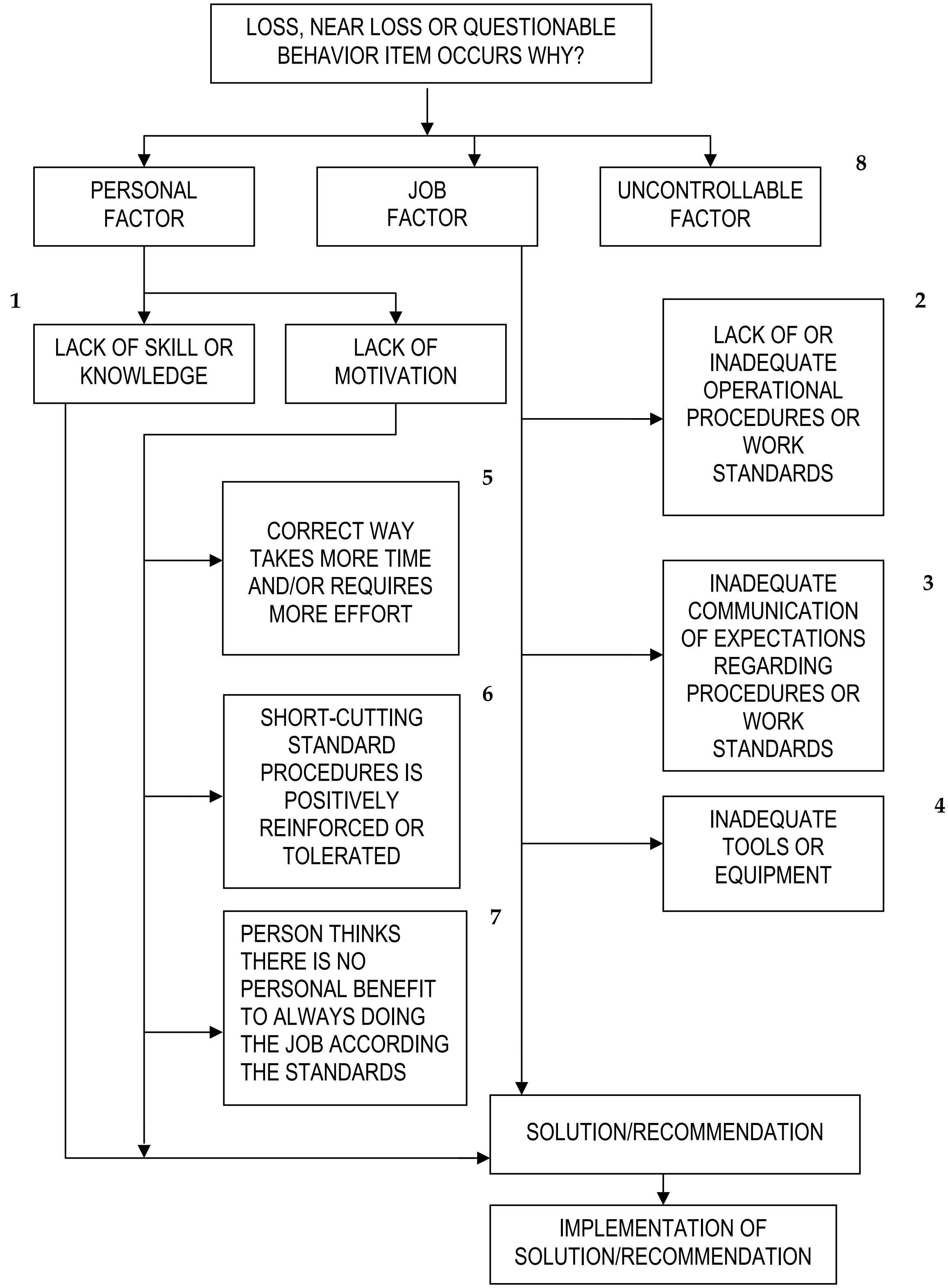
Name	Job Title	Date

Results of Solution Verification and Validation

Reviewed By

Name	Job Title	Date

Root Cause Analysis Flow Chart



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Attachment 8

Hurricane Preparedness Plan

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Hurricane Preparedness Plan

MEC RCRA Facility Investigation

Anti-Tank/Rocket Grenade Range - FTRU-001-R-01
Infiltration/Grenade Range - FTRU-003-R-01
.22-Caliber Target Butt - FTRU-004-R-01

Fort Rucker, Alabama

DRAFT

Contract W91ZLK-05-D-0014
Task Order No. 0001

Prepared for:

U.S. Army Environmental Command

Prepared by:

CH2MHILL

Northpark 400
1000 Abernathy Road
Suite 1600
Atlanta, Georgia

August 2010

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Contents

Attachments

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Acronyms and Abbreviations

COR	Condition of Readiness
FEMA	Federal Emergency Management Administration
SSHO	Site Safety and Health Officer
mph	mile(s) per hour
NOAA	National Oceanic and Atmospheric Administration
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment

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1.0 Introduction

1.1 Purpose

This procedure outlines the general responsibilities and actions to be taken in preparation for and response to a hurricane or hurricane warnings posted for southern Alabama, where Fort Rucker is located. All personnel should understand that predicting the occurrence and path of a hurricane is difficult; however, the risk can be minimized and controlled by following the procedures in this plan.

1.2 Scope

This procedure is applicable to all personnel, including CH2M HILL and its subcontractors, and equipment present on Sites defined by the project limits of work.

1.3 Discussion

This procedure provides information on how to protect personnel and property in the event of a hurricane. For the southern Alabama region, attention must be paid to all tropical storms and hurricanes due to the uncertainty of time and location of landfall.

The following table demonstrates accuracy of forecasting a hurricane landfall. Probability of a landfall occurrence is low more than 24 hours in advance of a storm.

Hours Before Landfall	Maximum Probability Values
72 Hours	10 Percent
48 Hours	13-18 Percent
36 Hours	20-25 Percent
24 Hours	35-45 Percent
12 Hours	60-70 Percent

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2.0 Definitions

The following definitions apply to various terms used in this document.

Conditions of Readiness (COR):

- **Condition V -** Destructive winds are possible at **Project Site within 96 hours**. Normal daily job Site cleanup and good housekeeping practices.
- **Condition IV** - Destructive winds are possible at **Project Site within 72 hours**. Normal daily job Site cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the end of each workday. Maintain the construction Site, including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 4 feet high. Remove all trash debris and other objects that could become missile hazards. Contact the Resident Officer in Charge of Construction, Contracting Officer or Contracting Officer Representative for Condition requirements, updates, and completion of required actions.
- **Condition III** - Destructive winds are possible at **Project Site** within **48 hours**. Maintain **Condition IV** requirements. Begin securing the job Site and taking those actions necessary for **Condition I**, which cannot be completed within 18 hours. Cease all routine activities that might interfere with securing operations. Begin collecting and stowing all gear and portable equipment. Make preparations for securing buildings. Review requirements pertaining to **Condition II** and continue action as necessary to attain **Condition III** readiness. Contact the weather station on Base for weather and COR updates and completion of required actions.
- **Condition II** - Destructive winds are possible at **Project Site within 24 hours.** Curtail or cease routine activities until securing operations are complete. Reinforce or remove formwork and scaffolding. Secure machinery, tools, equipment, and materials, or remove from job Site. Expend every effort to clear all missile hazards and loose equipment from the job Site. Contact the Resident Officer in Charge of Construction, Contracting Officer or Contracting Officer Representative for weather and COR updates and completion of required actions.
- **Condition I** - Destructive winds are possible in at **Project Site within 12 hours**. Perform and complete all remaining actions required for lower conditions of readiness. Secure the job Site and leave the government premises.
- **Destructive Winds** - Generally winds reaching or exceeding the force of a tropical storm ($\geq$ 39 miles per hour [mph] or 34 knots). Winds from any storm system (tropical or otherwise) that are determined to have the potential to cause property damage or personal injury would warrant Fort Jackson to initiate a Condition IV alert.
- **Gale** - Non-tropical windstorm with winds 38 to 63 mph (33 to 55 knots).
- **Hurricane** - A tropical cyclone in which the maximum sustained surface wind is 74 mph (64 knots) or greater.

- **Hurricane Warning** - A warning that sustained winds of 74 mph (64 knots) or higher, associated with a hurricane, are expected in a specified coastal area in 24 hours or less.
- **Hurricane Watch** - An announcement for specific areas where a hurricane or an incipient hurricane poses a possible threat to a coastal area, generally within 36 hours.
- **Missile Hazard** - Any object that may become airborne during high winds.
- **Severe Weather -** Any storm of tropical or non-tropical origin that has the capacity to produce destructive winds.
- **Storm** - Non-tropical windstorm with winds 38 to 62 mph (33 to 55 knots).
- **Storm Surge** - An abnormal rise in sea level accompanying a hurricane or other intense storm, and whose height is the difference between the observed level of the sea surface and the level that would have occurred in the absence of the storm.
- **Storm Tide** - The actual sea level resulting from the astronomical tide combined with the storm surge. This term is used interchangeably with "Hurricane Tide."
- **Tornado** - Violent rotating columns of air with winds 115 to 288 mph (100 to 250 knots).
- **Tropical Depression** - A tropical low-pressure system in which the maximum sustained surface wind is 38 mph (33 knots) or less.
- **Tropical Storm** - A tropical low pressure system in which the maximum surface wind ranges from 39 to 73 mph (34 to 63 knots) inclusive. This is the strength at which the National Hurricane Center applies a name to the storm.
- **Tropical Storm Watch** - Tropical storm conditions pose a threat to a coastal area generally within 36 hours.
- **Tropical Storm Warning** - A warning for tropical storm conditions with sustained winds within the range of 39 to 73 mph (34 to 63 knots), which are expected in a specified coastal area within 24 hours or less.

3.0 Emergency Operating Procedures

3.1 Condition V – Destructive Winds are Possible within 96 Hours (Early Preparedness)

The Site Safety and Health Officer (SSHO)/Unexploded Ordnance Safety Officer (UXOSO) will notify the project manager and Site Manager when a tropical storm has been named and/or any severe weather has the potential to produce destructive winds at within **96 hours**. This will initiate COR Condition V. This phase will continue until:

- The storm or condition is downgraded
- The storm track poses no threat to the Site
- Condition IV begins

During Condition V, the progress of the storm will be monitored and tracked by Hurricane Tracking Maps (**Attachment A**). The Resident Officer in Charge of Construction, Contracting Officer or Contracting Officer Representative will be contacted at least twice daily for Condition Requirements updates and to inform him of completion of required actions for Condition V.

See **Attachment A** for the Hurricane Preparedness Responsibility Checklist - Condition V.

3.2 Condition IV – Destructive Winds are Possible within 72 Hours

This COR starts when severe weather is within 72 hours of posing a threat to the project location. The Site Manager or SSHO/UXOSO will ensure that the following steps are taken:

- Monitor the storm and inform the Project Manager and Site Manager of its progress.

- Check personal protective equipment (PPE) supplies and equipment to determine if any shipments are required or if pending shipments should be advanced or postponed.

During Condition IV, the progress of the storm will be continuously monitored and tracked. The Site Manager or SSHO/UXOSO will instruct Site personnel to begin general cleanup of all loose materials that may pose a hazard during high winds or rain. This will include removal of all debris, trash, and other rubble that may become missile hazards. All form lumber will be stacked in neat piles less than 4 feet high. The Resident Officer in Charge of Construction, Contracting Officer or Contracting Officer Representative will be contacted at least twice daily for Condition Requirements updates and to inform him of completion of required actions for Condition IV.

The Site Manager or SSHO/UXOSO will keep all Site personnel advised of the status of the storm and Site preparation activities. Due to the urgency and amount of work involved in preparing for a threatening storm, all construction operations that might interfere with securing operations, such as starting a major excavation, will cease.

The Site Manager will ensure that the following steps are taken:

- Fill fuel tanks in all equipment on-site
- Secure stockpiled material on-site
- Review requirements for Condition IV with all Site personnel
- Maintain Condition IV requirements

See **Attachment A** for the Hurricane Preparedness Responsibility Checklist - Condition IV.

3.3 Condition III – Tropical Storm Warning (Destructive Winds are Possible within 48 Hours)

This COR starts when severe weather poses a threat to the project Site within 48 hours. Condition III activities will also start if a threatening tropical storm is upgraded to a hurricane, or a severe storm approaching the Site has generated destructive winds in other locations. The Project Manager, Site Manager, and SSHO/UXOSO will determine when to cease all operations based upon current weather conditions and/or as directed by the Base contact. If the storm or Condition is downgraded, the Project Manager, Site Manager, and SSHO/UXOSO will contact the project Resident Officer in Charge of Construction, Contracting Officer or Contracting Officer Representative Contracting Officer or Contracting Officer Representative to decide if a downgrade of the COR is appropriate. Actions for Condition III will be maintained and the following shall also be completed:

- Secure or remove from the Site all machinery, tools, equipment, and materials

- Take actions to secure job Site necessary for Condition I that cannot be completed within 18 hours

See **Attachment A** for the Hurricane Preparedness Responsibility Checklist - Condition III.

3.4 Condition II – Destructive Winds are Possible within 24 Hours (Tropical Storm Warning)

Condition II begins when destructive winds are anticipated within 24 hours and/or as directed by the Base contact. The Project Manager, Site Manager, and SSHO/UXOSO will determine when to demobilize from the Site based upon weather conditions. The following tasks will be performed during this phase:

3.4.1 Site Manager Responsibilities:

- Where a Site Manager is assigned to the project and on-site at the time of the Condition II warning, this individual shall be responsible for the following actions:

- Secure machinery, tools, equipment, and materials or remove them from the job Site.

- Conduct a roll call of personnel on-site and inform the SSHO/UXOSO.

- Notify personnel on leave of schedule changes.

- Personnel needing to leave the project to attend to personal matters will notify their Site Manager immediately.
- Heavy equipment will be secured according to the manufacturer's recommendations.
- All small field equipment will be secured.
- Where a full time SSHO is not assigned or is not on the Site at the time of the Condition II warning, the Site Manager shall execute the above responsibilities and the SSHO/UXOSO responsibilities identified in section 3.4.2.

3.4.2 SSHO Responsibilities:

- Where a SSHO/UXOSO is assigned to the project and on-site at the time of the Condition II warning, this individual shall be responsible for the following actions, when designated by the CH2M HILL site Manager/supervisor or field team leader:
- Ensure all visitors from the Site are evacuated.
- Make a final Site walk-through to determine that the Site is secure and clear all missile hazards from the job Site.
- Inform the Project Manager that all personnel are being released from the Site.
- Where a full time Site Manager is not assigned or is not on the Site at the time of the Condition II warning, the SSHO/UXOSO is shall execute the above responsibilities and the Site Manager responsibilities identified in section 3.4.1.

If the storm or Condition is downgraded, the Project Manager, Site Manager, and SSHO/UXOSO will conference to decide if a downgrade of the phase is necessary.

See **Attachment A** for the Hurricane Preparedness Responsibility Checklist - Condition II.

3.5 Condition I – Destructive Winds are Possible within 12 Hours

Condition I begins when destructive winds are anticipated within 12 hours and/or as directed by the Base contact. The Site Manager will ensure that the following steps are taken:

- Complete all remaining actions required for lower conditions of readiness
- Secure job Site access and evacuate to safe refuge

See **Attachment A** for the Hurricane Preparedness Responsibility Checklist - Condition I.

3.6 Resuming Site Operations

The Project Manager will contact the Base to determine when Site operations will resume. Although the hurricane/severe weather has passed, hazards may still exist because of water damage, other hazardous conditions, dangers from electric shock, poisonous snakes, etc.

The SSHO/UXOSO will conduct a damage survey with the Project Manager and Site Manager. The Site Manager will take photographs of the storm damage at the Site. They will develop a prioritized recovery plan from the survey findings. Subsequently, all Site personnel will be notified when it is safe to return to work. Required personnel and subcontractor expertise will be mobilized to the Site to repair any damaged equipment.

See **Attachment A** for the Hurricane Preparedness Responsibility Checklist - Resume Site Operations.

4.0 Debriefing

Following their return to work, the Site Manager will conduct a debriefing with Site personnel to accomplish the following objectives:

- Finalize a recovery plan
- Review the Hurricane Preparedness Plan for effectiveness
- Suggest and agree on improvements to the plan
- Incorporate plan changes

When completed, the Project Manager and/or Site Manager will meet with Site personnel to discuss any corrective actions or changes in this plan.

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5.0 References

The following references and sources of information may be consulted for additional guidance on hurricane preparedness and response:

- Disaster Planning Guide for Business and Industry, Federal Emergency Management Administration (FEMA).
- U.S. Department of Commerce; National Oceanic and Atmospheric Administration (NOAA).

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Attachment A
Hurricane Preparedness Responsibility Checklist

Hurricane Preparedness Responsibility Checklist

Condition V (Landfall Within 96 Hours)

Date/Time Entered Condition V:______________________________

Severe Weather/ Tropical Storm:

____

Action Items

☐ Notify Project Manager

☐ Track of Storm Poses No Threat

☐ Storm or Condition is Downgraded

☐ Upgrade to Condition IV

Storm Location

Date/Time:____________________

Location/Coordinates:______________

Date/Time:____________________

Location/Coordinates:______________

Date/Time:____________________

Location/Coordinates:______________

Date/Time:____________________

Location/Coordinates:______________

Condition V Action Items Complete:________________________

Date:_______________

Hurricane Preparedness Responsibility Checklist

Condition IV (Landfall Within 72 hours)

Date/Time Entered Condition IV:______________________________

Action Items

☐ Notify Project Manager

☐ Notify Site Manager

☐ Notify Site Personnel

☐ Assemble shift personnel to begin preparation

☐ Track storm on hurricane tracking map (if applicable) (Attachment B)

The Project Foremen will ensure the following steps are taken:

☐ Secure all heavy equipment located at the Site in accordance with manufacturer's specifications. All equipment will be moved to a secured Site location.

☐ All equipment fuel tanks will be filled.

☐ All subcontractors with equipment or supplies on-site will be notified to begin removal procedures.

Condition IV Action Items Complete:______________________________

Date:______________

Hurricane Preparedness Responsibility Checklist

Condition III (Landfall Within 48 hours)

Date/Time Entered Condition III:______________________________

Action Items

☐ Provide the status of the storm to Site personnel on an hourly basis

☐ Take actions to secure job Site necessary for Condition I that cannot be accomplished in 18 hours

☐ Recheck all items on checklist for Condition IV to ensure they are complete (e.g., gas tanks are still filled)

See itemized equipment checklist (itemized list of equipment to be secured/removed and COR for action)

Condition III Action Items Complete:_____________________________

Date:______________

Hurricane Preparedness Responsibility Checklist

Condition II (Landfall Within 24 Hours)

Date/Time Entered Condition II:______________________________

Action Items

☐ Evacuate all visitors from the Site

☐ Conduct a roll call of Site personnel and inform the HSO

☐ Check the status of all incoming shipments of supplies and equipment

☐ Remove all unnecessary vehicles from the Site

☐ Secure heavy equipment in accordance with manufacturer's specification

☐ Secure all valuable records and equipment

☐ Release personnel from the Site

☐ Recheck all items on checklist for Conditions IV and III to ensure they are complete (e.g., gas tanks are still filled)

Condition II Action Items Complete:_____________________________

Date:______________

Hurricane Preparedness Responsibility Checklist

Condition I (Landfall Within 12 Hours)

Date/Time Entered Condition I:______________________________

Action Items

☐ Complete all action items for lower conditions of readiness

☐ Secure job Site access and evacuate to safe refuge

Condition I Action Items Complete:______________________________

Date:______________

Hurricane Preparedness Responsibility Checklist

Resume Site Operations

Date/Time Resume Site Operations:______________________________

Action Items

☐ Conduct a damage survey

☐ Notify all Site personnel when to return to work

☐ Develop a prioritized recovery plan

☐ Inspect electrical equipment before re-energizing to detect and repair damage

☐ Provide bottled water for drinking until normal drinking water is deemed safe to drink

☐ Remove storm debris from Site

☐ Notify Base of the resumption of Site activities

Resume Site Operations Action Items Complete:_____________________________

Date:______________

Hurricane Preparedness Responsibility Checklist

Itemized Equipment Checklist, Condition III

Equipment	Secure in Place	Remove from Project Site

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Attachment B
Hurricane Tracking Map

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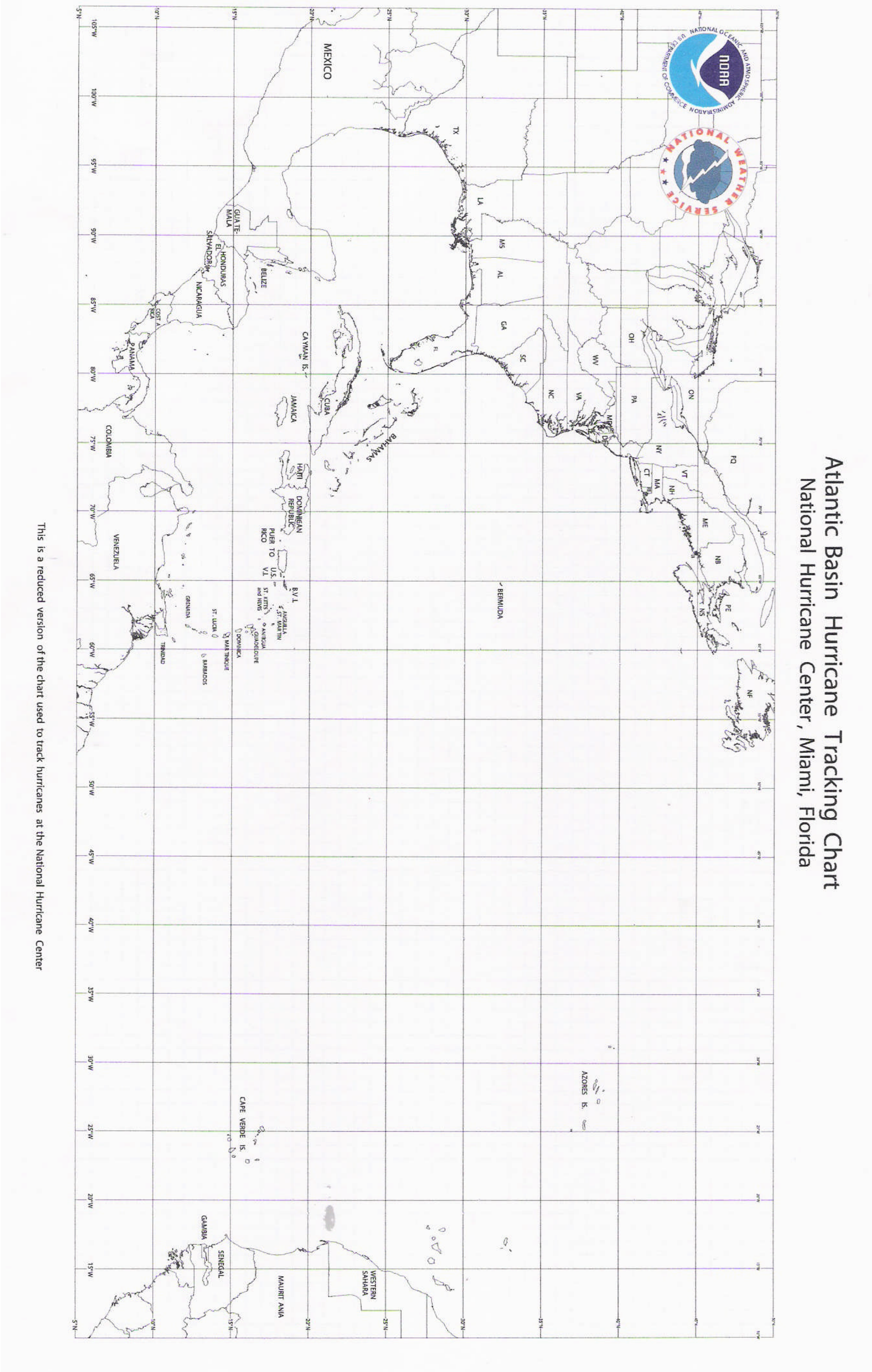
HURRICANE TRACKING MAP


Atlantic Basin Hurricane Tracking Chart
National Hurricane Center, Miami, Florida

This is a reduced version of the chart used to track hurricanes at the National Hurricane Center

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Attachment 9

Emergency Contact List and Route to Hospital

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Emergency Contacts and Route to Hospital

24-hour CH2M HILL Serious Incident Reporting Contact/Pager – 720-286-4911

If injured on the job, notify your supervisor and then call 1-866-893-2514 to contact CH2M HILL's Occupational Nurse

Medical Emergency – 911
Facility Medical Response #: 911
Local Ambulance #: 911

CH2M HILL Medical Consultant
WorkCare
Peter Greaney, M.D.
300 S. Harbor Boulevard, Site 600
Anaheim, CA 92805
800/455-6155
714/978-7488

Fire/Spill Emergency – 911
Facility Fire Response #: 911
Local Fire Dept #: 911

CH2M HILL Director Security Operations
Thomas Horton/DEN
720/273-3100 (cell) or 720/286-0022 (office)

Military Police – 334/255-2222
Local Police #: 911

Automobile Accidents
Rental: Linda Anderson/COR 720/286-2401
CH2M HILL owned vehicle:
Linda George 720/286-2057

Utilities Emergency

Water:	334/255-9041
Gas:	334/255-9041
Electric:	334/255-9041

Human Resources Department
Name: Sherri Huntley
703/376-5192

Site Safety & Health Officer
Name: Cliff Walden/GNV
Phone: 352/335-5877
787/510-2544 (cell)

Responsible Health and Safety Manager
Name: Michael Goldman/ATL
Phone: 678/530-4133 (office); 770/331-3127 (cell)

Project Manager
Name: Mark Sherrill/ATL
Phone: 678/530-4320
678/938-0923 (cell)

Media Inquiries Corporate Strategic Communications
Name: John Corsi
Phone: 720/286-2087

Federal Express Dangerous Goods Shipping
Phone: 800/238-5355

CH2M HILL Emergency Number for Shipping Dangerous Goods
Phone: 800/255-3924

Worker's Compensation:
Contact Business Group HR Dept. to have form completed or contact Jennifer Rindahl after hours: 720/891-5382

Local Agency / Contact Name: Ft. Rucker/Susan Cowart **Phone:** 334/255-1652

***Contact the PM. Generally, the PM will contact relevant government agencies.**

Facility Alarms: Big Voice System **Evacuation Assembly Area(s):** Nearest MRS ECP

Facility/Site Evacuation Route(s): See **Figure 9-1**

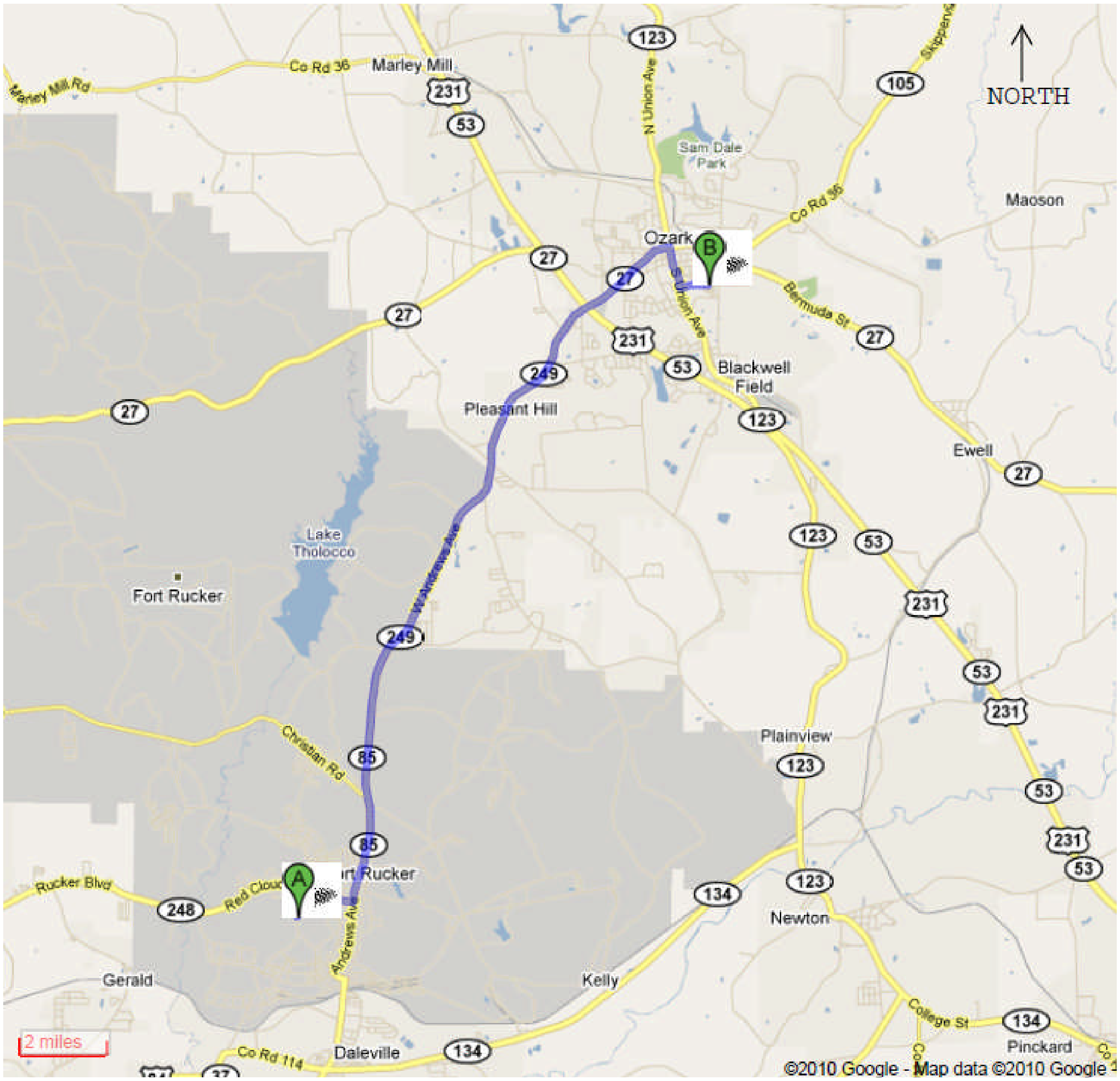
24-hour CH2M HILL Serious Incident Reporting Contact/Pager – 720-286-4911

Hospital Name/Address: Dale Medical Center, 126 Hospital Avenue, Ozark, AL 36360 **Hospital Phone #: 334/774-2601**

Directions to Hospital

From the **Anti-Tank/Rocket Grenade Range - FTRU-001-R-01 or Infiltration/Grenade Range - FTRU-003-R-01:** Turn right at Hatch Road (0.9 miles). Turn right onto AL-85 N, Andrews Avenue (8.6 miles). Turn right at South Union Avenue (0.6 miles). Turn left at Adams Street (0.2 miles). Continue onto James Street (0.2 miles). The hospital will be on the right. Follow signs to the emergency room.

From the .22 Caliber Target Butt – Head north on Farrel Road toward Hartell Way (0.4 miles). Take the third right onto Red Cloud Road (0.7 miles). Turn left at Andrews Avenue (9.8 miles). Turn right at South Union Avenue (0.6 miles). Turn left at Adams Street (0.2 miles). Continue onto James Street (0.2 miles). The hospital will be on the right. Follow signs to the emergency room.



Attachment 10
Material Safety Data Sheets (MSDSs)
(provided onsite as materials are delivered)

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Attachment 11
Qualifications of Key Safety Personnel

Michael Goldman
Regional H&S Program Manager

Professional Registrations

Certified Industrial Hygienist: No. 6576
Certified Safety Professional: No. 18884
Certified Professional Environmental Auditor: No. 856
Certified Hazardous Material Manager, Senior Level: No. 5907

Daniel N Young
Munitions Response Safety/Quality Officer

Professional Registrations

Certified Safety Professional (CSP)
Canadian Registered Safety Professional (CRSP)
Certified Quality Manager (ASQ)
CEHNC UXO 1906

Kevin Rocco Lombardo
Munitions Response (MR) Operations Manager

Professional Registrations

Certified Construction Safety Manager: Virginia, 2004
Certified Blaster: Maryland, Pennsylvania, Hawaii (2007)
Certified Emergency Medical Technician: Virginia (2006)
Certified Safety Planner (National) 2004
Certified Safety Trainer (National) 2004

Cliff Walden
UXOSO

Professional Registrations/Training

OSHA 40 hr, Current on 8-hr Refresher, OSHA Supervisor, First Aid/CPR

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Attachment 12
References List

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ATTACHMENT 12

References List

ACGIH, *Guide to Occupational Exposure Values*, 2001

American Conference of Governmental Industrial Hygienists (ACGIH), *Threshold Limit Values and Biological Exposure Indices for 1993-1994*.

CH2M HILL HSE SOPs

DDESB. TP-18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel.

DoD. October 21, 1991. DoD 4160.21-M-1, *Defense Demilitarization Manual*.

DoD. March 2008. DoD 4145.26-M, *Contractors Safety Manual for Ammunition and Explosives.*

DoD. 1997. DoD 4160.21-M, *Defense Materiel Disposition Manual*

DoD. February 2008. DoD 6055.9-STD, *DoD Ammunition and Explosives Safety Standards*.

National Institute for Occupational Safety and Health (NIOSH)/OSHA/USCG/EPA, *Occupational safety and Health Guidance Manual for Hazardous Waste Site Activities*, Publication No. 85-115, October 1985.

SERDP/ESTCP/ITRC. 2006. *Survey of Munitions Response Technologies*

Title 29 of the CFR, Parts 1910 and 1926 including Part 1926.65

Title 40 of the Code of Federal Regulations (CFR) 260-270 - US EPA Hazardous Waste Requirements.

USACE, Safety and Health Requirements Manual, EM 385-1-1, November, 2003.

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Appendix E
Munitions Constituents Sampling and Analysis Plan

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Munitions Constituents Sampling and Analysis Plan

MEC RCRA Facility Investigation

Anti-Tank/Rocket Grenade Range - FTRU-001-R-01
Infiltration/Grenade Range - FTRU-003-R-01
.22-Caliber Target Butt - FTRU-004-R-01

Fort Rucker, Alabama

FINAL

Contract W91ZLK-05-D-0014
Task Order No. 0001

Prepared for:

U.S. Army Environmental Command

Prepared by:

CH2MHILL

Northpark 400
1000 Abernathy Road
Suite 1600
Atlanta, Georgia

September 2011

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Part II- Quality Assurance Project Plan

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Part I – Field Sampling Plan

MEC RCRA Facility Investigation
Fort Rucker, Alabama

Contract W91ZLK-05-D-0014

Task Order 0001

September 2010

Prepared for

Army Environmental Command

Prepared by

CH2MHILL

Atlanta Georgia

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Tables

Figures (located at the end of the sections)

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Acronyms and Abbreviations

APP/SSHP	Accident Prevention Plan/Site Safety and Health Plan
ASTM	American Society for Testing and Materials
bgs	below ground surface
BIP	blow in place
CCQC	contractor chemical quality control
CFR	Code of Federal Regulations
COR	Contracting Officer's Representative
CTO	Contract Task Order
DGM	digital geophysical mapping
DOT	Department of Transportation
DQCR	Daily Quality Control Report
FSP	Field Sampling Plan
IDW	investigation-derived waste
MC	munitions constituent
MD	munitions debris
MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MRS	Munitions Response Site
MS	matrix spike
MSD	matrix spike duplicate
NFA	no further action
NROR	non-routine occurrence report
PM	Project Manager
PRG	Preliminary Remediation Goal
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI/FS	Remedial Investigation/Feasibility Study
SI	site inspection
SM	Site Manager

SOP	standard operating procedure
SUXOS	Senior UXO Supervisor
TCLP	toxicity characteristic leaching procedure
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance
VOC	volatile organic compound
WP	Work Plan

SECTION 1

Introduction

This document serves as the project Field Sampling Plan (FSP) for Resource Conservation Recovery Act (RCRA) Facility Investigation (RFI) activities at three sites being managed under the Military Munitions Response Program (MMRP) at Fort Rucker, Alabama. The sites are regulated through Fort Rucker's existing RCRA permit and will be managed through the RCRA corrective action framework. The three MMRP sites addressed in this FSP are:

- The FTRU-001-R-01 Anti-Tank/Rocket Grenade Range
- The FTRU-003-R-01 Infiltration/Grenade Range
- The FTRU-004-R-01 .22-Caliber Target Butt

This FSP presents the sampling methods and procedures that will be used during the field sampling activities.

Subcontractors, as well as CH2M HILL personnel, will be expected to adhere to the procedures specified in this document. All field activities will be conducted by CH2M HILL personnel or subcontractors under the supervision of CH2M HILL.

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SECTION 2

Project Description

2.1 Site History

2.1.1 Fort Rucker

Fort Rucker began operations in 1942 in response to the United States military escalation following the attack on Pearl Harbor. It was originally named the Ozark Triangular Division Camp and became Camp Rucker in 1943. It was renamed Fort Rucker in 1955. Fort Rucker has been the site of an infantry training ground, aviation school flight training, and heliport. Since 1973, the mission at Fort Rucker has been to maintain and operate facilities and provide services and material to support rotary and fixed-wing pilot training for Army aviation enlisted specialists and related test activities.

Fort Rucker is located approximately 20 miles northwest of Dothan, Alabama, and is bounded by the towns of Enterprise on the west, Daleville on the south, and Ozark on the east. Fort Rucker encompasses approximately 62,430 acres, primarily situated in Dale and Coffee Counties (**Figure 2-1**). The three MMRP sites are shown in **Figure 2-2**.

2.1.2 FTRU-001-R-01 Anti-Tank/Rocket Grenade Range

The FTRU-001-R-01 Anti-Tank/Rocket Grenade Range Munitions Response Site (MRS) (shown in **Figure 2-3**) covers approximately 57 acres northeast of the cantonment area and was historically used as an anti-tank rocket and grenade range. The site is made up of three distinct sub-ranges—Anti-Tank/Rocket Range No.1, Anti-Tank/Grenade Range No. 1, and an unnamed range. The area has been developed as part of the post's golf course.

During the site inspection (SI), four munitions debris (MD) items were discovered on Anti-Tank/Rocket Range No. 1. The MD consisted of a fragment from a practice rifle grenade, a fragment of an expended 2.36-inch rocket, and fragments from two expended M28 3.5-inch rockets. The M28 3.5-inch rockets were not expected to be present onsite, based on the historical records review, but are consistent with other activities known to have taken place in the area. The records review identified several munitions that could be present at the site: 2.36-inch rocket, M6A1, M9A1 HEAT, MII A1-MII A4 practice, and M17 fragmentation rounds. A World War I-era tank hull, exhibiting numerous holes and pockmarks resulting from being the target of live armor-piercing ammunition, was located just outside of the non-operational range boundary in the operational portion of the post (which is outside the area subject to the RFI). The orientation of the range and the orientation of the tank hull relative to the range indicate that the tank may have been fired at from the non-operational portion of the range.

Based on historical records, the Anti-Tank/Rocket Grenade Range MRS extends into the operational ranges of Fort Rucker (shown in **Figure 2-2).** This area is excluded from the RFI. Only 52 acres of the Anti-Tank/Rocket Grenade Range MRS will be investigated as part of this RFI.

2.1.3 FTRU-003-R-01 Infiltration/Grenade Range

The FTRU-003-R-01 Infiltration/Grenade Range MRS (shown in **Figure 2-4**) is adjacent to, but not contiguous with, the FTRU-001-R-01 Anti-Tank/Rocket Grenade Range and occupies approximately 44 acres outside the active ranges of Fort Rucker (northeast of the cantonment area).

The site was historically used as an infiltration and grenade range and is made up of three distinct sub-ranges: Infiltration Range No. 2, Grenade Range No. 1, and the Rifle Grenade Fragmentation Range. The FTRU-003-R-01 Infiltration/Grenade Range has been developed as part of the post's equestrian center and golf course driving range.

No munitions and explosives of concern (MEC) or MD items were observed during SI activities at the FTRU-003-R-01 Infiltration/Grenade Range. Information received from Fort Rucker Range Control identified two explosive ordnance disposal responses to MEC items identified within the area in 2003. Both items (rifle grenades) were destroyed by explosive ordnance disposal personnel. The historical records review identified several munitions that could be present at the site: M II A1-MII A4 practice and M17 fragmentation rounds. Small arms munitions may also be present.

2.1.4 FTRU-004-R-01 .22-Caliber Target Butt

The FTRU-004-R-01 .22-Caliber Target Butt MMRP site (shown in **Figure 2-5**) covers approximately 2.4 acres in the central portion of the cantonment area and is the reported site of a .22-Caliber Target Butt.

The only indication that the Target Butt existed is on a 1944 map. During the SI, no surface features were found that would indicate the presence of a former small arms range. The area is heavily wooded and hilly (with some steep slopes) and does not appear to have been significantly disturbed over the years. During the site reconnaissance walk conducted as part of SI activities, an expended empty M48 trip flare (a non-fragmentation-producing munition designed to illuminate enemy forces) was identified along the northwestern edge but within the identified "limits" of the site. The flare was found on the ground and appeared to have been undisturbed since its use because the base of a tree had grown around the item. Only small arms (.22-caliber) munitions were identified in the historical records review as potentially being located at this site.

2.2 Summary of Existing Site Data

In May 2005, the Final SI Report, Fort Rucker was published by Malcolm Pirnie. The SI investigated six MMRP sites for both MEC and munitions constituent (MC) issues. The objective of the SI was to collect sufficient data to conclude if the site required immediate response, a Remedial Investigation/Feasibility Study (RI/FS), or if the site qualifies for no further action (NFA). The SI Report identified three sites for further MEC investigation: the FTRU-001-R-01 Anti-Tank/Rocket Grenade Range, the FTRU-003-R-01 Infiltration/Grenade Range, and the FTRU-004-R-01 .22-Caliber Target Butt.

At the FTRU-001-R-01 Anti-Tank/Rocket Grenade Range MRS, the SI included a magnetometer assisted site walk of approximately 10% of undeveloped portions of the MRS. Four MD items were observed at the MRS. The MD items consisted of a fragment from a Practice Rifle Grenade, a fragment of an expended 2.36” Rocket, and fragments from two expended M28 3.5” Rockets. A World War I era tank hull with numerous holes and pockmarks resulting from the use of live armor-piercing ammunition was identified just inside the operation range boundary, oriented in a manner that suggests it may have been fired at from this MRS. Approximately 20 discrete subsurface anomalies were detected throughout the site during the site walk. MC sampling activities included collecting 10 surface soil samples, and 1 duplicate sample, which were analyzed for explosives. One sample contained detectable concentrations of nitrobenzene, but none of the analyzed soil samples contained any explosives in concentrations exceeding the U.S. Environmental Protection Agency (USEPA) Region 9 Industrial Preliminary Remediation Goals (PRGs).

At the FTRU-003-R-01 Infiltration/Grenade Range MRS, a magnetometer assisted site walk of approximately 10% of the undeveloped portions of the MRS was completed and no MD was observed. Ten surface soil samples, one field duplicate, and one matrix spike/matrix spike duplicate (MS/MSD) were analyzed for explosives. Three explosive compounds (nitrobenzene, 2-amino-4,6-dinitrotoluene, and 4-amino-2,6-dinitrotoluene) were identified in two soil samples at concentrations below the USEPA Region 9 Industrial PRGs.

No MEC activities were conducted at the FTRU-004-R-01 .22-Caliber Target Butt MMRP site as part of the May 2005 SI, due to its suspected use as a small arms range. However, an extensive site walk was performed to locate surface features associated with a small arms range. No surface features were found that would indicate the presence of a former small arms range in the MMRP site. No explosive compounds were present in detectable concentrations in the single soil sample submitted for analytical testing.

2.3 Project Organization and Responsibilities

CH2M HILL is responsible for the following:

- Task Order Management
- Quality assurance/quality control (QA/QC)
- CH2M HILL worker safety and health
- Planning
- Sample collection
- Record keeping
- Subcontractor supervision
- Data evaluation and reporting
- Preparation of Statement of Basis

CH2M HILL personnel responsible for these aspects of the project are identified in **Table 2-1**. In addition, the project organizational structure is summarized in Section 2 of the Work Plan (WP).

TABLE 2-1
CH2M HILL Project Responsibilities
MEC RFI, Fort Rucker, Alabama

Project Position	Responsible Personnel	Contact Information
Project Manager	Mark Sherrill, PG	CH2M HILL Northpark 400 1000 Abernathy Road Suite 1600 Atlanta, GA 30328 (770) 604-9095 msherril@ch2m.com
Senior Munitions Response Technical Consultant	Kevin Lombardo	CH2M HILL 15010 Conference Center Drive Suite 200 Chantilly, VA 20151 (703) 376-5175 kevin.lombardo@ch2m.com
Munitions Response Geophysicist	Tamir Klaff	CH2M HILL 15010 Conference Center Drive Suite 200 Chantilly, VA 20151 (703) 669-9611 tamir.klaff@ch2m.com
CH2M HILL QA	Theresa Rojas	CH2M HILL 1000 Abernathy Road Suite 1600 Atlanta, GA 30328 (678) 530- 4297 Theresa.rojas@ch2m.com
CH2M HILL Senior Unexploded Ordnance Supervisor	Chris Rose	CH2M HILL (360) 705-7070 chris.rose@ch2m.com
CH2M HILL Munitions Response Safety and QC Officer	George DeMetropolis	CH2M HILL 402 W. Broadway Ste. 1450 San Diego , CA 92101 619) 687-0120x37239 george.demetropolis@ch2m.com
Project Chemist	Ward Dickens	CH2M HILL 3011 SW Williston Road Gainesville, FL 32608 (352) 384-7049 ward.dickens@ch2m.com
Safety and Health Manager	Mike Goldman	CH2M HILL Northpark 400 1000 Abernathy Road Suite 1600 Atlanta, GA 30328 (770)604-9182 x54133 michael.goldman@ch2m.com

TABLE 2-1
CH2M HILL Project Responsibilities
MEC RFI, Fort Rucker, Alabama

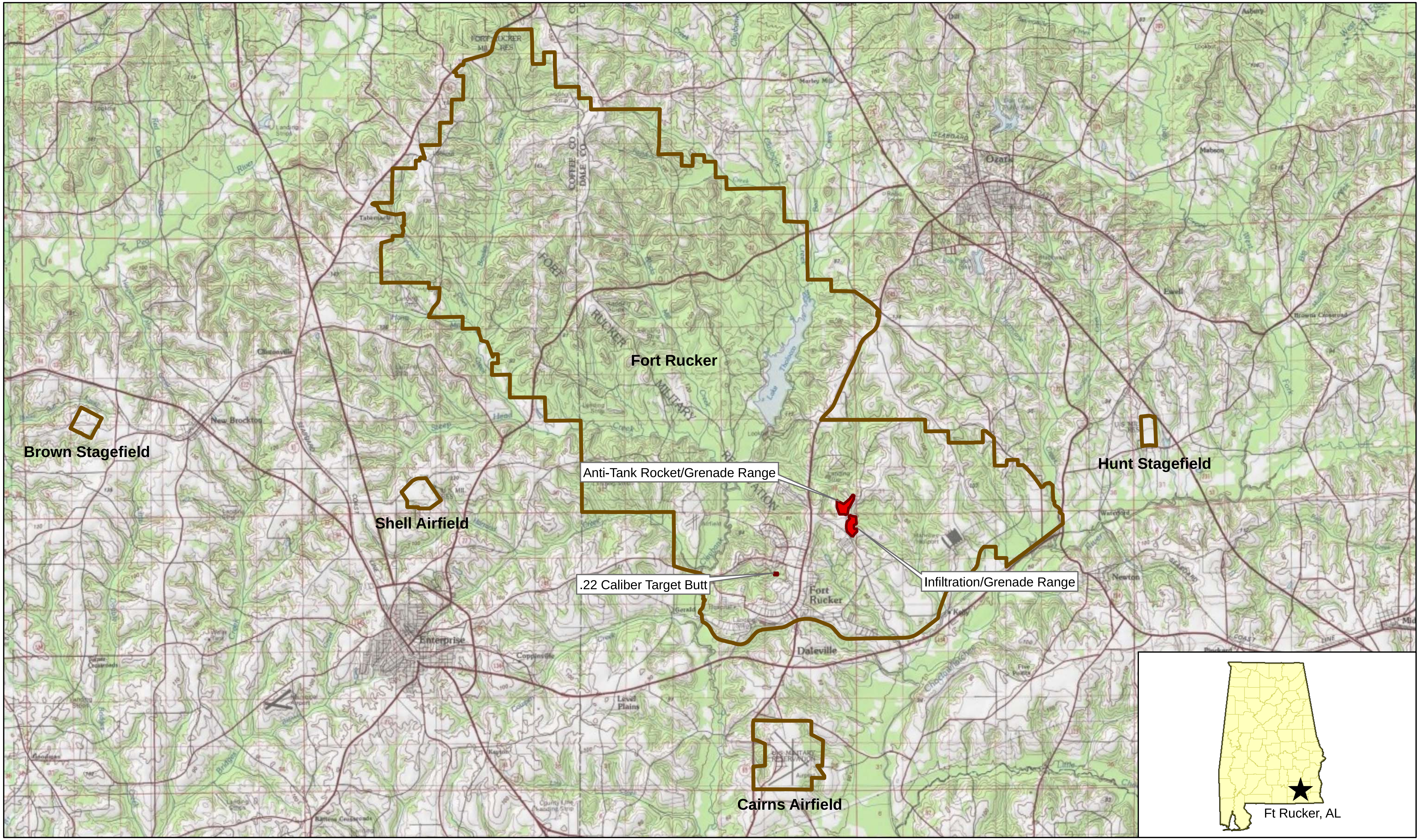
Project Position	Responsible Personnel	Contact Information
Senior Unexploded Ordnance (UXO) Supervisor/Site Manager (SM)	Chris Rose	CH2M HILL (360) 705-7070 chris.rose@ch2m.com
UXO Quality Control Specialist/ UXO Safety Officer	Cliff Walden	CH2M HILL (352) 335-5877 cliff.walden@ch2m.com

In addition to these personnel, other team members will be used on the project. Field team members will be responsible for collecting samples and performing field measurements under the supervision of the Senior UXO Supervisor (SUXOS)/SM and in accordance with the procedures set forth in the WP, Quality Assurance Project Plan (**Appendix E, Part II** of the WP) Investigative Derived Waste Plan (**Section 3.12** of the WP), and Accident Prevention Plan/Site Safety and Health Plan (APP/SSHP) (**Appendix D** of the WP).

Subcontractors will be used for several project activities. The subcontracted services and subcontractors are presented in **Table 2-2**.

TABLE 2-2
Subcontractors to be Used for Project Activities
MEC RFI, Fort Rucker, Alabama

Services Provided	Subcontractor	Point of Contact	Contact Information
Laboratory Analytical Services	Empirical Laboratories	Sonya Gordon	Project Manager (615) 345-1115 ext. 238 sgordon@empirlabs.com
	Empirical Laboratories	Rick Davis	Laboratory Director rdavis@empirlabs.com (615) 345-1115 ext. 245
	Empirical Laboratories	Marcia McGinnity	Data Quality Manager mmcginnity@empirlabs.com (615) 345-1555 ext. 232
Surveying Services	Donaldson, Garrett, and Associates	James Newberry	Project Manager (478)474-5350 ext 125/ cell (478) 361-3384
Vegetation Clearing	TBD		
Munitions Response	EERG	Frank Cota	Project Manager (623)266-9532, cell (623)680-0898/ frank.cota@errg.com
Geophysical Services	NAEVA	John Breznick	Project Manager (434)978-3187 ext. 206/JBreznick@naevageophysics.com
Investigation-Derived Waste (IDW) Transport and Disposal	Capital Environmental Services, Inc.	Terri Fort	Customer Representative (540) 777-6547, terri.fort@capitol-environmental.com



🟫 Installation Boundary
🟥 Munitions Response Site Boundary
NGS USA Topographic Maps

0 0.5 1 2
Miles

FIGURE 2-1
General Location Map
Fort Rucker, Alabama

\\GALILEO\PROJ\USACE\FT_RUCKER\MAPFILES\RFI\FIGURE_2-1-GENERALLOCATION.MXD SSMITH21 3/15/2010 12:04:26

CH2MHILL

FIGURE 2-2
Munitions Response Sites
Fort Rucker, Alabama

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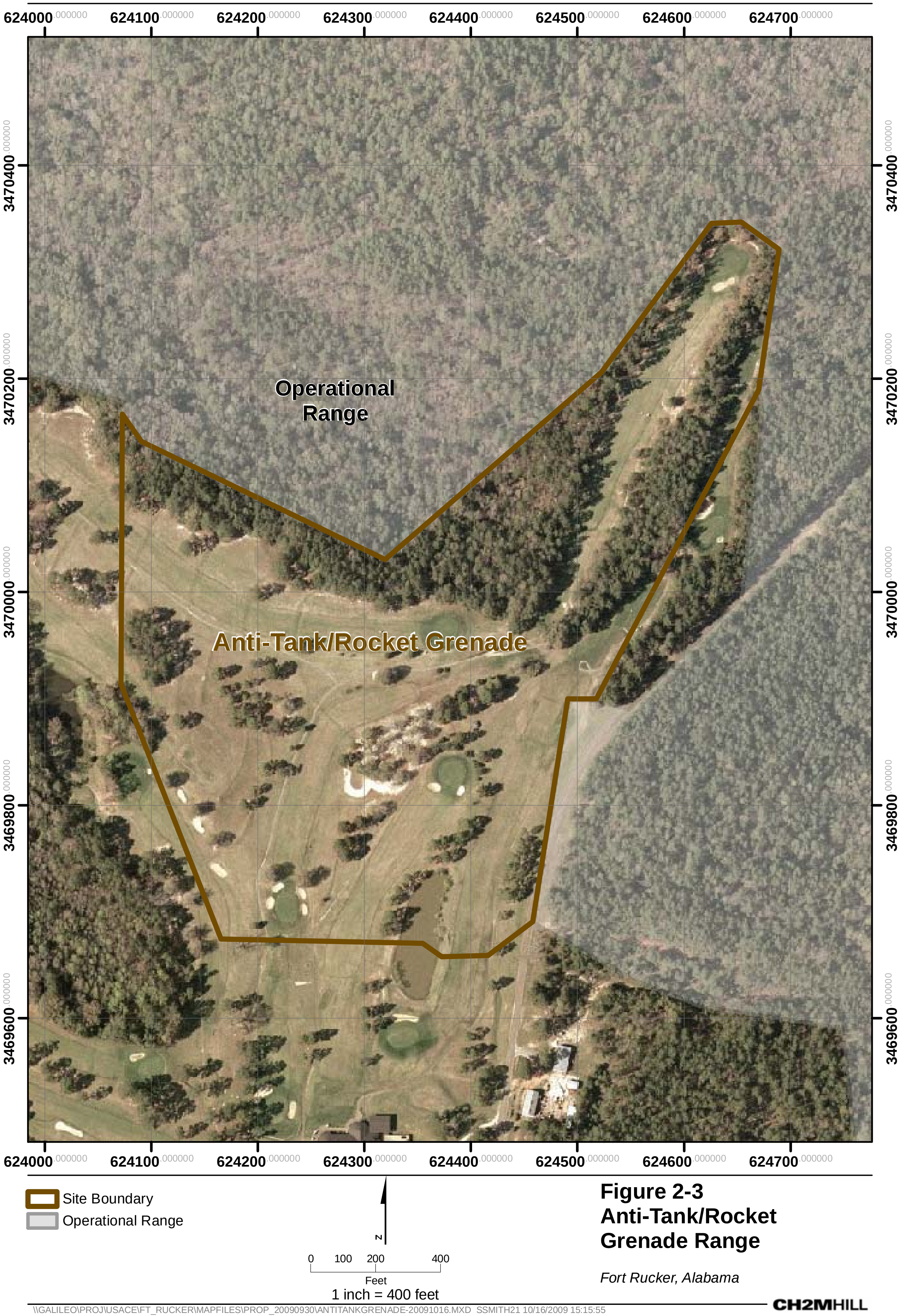

Figure 2-3
Anti-Tank/Rocket Grenade Range

Fort Rucker, Alabama

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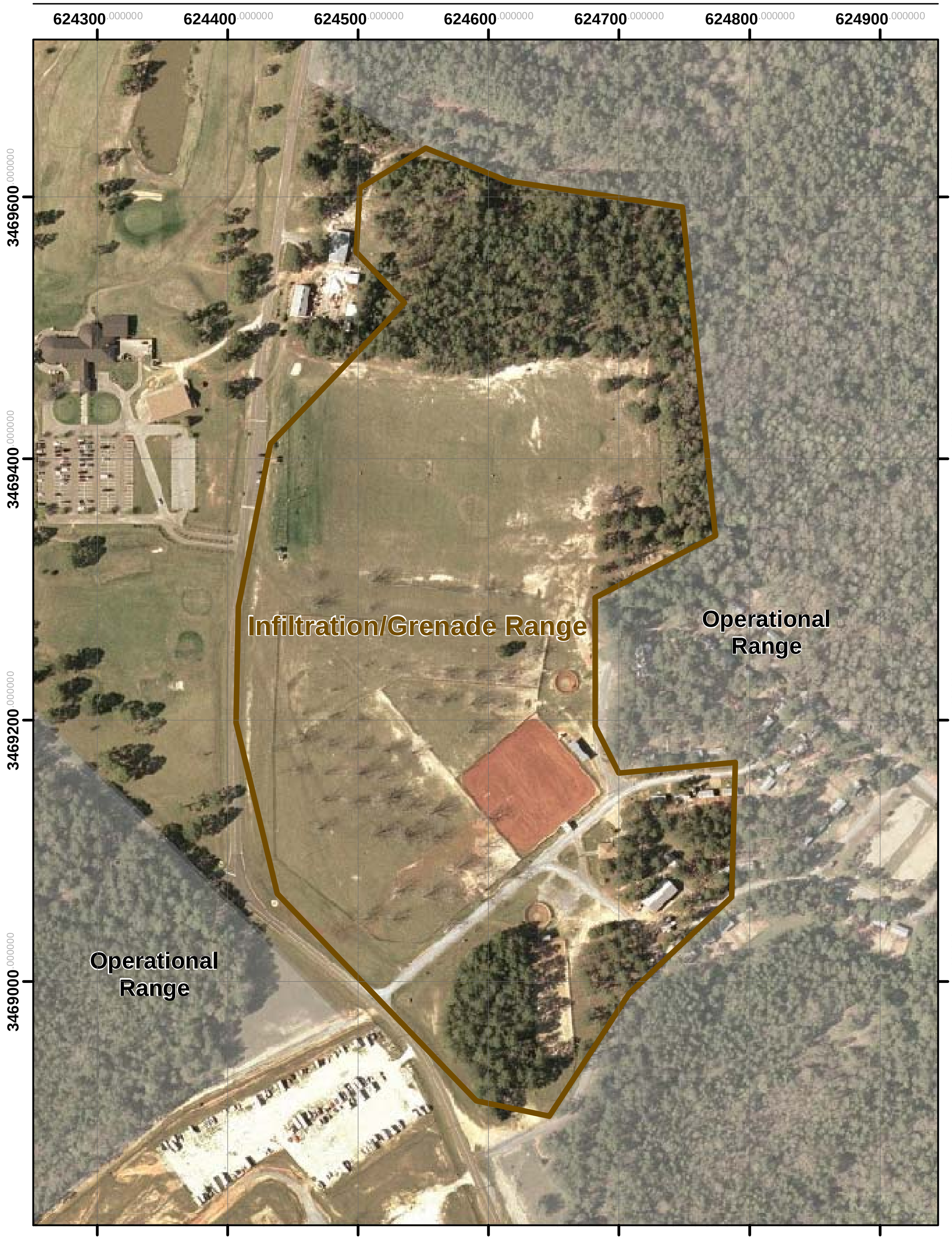

Figure 2-4
Infiltration/Grenade Range

Fort Rucker, Alabama

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▭ Site Boundary
▭ Operational Range

N

0 50 100 200
Feet
1 inch = 200 feet

Figure 2-5
.22-Caliber Target Butt

Fort Rucker, Alabama

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SECTION 3

Scope and Objectives

The purpose of the RFI is to determine if a release of contamination associated with MEC and small arms ammunition has occurred at levels posing potential risks to human and ecological receptors. The information derived from the RFI will be used to decide whether NFA is appropriate, further investigation is necessary, or a corrective measures study should be prepared to evaluate remediation alternatives for the MMRP sites.

Tasks associated with the field sampling and/or data collection are as follows:

- At the FTRU-001-R-01 Anti-Tank/Rocket Grenade Range MRS and the FTRU-003-R-01 Infiltration/Grenade Range MRS:
  - Instrument-Assisted Surface Clearance of wooded transects (see **Section 3.8.5** of the WP)
  - Digital geophysical mapping (DGM) (see **Section 3.8.7** of the WP)
  - Intrusive investigations (see **Section 3.8.9** of the WP)
  - MC soil sampling (see **Attachment 1** of this FSP for shallow soil sampling procedures) at locations where MEC/MPPEH (material potentially presenting an explosive hazard) was detonated (pre-blow-in place [BIP] and post-BIP samples). If significant MEC, MPPEH, or MD are found grouped together, soil samples will be collected using a grid sampling approach over the area, to determine any MC impact to site soils.
- At the FTRU-004-R-01 .22-Caliber Target Butt MMRP site:
  - Instrument-assisted walkabout (see **Section 3.8.8** of the WP)
  - MC soil sampling (see **Attachment 1** of this FSP for shallow soil sampling procedures) at biased locations (if there is evidence of munitions or munitions use).

At the FTRU-001-R-01 Anti-Tank/Rocket Grenade Range and FTRU-003-R-01 Infiltration/Grenade Range MRS, instrument-aided surface clearance, DGM, and intrusive investigations to identify potential MEC/MPPEH will be conducted. Collection of soil samples will be biased towards areas that have evidence of or potential for MEC/MPPEH as determined by field activities. If significant MEC, MPPEH, or MD are found grouped together, soil samples will be collected using a grid sampling approach over the area. Laboratory analysis will be performed for explosives (by USEPA Method SW8330A) and select metals (arsenic, cadmium, chromium, lead, mercury, and selenium) (by USEPA Method SW6010B/7000).

At the FTRU-004-R-01 .22-Caliber Target Butt MMRP site, an instrument-assisted site walkabout will be completed. Soil sampling will be biased based on findings of the instrument-assisted walkabout. Where small arms ammunition or other munitions are observed, discrete soil samples will be collected and sent to the laboratory for analysis of select metals (antimony, copper, lead, and zinc) (by USEPA Method SW6010B).

Soil samples will be collected and analyzed, and the data will be validated to provide a Level III data package. Data requirements are detailed in the Quality Assurance Project Plan (see **Part II** of this Sampling and Analysis Plan).

SECTION 4

Field Activities

4.1 Introduction

The RFI field tasks will be completed in one mobilization. Before mobilization to the field, CH2M HILL will ask the Fort Rucker Directorate of Public Works for available information regarding the location of subsurface utilities at the MRSs and the necessary utility clearances and permits to perform the planned investigation. The standard operating procedure (SOP) for locating and clearing underground utilities is presented in **Attachment 2**.

4.2 Soil Sampling

4.2.1 Rationale and Sampling Approach

4.2.1.1 FTRU-001-R-01 Anti-Tank/Rocket Grenade Range and FTRU-003-R-01 Infiltration/Grenade Range

Based on historical munitions training at these MRSs, the ranges in these sites are anticipated to have a significant density of MEC/MPPEH in the soil near any targets, with the density of items dropping off as the radial distance increases.

Soil samples will be collected with a bias toward areas that have evidence of or potential for MEC/MPPEH as determined by the DGM and intrusive investigation process. A discrete soil sample will be collected underneath the location where MEC was detonated. If significant anomalies are found grouped together, soil samples will be collected using a grid sampling approach in the area where the anomalies were found. Up to 25 soil samples are planned for collection at each MRS. The exact locations of the samples are not known at this time.

Based on the nature of munitions use, penetration of the munitions into the soil is not expected to exceed 2 feet below ground surface (bgs) at these sites.

4.2.1.2 FTRU-004-R-01 .22-Caliber Target Butt MMRP Site

This site may have been historically used as a small arms range (suggesting that MEC/MPPEH is not present); however, the discovery of an empty M48 trip flare (a non-fragmentation-producing munition used to illuminate enemy forces at night) within the boundary of the identified site suggests that the area was used for some type of surface military training activities. Because Fort Rucker is a military installation, it can be anticipated that many areas were used for training activities and that individual munitions items (such as the discovered flare) could be found nearly anywhere on the installation.

An instrument-assisted site walkabout will be completed using a Schonstedt GA 52-Cx flux gate magnetometer, or equivalent, to search for evidence of small arms or munitions use. The SOP for using a magnetometer is presented in **Attachment 3**. Where small arms ammunition or other munitions are observed, discrete soil samples will be collected and sent to the laboratory for analysis of select metals (antimony, copper, lead, and zinc).

Ammunition usage is expected to be limited to .22-caliber rounds for small arms. Potential MCs associated with this type of munitions are lead, antimony, arsenic, copper, and zinc.

Based on the nature of small arms ammunition, penetration of the ammunition into the soil is not expected to exceed 12 inches bgs at the site; however, a small portion of the samples will be collected from the subsurface if the presence of a berm is discovered. A berm would indicate that there may be a presence of MC at depths deeper than 1 foot bgs.

4.2.2 Procedures

4.2.2.1 Sampling Methods – Field and Laboratory Analyses

Before munitions response activities begin, CH2M HILL will obtain all proper clearances and permits, and the sampling locations will be checked for obvious obstructions or hazards. The soil samples will be collected in accordance with the SOP for shallow soil samples presented in **Attachment 1.**

The soil sample laboratory analysis requirements are presented in **Table 4-1.**

TABLE 4-1
Soil Sample Analysis Requirements
RFI, MMRP, Fort Rucker, Alabama

Site	Matrix	Depth	Method	No. of Field Samples
FTRU-001-R-01 Anti-Tank/Rocket Grenade Range	Surface Soil	0-6 inches	SW8330A Explosives SW6010B/7000 Metals (arsenic, cadmium, chromium, lead, mercury, and selenium)	*25
FTRU-003-R-01 Infiltration/Grenade Range	Surface Soil	0-6 inches	SW8330A Explosives SW6010B/7000 Metals (arsenic, cadmium, chromium, lead, mercury, and selenium)	*25
FTRU-004-R-01 .22-Caliber Target Butt	Surface and Subsurface Soil	0-6 inches, 6-12 inches (subsurface soil collected in the berm if discovered)	SW6010 Metals (lead, antimony, copper, and zinc)	*25

* Total number of field samples is estimated and is subject to the results of the intrusive investigation and site walkabout.

4.2.2.3 Sample Containers and Preservation Techniques

The analytical laboratory will provide all sample containers. The containers will be cleaned in accordance with USEPA protocol and pre-preserved by the laboratory. All samples collected during the field investigation and submitted to the laboratory for chemical analyses will be preserved according to USEPA standards. Immediately upon sample collection, the sample containers will be properly labeled then placed into ice-cooled chests for shipment to the laboratory. Sample preservation requirements, holding times, and required sample container types are presented in **Table 4-2**.

TABLE 4-2
Container, Preservative, and Holding Time Requirements for Soil Samples
RFI, MMRP Fort Rucker, Alabama

Matrix	Test	Method	Container	Preservative/ Temperature	Holding Time
Soil	Metals	6010B	4 oz. glass jar	None / 4^{o}C	180 days
Soil	Mercury	7470/7471	4 0z. glass jar	None/4□C	28 Days
Soil	Explosives	8330A	4 oz. glass jar	None / 4^{o}C	14 days*

*For extraction; extract must be analyzed within 40 days of extraction.

4.2.2.4 Field Quality Control Sampling Procedures

All sampling will require 10 percent accompanying QA/QC samples (field duplicates and equipment rinsate blanks) and 5 percent MS/MSD samples. Temperature blanks will be included for each cooler submitted to the laboratory. When QA/QC and MS/MSD samples are collected, all containers for the same analysis will be filled simultaneously (e.g., fill the field, QA/QC, and MS/MSD metals sample containers all at once, then repeat this procedure for all other analytical methods). When possible, QA/QC and MS/MSD samples will be collected from a location that can be characterized as most likely to exhibit the highest quantity of detectable constituents. The field duplicates and MS/MSD samples will serve as a check on the precision and accuracy of the laboratory. Equipment rinsate blank results will be used to identify problems associated with decontamination procedures in the field.

Equipment rinsate blanks will be prepared by rinsing equipment with reagent grade American Society for Testing and Materials (ASTM) Type II water after the equipment has been decontaminated. The rinsate will be collected directly into the required sample containers. Sample analysis requirements for these equipment blank samples are presented in **Table 4-3**.

TABLE 4-3
Field QC Requirements
RFI, MMRP, Fort Rucker, Alabama

Matrix	Method/ Analytical Group	Number of Sampling Locations	Number of Field Duplicates	Number of MS/MSDs	Number of Equipment Blanks	Number of Volatile Organic Compound (VOC) Trip Blanks
Soil	6010B/7000 - Metals	*75	8	4	8	0
Soil	8330A - Explosives	*50	5	3	3	0

* Total number of field samples is estimated and is dependent on the results of the intrusive investigation and site walkabout

4.2.2.5 Decontamination Procedures

The sampling equipment (scoops, bowls, and any other hand sampling tools) will be decontaminated before initial use (except for disposable equipment that is not reused) and between each sampling event. Decontamination of the small sampling tools will involve scrubbing the equipment with a solution of distilled water and Alconox, or equivalent, followed by a distilled water rinse and an ASTM Type II reagent grade water rinse. All equipment must be allowed to completely air dry before reuse. Sampling tools that will not be immediately used after decontamination will be placed in sealable plastic bags or wrapped in aluminum foil for temporary storage. The SOP for decontamination of personnel and equipment is presented in **Attachment 4**.

SECTION 5

Documentation

5.1 Field Logbook

All field activities will be documented in a bound field logbook in indelible, waterproof ink. The SOP for preparing field logbooks is presented in **Attachment 5**. Information about all the onsite activities will be recorded in the logbook and will include, at a minimum, the following:

- Project name and number
- The current date, pertinent times (in military time), and arrival/departure times from the site
- Individuals (team members and non-members) onsite
- Site-safety activities, injuries, and other incidents
- Directions from others
- Site conditions and ambient weather conditions
- Sample locations (boring number) and depths
- Sample numbers, number/type of containers, sample time and date
- Analyses requested and laboratory assignments
- Sampler's name and signature
- Type of sample collected
- Other notes and information, as required

Notes will be written on sequentially numbered pages. At the end of each day, any unused space at the bottom of the last page will be crossed out, dated, and initialed by the SM.

5.2 Field Log Sheets

All field log sheets (sampling forms, etc.) will be completed using indelible, waterproof ink following the procedures outlined in this FSP. The SM will be responsible for the daily collection of all field log sheets, including chain-of-custody documentation, from team members.

5.3 Photographs

Photographs of the various RFI field activities will be taken throughout the field activities. Photographs that are representative of field activities are required; however, photographs of each sampling location are not required. All photographs will be numbered sequentially and the numbers recorded in the field logbook.

5.4 Sample Documentation

5.4.1 Sample Numbering System

In order to identify and accurately track the various samples, all samples collected during this investigation, including QA/QC samples, will be designated with a unique number. The number will identify the investigation, the site, the sample media, sampling location, the depth or round of sample, and QA/QC qualifiers.

The sample designation format is as follows:

- Site and MMRP Site - Media–Station #–Depth and QA/QC (if applicable)

An explanation of each of these identifiers is given below.

Site and MMRP:

- FTRU-001 = Anti-Tank/Rocket Grenade Range MRS
- FTRU-003 = Infiltration/Grenade Range MRS
- FTRU-004 = .22-Caliber Target Butt MMRP site

Media:

- SS = Surface Soil
- SB = Subsurface Soil
- Station #: Each soil test location will be identified with a unique identification number.
- Depth/Round Depth indicators will be used for soil samples during the investigation. The top sample depth will used in the identification number. For example:
- 0 to 6 inches bgs will be referenced as 6

QA/QC:

- FD = Field Duplicate Sample
- TB = Trip Blank
- ER = Equipment Rinsate
- MS= Matrix Spike
- MSD = Matrix Spike Duplicate

<u>EXAMPLE</u>: Under this sample designation format, the sample designation FTRU-003-SS-7-6FD refers to: FTRU-003 = Infiltration/Grenade Range MRS, SS = surface soil sample, 7 = Station #7, 6 = Sample depth interval 0-6 inches, and FD = Field Duplicate.

The sample identification number for each soil or groundwater sample collected will be documented in the field logbook.

5.4.2 Sample Labels and/or Tags

Each sample container will include a label that identifies, at a minimum: sample identification number, analytical preparation and analysis methods requested, sample date, sample time, initials of the sampler, and client. All information will be written in waterproof ink and the label will be affixed with clear tape.

5.4.3 Chain-of-Custody Forms

A chain-of-custody form will be prepared for each cooler of samples shipped to the laboratory. The SOP for chain-of-custody forms is presented in **Attachment 6**.

Information recorded will include, at a minimum: investigation site name, sampler name(s), date and time of sample collection, identification code unique to each sample, number of containers with the same sample code, analyses requested for each sample (including the analytical method numbers), and signature blocks for each individual who had custody of the sample(s).

Upon receipt of samples at the laboratory, all samples will proceed through an orderly processing sequence specifically designed to ensure continuous integrity of both the sample and other information pertinent to the analysis. If no discrepancies are identified, the sample chain-of-custody record will be signed, and the samples will be assigned a unique laboratory identification number by the laboratory for tracking and filing. The laboratory QA system and the use of an internal chain-of-custody procedure will ensure that the samples are appropriately tracked by the laboratory from receipt through completion of analysis.

5.4.4 Receipt for Sample Forms

Upon receipt at the laboratory, all samples will be carefully checked and verified for proper chain-of-custody records, preservation, broken or leaking sample containers, proper label identification, and any associated discrepancies. These items will be documented on a laboratory cooler receipt form. If any samples arrive leaking or broken, or the custody seal on the shipment coolers is not intact, the Project Chemist and/or CH2M HILL Project Manager (PM) will be notified immediately. The cooler receipt form will become part of the permanent laboratory record.

5.5 Non-Routine Occurrence Report

A written non-routine occurrence report (NROR) of all significant problems resulting from non-routine occurrences in the field or at the laboratory will be submitted to the Contracting Officer's Representative (COR) within 48 hours of the occurrence of the event. These NRORs will identify the problems encountered, verbal or written instructions from the COR, corrective actions taken, and any re-sampling or re-analyses that are deemed necessary.

5.6 Corrections to Documentation

Corrections that are required in field logbook(s) or on any field forms must be completed by lining through incorrect entries with a single line and initialing and dating the strikeout.

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SECTION 6

Sample Packaging and Shipping

Samples collected during the field activities will be shipped via an overnight courier to the analytical laboratory. A cooler of suitable strength for packaging and shipping samples will be used and will be manifested to meet U.S. Department of Transportation regulations. The inside bottom and sides of each cooler will be lined with bubble wrap or other cushioning material. Each sample jar or bottle will also be individually wrapped in bubble wrap to prevent breakage. All samples will be kept upright in the cooler. Once the samples are in the cooler, any voids will be filled with additional packaging material. Ice will be double-bagged in re-sealable bags and placed in the cooler with the samples. A sufficient amount of ice will be added to the coolers to ensure that they arrive at the laboratory at a temperature of 4° Celsius (± 2° Celsius). The chain-of-custody record will be placed in a watertight plastic bag and taped to the inside lid of the cooler, and one copy of the chain-of-custody record will be retained by the SM. The shipping air bill tracking number will be written on the chain-of-custody record for reference. If the cooler has an identification number, the identification number will also be recorded on the chain-of-custody record. The cooler will be secured with strapping tape, and custody seals will be affixed to the front and back of the cooler. The custody seals will be covered with wide, clear adhesive tape.

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SECTION 7

Investigation-Derived Wastes

7.1 Rationale

Although the waste generated during the field activities is assumed to be non-hazardous, all waste in contact with site soils will be containerized and handled as hazardous until analytical results of characterization sampling indicate that the waste is non-hazardous. The following IDWs are expected to be generated during the field activities:

- Used personal protective equipment and disposable sampling equipment
- Decontamination fluids
- General trash (uncontaminated)
- Empty containers

A subcontractor for IDW management will be procured, as needed.

7.2 IDW Handling and Management

It is assumed that field screening and visual observations made during the field activities will be sufficient to characterize IDWs as potentially hazardous or non-hazardous for the purpose of segregating them in the field. **Table 7-1** identifies the approximate volumes of IDWs expected to be generated during this project.

TABLE 7-1
Volumes of IDWs Expected to be Generated During Field Activities
RFI, MMRP, Fort Rucker, Alabama

Waste Media	Container Type	Total Volume Expected
Used personal protective equipment and disposable sampling equipment	55-gal. drum	1 drum
Decontamination water	55-gal. drum	2 drums
General trash (uncontaminated)	55-gal. drum	1 drum
Empty containers	55-gal. drum	1 drum

The SM will label each waste container to indicate the container contents, type of waste, location where the waste was generated, identification numbers of the soil boring location(s) associated with the waste, date that the drum was filled, name of the contractor who filled the drum, and a contractor point of contact name. The container number, contents, and filling date(s) will be recorded in the project field logbook.

7.3 IDW Characterization

To characterize soil IDW for disposal, one composite soil sample will be collected from the drums containing soil. Waste characterization and profiling will be performed by CH2M HILL. To characterize liquid IDW for disposal, one grab sample will be collected from the decontamination water in the drums. The liquid IDW sample will be submitted for analysis of toxicity characteristic leaching procedure (TCLP) VOCs TCLP semivolatile organic compounds, TCLP RCRA metals, TCLP pesticides, TCLP herbicides, and for reactivity, corrosivity, and ignitability. The SOP for collecting a sample from tanks and drums is presented in **Attachment 7**. Waste transportation and disposal will be subcontracted. The SOP for disposal of waste fluids and solids is provided in **Attachment 8**.

7.4 Waste Management

7.4.1 Waste Storage Time Limit

Hazardous wastes generated from treatment detonation-related activities will be removed from the site within 90 days of generation. Waste, debris, and wastewater that are characterized as non-hazardous will be removed from the site as soon as possible.

7.4.2 Labels

The labeling of waste containers will be in accordance with 49 Code of Federal Regulations (CFR) 172, 173 and 178. Labels will include the type of waste, location from which the waste was generated, and accumulation start date. Containers and tanks used to store/accumulate waste will include one of the following labels:

- "Analysis Pending" or "Waste Material" - Temporary or handwritten label until analytical results are received and reviewed. This label will include the accumulation start date.
- "Non-Hazardous Waste" - Preprinted labels with the following information:
    - Accumulation start date
    - Generator name
    - USEPA identification number
    - Waste-specific information (e.g., contaminated soil)

7.4.3 General Waste Management Requirements

Wastes will be accumulated in an area identified or approved by Fort Rucker, that is not accessible to the general public, and that can be secured.

Temporary waste accumulation areas will contain appropriate emergency response equipment. The APP/SSHP **(Appendix D)** identifies the specific emergency response procedures and equipment.

All containers, drums, and tanks will be inspected upon arrival at the site for equipment in disrepair and any contamination of contents. If a container contains waste upon arrival or is in disrepair, it will be immediately rejected and documented.

The following guidelines relate to drums and small containers:

- Drums and small containers will be transported to the temporary accumulation areas on wood pallets and will be secured together with non-metallic banding.
- Drums will be inspected and inventoried upon arrival onsite for signs of contamination and/or deterioration.
- Adequate aisle space (e.g., 30 inches) will be provided for containers such as 55-gallon drums to allow the unobstructed movement of personnel and equipment. A row of drums should be no more than two drums wide.
- Each drum will be provided with its own label, and labels will be visible.
- Drums will remain covered except when removing or adding waste to the drum. Covers will be properly secured at the end of each workday.
- Drums will be disposed of with the contents. If the contents are removed from the drums for offsite transportation and treatment or disposal, the drums will be decontaminated prior to re-use or before leaving the site.
- Drums containing liquids or hazardous waste will be provided with secondary containment.

7.4.3.5 Inspection of Waste Storage Areas

Waste accumulation areas will be inspected for malfunctions, deterioration, discharges, and leaks that could result in a release. The following inspection schedule will be followed:

- At a minimum, weekly inspection of containers (for leaks, signs of corrosion, or signs of general deterioration).

Any deficiencies observed or noted during inspection will be rectified immediately.

Inspections will be recorded in the Daily Quality Control Report (DQCR) (see Section 8) and include any deficiencies and how issue was rectified. Copies of the report will be maintained onsite and available for review.

7.5 Shipping Documentation

Prior to offsite disposal of any waste, a waste approval package will be provided to the COR for each waste stream. This package will include a waste profile naming the U.S. Army as the generator of the waste, analytical summary table(s) applicable to the waste, a completed waste manifest, and any other applicable information necessary for the Army to complete its review of the disposal package and add its signature as the generator.

The signed profile will then be submitted to the disposal facility for acceptance. Once the approval letter is received from the disposal facility, transportation can be scheduled.

Each load of waste material will be manifested prior to leaving the site. At a minimum, the manifest form will include the following information:

- Generator information, including (1) contact name, address, and phone number and (2) USEPA identification number
- Transporter information, including (1) contact name, address, and phone number and (2) USEPA identification number
- Facility information, including name, address, and phone number, as well as USEPA identification number
- Site name, including street/mailing address
- U.S. Department of Transportation (DOT) Proper Shipping Name
- Quantity of waste (volumetric estimate)
- Contract Task Order (CTO) or job number
- Profile number
- 24-hour emergency phone number

The generator (Army) and the transporter must sign the manifest prior to the load of waste leaving the site. A copy of the manifest will be retained onsite and included with the DQCR. The original signed manifest will be returned to the address of the generator. The facility will provide a copy of this signed manifest to CH2M HILL for the final report. The final report will include copies of the facility signed manifest and the Certificate of Disposal/Destruction/Recycle.

7.6 Disposal

Offsite treatment, recycling, or disposal facilities will use the waste profile and supporting documentation, such as analytical results, to determine if the facility will accept a waste. Petroleum-contaminated liquids will be sent to a qualified wastewater treatment facility.

SECTION 8

Contractor Chemical Quality Control

8.1 Introduction

The contractor chemical quality control (CCQC) will be summarized in the DQCR (see **Attachment 9**), which will be submitted to the COR. The objective of CCQC is to ensure that QC is maintained through all phases of field work.

8.2 Preparatory Phase

The SM will conduct a CCQC review before any field activities begin. The review will cover, but not be limited to, the following: all work requirements, a physical examination of all project materials and equipment, an examination of the work area to confirm the completion of preliminary work, and a discussion of all field activities. The CCQC review must be repeated if new personnel begin work at the investigation site at a later date.

8.3 Initial Phase

The SM will monitor field activities on a daily basis to confirm that all aspects of CCQC are followed. Any action items identified will be included with the DQCR.

8.4 Follow-up Phase

A summary of CCQC activities will be submitted with the DQCR.

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SECTION 9

Daily Quality Control Reports

DQCRs (see **Attachment 9**) will be completed by the SM for each day of field activity and forwarded to the CH2M HILL PM. The PM will submit the DQCR to the COR the following morning. If a significant problem arises at the investigation site, the DQCR will be sent to the COR on the day of occurrence, along with an NROR. The DQCR will include, at a minimum, the following information:

- Project title
- Date and sequential DQCR number
- Contract and task order number
- Location of work
- Weather (temperature, wind speed, direction, etc.)
- Work performed
- Sampling information (location, type, identification number of samples, etc.)
- Field analyses (type, results, calibration, problems, etc.)
- Problems encountered and corrective actions taken
- QC activities
- Verbal or written instructions from the COR
- Names of all personnel onsite (including affiliation, job function)
- Equipment used
- Health and safety considerations (protective equipment required, etc.)
- Deviations from this approved FSP
- Other pertinent remarks
- Expected activities for the following day

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SECTION 10

Corrective Actions

10.1 Introduction

A corrective action program will be implemented to ensure that conditions adverse to quality are identified promptly and corrected as soon as practical. In the case of significant conditions adverse to quality, the root cause of the condition will be identified, and corrective action will be taken to prevent recurrence. These actions will be documented and reported to appropriate levels of management. Corrective actions may be the result of internal audits or surveillance, laboratory analytical results that appear unusual or questionable, or the exceedance of QC criteria. Follow-up actions will be taken to verify implementation of all corrective actions.

10.2 Reporting and Resolution Requirements

Significant quality problems and conditions will be identified, reported, and corrected in accordance with the following requirements:

- Existing, developing, or potentially out-of-control quality conditions will be promptly reported to the PM for evaluation and action. The PM will notify the COR verbally, as soon as possible, of all non-routine occurrences, followed by a written NROR within 48 hours. Following any corrective action, the PM will submit a report to the COR detailing the problems, corrective actions taken, and verbal or written instructions received from the COR.

- Reports documenting quality problems and their resolution, including lessons learned from significant quality problems and adverse conditions, will be disseminated to all affected project personnel.

- Reports documenting quality problems, if they reflect data quality issues, will be included in the chemical data report packages.

10.3 Laboratory Corrective Action

The analytical data generated during the project will be reviewed by the laboratory to ensure that all QC samples have been analyzed as specified in the methods. Recoveries of laboratory MS/MSD samples and surrogates will be checked for compliance with method accuracy requirements. Relative percent difference of laboratory MS/MSDs will be checked for compliance with method precision requirements. Where sample results fall outside of the acceptable ranges for accuracy and precision associated with individual methods, discrepancies will be reported immediately to the CH2M HILL PM. Corrective actions will be defined and documented appropriately.

The contracted laboratory will have an internal QA corrective action program. This program will include verification that QC data are not outside acceptable windows for precision and accuracy, that blanks or control samples do not contain contaminants above detection limits, and that undesirable trends detected in spike recoveries or relative percent differences between duplicates are corrected. The program will also ensure that there are no unusual changes in detection limits, that holding times have not been exceeded, and that deficiencies detected by the laboratory QA department during internal or external audits or from results of performance evaluation samples are corrected.

10.4 Recurring Conditions Adverse to Quality

For recurring quality problems, where corrective actions have not been effective, the CH2M HILL PM, as needed, will do the following:

- Identify the events leading to the occurrence of the quality problems.
- Develop an understanding of the technical details and work activities associated with the quality problems.
- Ascertain the implications of the quality problems.
- Determine the extent to which similar quality problems (or precursors to the problems) have been recognized by the responsible party, the effectiveness of any corrective actions that were taken, and impacts on completed work.
- Consider stopping work associated with the applicable activity.
- Recommend actions that can be taken by the responsible party to prevent or minimize recurrence.

SECTION 11

Project Schedule

The project schedule for the MMRP RFI is presented in **Section 2** of the WP (see **Figure 2-1**). The figure shows the anticipated duration (in days) for each task, anticipated starting and ending dates for each task, a graphical representation of the time frames for the performance of each task, and the interrelationships between various tasks.

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Attachment 1
SOP: Shallow Soil Sampling

STANDARD OPERATING PROCEDURE

Shallow Soil Sampling

I. Purpose

To provide general guidelines for the collection and handling of surface soil samples during field operations.

II. Scope

The method described for surface soil sampling is applicable for loosely packed earth and is used to collect disturbed-soil samples.

III. Equipment and Materials

- Sample jars.
- A hand auger or other device that can be used to remove the soil from the ground. Only stainless steel, Teflon, or glass materials should be used. The only exception is split spoons, which are most commonly available in carbon steel; these are acceptable for use only if they are not rusty.
- A stainless steel spatula should be used to remove material from the sampling device.
- Unpainted wooden stakes or pin flags
- Fiberglass measuring tape (at least 200 feet in length)
- GPS Unit (if available)

IV. Procedures and Guidelines

A. Wear protective gear, as specified in the Health and Safety Plan.

B. To locate samples, identify the correct location using the pin flags or stakes. Proceed to collect a sample from the undisturbed soil adjacent to the marker following steps C and D. If markers are not present, the following procedures will be used.

1. For samples on a grid:

   a. Use measuring tape to locate each sampling point on the first grid line as prescribed in the sampling plan. As each point is located, drive a numbered stake in the ground and record its location on the site map and in the logbook.

   - b. Proceed to sample the points on the grid line.
   - c. Measure to location where next grid line is to start and stake first sample. For subsequent samples on the line take two orthogonal measurements: one to the previous grid line, and one to the previous sample on the same grid line.
   - d. Proceed to sample the points on the grid line as described in Section C below.
   - e. Repeat 1c and 1d above until all samples are collected from the area.
   - f. Or, a GPS unit can be used to identify each location based on map coordinated, if available.

2. For non-grid samples:
   - a. Use steel measuring tape to position sampling point at location described in the sampling plan by taking two measurements from fixed landmarks (e.g., corner of house and fence post).
   - b. Note measurements, landmarks, and sampling point on a sketch in the field notebook, and on a site location map.
   - c. Proceed to sample as described in Section C below.
   - d. Repeat 2a through 2c above until all samples are collected from the area.
   - e. Or, a GPS unit can be used to identify each location based on map coordinated, if available.

C. To the extent possible, differentiate between fill and natural soil. If both are encountered at a boring location, sample both as prescribed in the field sampling plan. Do not locate samples in debris, tree roots, or standing water. In residential areas, do not sample in areas where residents' activities may impact the sample (e.g., barbecue areas, beneath eaves of roofs, driveways, garbage areas). If an obstacle prevents sampling at a measured grid point, move as close as possible, but up to a distance of one half the grid spacing in any direction to locate an appropriate sample. If an appropriate location cannot be found, consult with the Field Team Leader (FTL). If the FTL concurs, the sampling point will be deleted from the program. The FTL will contact the CH2M HILL Project Manager (PM) immediately. The PM and QA Manager will discuss whether the point should be deleted from the program. If it is deleted, the PM will follow-up with the QA Manager in writing.

D. To collect samples:

1. Use a decontaminated stainless steel scoop/trowel to scrape away surficial organic material (grass, leaves, etc.) adjacent to the stake. New disposable scoops or trowels may also be used to reduce the need for equipment blanks.

2. If sampling:

    a. Surface soil: Obtain soil sample by scooping soil using the augering scoop/trowel, starting from the surface and digging down to a depth of about 6 inches, or the depth specified in the workplan.

    b. Subsurface soil: Obtain the subsurface soil sample using an auger down to the depths prescribed in the field sampling plan.

3. Take a photoionization detector (PID) reading of the sampled soil if organics are anticipated to be present and record the response in the field notebook. Also record lithologic description and any pertinent observations (such as discoloration) in the logbook.

4. Empty the contents of the scoop/trowel into a decontaminated stainless steel pan.

5. Repeat this procedure until sufficient soil is collected to meet volume requirements.

6. For TCL VOC and field GC aliquots, fill sample jars directly with the trowel/ scoop and cap immediately upon filling. DO NOT HOMOGENIZE.

7. For TCL pesticides/PCBs and SVOCs, TAL metals, and field XRF aliquots, homogenize cuttings in the pan using a decontaminated stainless steel utensil in accordance with SOP *Decontamination of Drilling Rigs and Equipment*.

8. Transfer sample for analysis into appropriate containers with a decontaminated utensil.

9. Backfill the hole with soil removed from the borehole. To the extent possible, replace topsoil and grass and attempt to return appearance of sampling area to its pre-sampled condition. For samples in non-residential, unmowed areas, mark the sample number on the stake and leave stake in place. In mowed areas, remove stake.

V. Attachments

None.

VI. Key Checks and Items

- Use phthalate-free latex or surgical gloves and other personal protective equipment.
- Transfer volatiles first, avoid mixing.
- Decontaminate utensils before reuse, or use dedicated, disposable utensils.

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Attachment 2
SOP: Locating and Clearing Underground Utilities

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STANDARD OPERATING PROCEDURE

Locating and Clearing Underground Utilities

I. Purpose

The purpose of this SOP is to provide general guidelines and specific procedures to be followed on MMRP sites for locating underground utilities and clearing dig locations to minimize hitting underground utilities and liabilities to CH2M HILL, its subcontractors, and health and safety risks to project staff.

This SOP shall be used by Project Manager to develop work-specific utility location procedures. The work-specific procedures will become part of work plans and project instructions and will be used to prepare scopes of work (SOWs) for the procurement of utility location subcontractors to meet the needs of this MMRP project.

This SOP also identifies the types of utility locating services that are available from subcontractors and the various tools that are used to locate utilities, and discusses when each type of service and tool may or may not be applicable.

II. Scope

The work permit requires utility locating (or dig clearance) services. Clearance of individual work (dig) locations should be done to a minimum 20-foot radius around the location. An example SOW for a utility subcontractor procurement is provided in Attachment A.

III. Services

The services that are available to us for identifying and marking underground utilities are:

- The local public/private utility-run service
- Utility location subcontractors (hired by us)

Attachment B provides a description of each type of organization.

IV. Equipment

Attachment C provides a summary of the various types of equipment used for subsurface utility location. It describes the capabilities and limitations of each in order to help the PM determine if the equipment being used by a subcontractor is adequate.

It is important to make the potential subcontractors aware of the possible types of utilities (and utility materials) that are at the site, and to have them explain in their bid what types of equipment they will use to locate utilities /clear dig locations, and the limitations of these equipment items.

V. Procedures and Guidelines

This section presents specific procedures to be followed by the PM for the utility location work to be conducted by CH2M HILL and its subcontractors. The PM will follow the procedures required by the work to obtain their approvals, clearances and dig permits where necessary. These "dig permit" requirements vary by activity and must be added to the project-specific SOP, or project instructions.

Work Notification and Dig Permit Procedures

Identify work permit and/or procedural requirements for excavation and drilling activities. Contact the Fort Rucker POC and obtain the appropriate form to begin the clearance process.

CH2M HILL Utility Clearance Procedures

Do not begin subsurface activities (e.g., trenching, excavation, drilling, etc.) until a check for underground utilities and similar obstructions has been conducted The use of as-built drawings and utility company searches must be supplemented with a geophysical or other survey by a qualified, independent survey contractor (subcontracted to CH2M HILL) to identify additional and undiscovered buried utilities.

- Examples of the type of geophysical technologies include (these are further described in Attachment C):**Ground Penetrating Radar (GPR),** which can detect pipes, including gas pipes, tanks, conduits, cables etc, both metallic and non-metallic at depths up to 30 feet depending on equipment. Sensitivity for both minimum object size and maximum depth detectable depends on equipment selected, soil conditions, etc.
- **Radio Frequency (RF),** involves inducing an RF signal in the pipe or cable and using a receiver to trace it. Some electric and telephone lines emit RF naturally and can be detected without an induced signal. This method requires knowing where the conductive utility can be accessed to induce RF field if necessary.
- **Dual RF**, a modified version of RF detection using multiple frequencies to enhance sensitivity but with similar limitations to RF
- **Ferromagnetic Detectors** are metal detectors that will detect ferrous and non-ferrous utilities. Sensitivity is limited, e.g. a 100 mm iron disk to a depth of about one meter or a 25 mm steel paper clip to a depth of about 20 cm.
- **Electronic markers** are emerging technologies that impart a unique electronic signature to materials such as polyethylene pipe to facilitate location and tracing after installation. Promising for future installations but not of help for most existing utilities already in place.

The following procedures shall be used to identify and mark underground utilities during subsurface construction activities on the project:

- Contact utility companies or the state/regional utility protection service at least two (2) working days prior to intrusive activities to advise of the proposed work, and establish the location of the utility underground installations prior to the start of actual excavation. These services will only mark the location of public-utility-owned lines.

- Procure and schedule the independent survey.
- The survey contractor shall determine the most appropriate geophysical technique or combinations of techniques to identify the buried utilities on the project site, based on the survey contractor's experience and expertise, types of utilities anticipated to be present and specific site conditions. ***The types of utilities must be provided to the bidding subcontractors in the SOW and procedures to be used must be specified by the bidder in their bid. When applicable, provide the sub with utility maps, with the caveat that all utilities are not necessarily depicted.***
- The survey subcontractor shall employ the same geophysical techniques used to identify the buried utilities, to survey the proposed path of subsurface investigation/construction work to confirm no buried utilities are present.
- Obtain utility clearances for subsurface work on both public and private property.
- Clearances provided by both the utility service and the CH2M HILL-subcontracted service are to be in writing, signed by the party conducting the clearance. The utility service will have standard notification forms/letters which typically simply state that they have been to the site and have done their work. The CH2M HILL subcontractor shall be required to fill out the form provided in Attachment D (this can be modified for a particular project) indicating that each dig/drill location has been addressed. ***This documentation requirement (with a copy of the form) needs to be provided in the subcontractor SOW.***
- Marking shall be done using the color coding presented in Attachment E.
- Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, the Project Manager must notify the utility company or utility protection service to inform them that the markings have been destroyed.
- Perform a field check prior to drilling/digging (preferably while the utility location sub is still at the site) to see if field utility markings coincide with locations on utility maps. Look for fire hydrants, valves, manholes, light poles, lighted signs, etc to see if they coincide with utilities identified by the subcontractor.
- Underground utility locations must be physically verified (or dig locations must be physically cleared) by hand digging using wood or fiberglass-handled tools, air knifing, or by some other acceptable means approved by CH2M HILL, when the dig location (e.g. mechanical drilling, excavating) is expected to be within 5 feet of a marked underground system. Hand clearance shall be done to a depth of four feet unless a utility cross-section is available that indicates the utility is at a greater depth. In that event, the hand clearance shall proceed until the documented depth of the utility is reached.
- Conduct a site briefing for employees at the start of the intrusive work regarding the hazards associated with working near the utilities and the means by which the operation will maintain a safe working environment. Detail the method used to isolate the utility and the hazards presented by breaching the isolation.

- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon during drilling or change in color, texture or density during excavation that could indicate the ground has been previously disturbed).

VI. Attachments

A- Example SOW for Utility Location Subcontractor Procurement

B - Services Available for Identifying and Marking Underground Utilities

C – Equipment Used for Identifying Underground Utilities

D – Buried Utility Location Tracking Form

E – Utility Marking Color Codes

Attachment A – Example SOW for Subcontracting Underground Utilities Locating Services

Project Name

Scope of Work

Subsurface Utility Locating

Site XX

MMRP Site Name

City, State

A licensed and insured utility locator will be subcontracted to identify and mark out subsurface utilities for an environmental investigation/remediation project at Site XX of <<insert name of fort, city, and state>>. The subcontractor will need to be available beginning at <<insert time>> on <<insert date>>. It is estimated that the work can be completed within XX days.

Proposed Scope of Work

The subcontractor will identify and mark all subsurface utilities (CHOOSE 1) that lie within a radius of 20 feet of each of XX sampling locations at Site XX shown on the attached Figure 1; (OR) that lie within the bounds of Site XX as delineated on the attached Figure 1. (If multiple sites are to be cleared, provide maps of each site with sample locations or clearance boundaries clearly delineated and a scale provided.)

Utilities will be identified using all reasonably available as-built drawings, electronic locating devices, and any other means necessary to maintain the safety of drilling and sampling personnel and the protection of the installation infrastructure. The location of utilities identified from as-built drawings or other maps must be verified in the field prior to marking.

Facility utility drawings for the Site(s) (CHOOSE 1) can be found at <<insert specific department and address or phone number on the facility >> and should be reviewed by the subcontractor and referenced as part of the utility locating. (OR), will be provided to the subcontractor by CH2M HILL upon the award of the subcontract. (OR), are not available. Utility drawings shall not be considered definitive and must be field verified.

Field verification will include detection using nonintrusive subsurface detection equipment (magnetometers, GPR, etc) as well as opening manhole covers to verify pipe directions. As part of the bid, the Subcontractor shall provide a list of the various subsurface investigation tools they propose to have available and use at the site and what the limitations are of each tool.

A CH2M HILL representative shall be present to coordinate utility clearance activities and identify points and features to be cleared.

Field Marking and Documentation

All utilities located within a 20-ft radius of the XX proposed soil boring locations (OR) within the boundary of the site(s) as identified on the attached figure(s) will be marked using paint and/or pin flags color coded to indicate electricity, gas, water, steam, telephone, TV cable, fiber optic, sewer, etc. The color coding shall match the industry standard as described on the attached form. In addition, the Buried Utility Location Tracking Form (attached) will be completed by the Subcontractor based upon what is identified in the field during the utility locating and submitted back to CH2M HILL (field staff or project manager) within <u>24 hours</u> of completing the utility locating activities.

(OPTIONAL) The subcontractor shall also provide a map (or hand sketch) of the identified utilities to the Engineer within XX days of field demobilization. The map shall include coordinates or ties from fixed surface features to each identified subsurface utility.

Bid Sheet/Payment Units

The subcontractor will bid on a time and materials basis for time spent on site and researching utility maps. Mobilization (including daily travel to the site) should be bid as a lump sum, as well as the preparation of the AHA and any required mapping. The per diem line item should be used if the field crew will require overnight accommodations at the project site.

Health and Safety Requirements

The utility locating subcontractor is to provide and assume responsibility for an adequate corporate Health and Safety Plan for onsite personnel. Standard personal safety equipment including: hard hat, safety glasses, steel-toed boots, gloves are recommended for all project activities. Specific health and safety requirements will be established by the Subcontractor for each project. The health and safety requirements will be subject to the review of CH2M HILL.

The subcontractor shall also prepare and provide to the Engineer, at least 48 hours prior to mobilization, an acceptable Activity Hazard Analysis (AHA) using the attached AHA form or similar.

It is also required that all subcontractor personnel who will be on site attend the daily 15-minute health and safety tailgate meeting at the start of each day in the field.

Subcontractor personnel showing indications of being under the influence of alcohol or illegal drugs will be sent off the job site and their employers will be notified. Subcontractor personnel under the influence of prescription or over-the-counter medication that may impair their ability to operate equipment will not be permitted to do so. It is expected that the subcontractor will assign them other work and provide a capable replacement (if necessary) to operate the equipment to continue work.

Security

The work will be performed on Army property. CH2M HILL will identify the Subcontractor personnel who will perform the work to the appropriate Fort Rucker POC, and will identify the Fort Rucker POC to the Subcontractor crew. The Subcontractor bears final responsibility for coordinating access of his personnel onto Fort Rucker property to perform required work. This responsibility includes arranging logistics and providing to CH2M HILL, in advance or at time of entry as specified, any required identification information for the Subcontractor personnel. Specifically, the following information should be submitted with the bid package for all personnel that will perform the work in question (this information is required to obtain a Fort Rucker pass):

- Name
- Birth Place
- Birth Date
- Social Security Number
- Drivers License State and Number
- Citizenship

No weapons, alcohol, or drugs will be permitted on the facility at any time. If any such items are found, they will be confiscated, and the Subcontractor will be dismissed.

Quality Assurance

The Subcontractor will be licensed and insured to operate in the State of Alabama   and will comply with all applicable federal, state, county and local laws and regulations. The subcontractor will maintain, calibrate, and operate all electronic locating instruments in accordance with the manufacturer’s recommendations. Additionally, the Subcontractor shall make all reasonable efforts to review as-built engineering drawings maintained by facility personnel, and shall notify the CH2M HILL Project Manager in writing (email is acceptable) whenever such documentation was not available or could not be reviewed.

Subcontractor Standby Time

At certain periods during the utility locating activities, the Subcontractor’s personnel may be asked to stop work and standby when work may normally occur. During such times, the Subcontractor will cease activities until directed by the CH2M HILL representative to resume operations. Subcontractor standby time also will include potential delays caused by the CH2M HILL representative not arriving at the site by the agreed-upon meeting time for start of the work day. Standby will be paid to the Subcontractor at the hourly rate specified in the Subcontractor’s Bid Form attached to these specifications.

Cumulative Subcontractor standby will be accrued in increments no shorter than 15 minutes (i.e., an individual standby episode of less than 15 minutes is not chargeable).

During periods for which standby time is paid, the surveying equipment will not be demobilized and the team will remain at the site. At the conclusion of each day, the daily logs for the Subcontractor and CH2M HILL representative will indicate the amount of standby time incurred by the Subcontractor, if any. Payment will be made only for standby time recorded on CH2M HILL’s daily logs.

Down Time

Should equipment furnished by the Subcontractor malfunction, preventing the effective and efficient prosecution of the work, or inclement weather conditions prevent safe and effective work from occurring, down time will be indicated in the Subcontractor's and CH2M Hill representative's daily logs. No payment will be made for down time.

Schedule

It is anticipated that the subsurface utility locating activities will occur on <<insert date>>. It is estimated that the above scope will be completed within XXX days.

Attachment B - Services Available for Identifying and Marking Underground Utilities

The services that are available to us for identifying and marking underground utilities are:

- The local public/private utility-run service
- Utility location subcontractors (hired by CH2M HILL)

Each is discussed below.

Local Utility or "One Call" Service for Public Utility Mark-outs

Local utility or "One Call" service centers are information exchange centers for excavators, contractors and property owners planning any kind of excavation or digging. The "One Call" center notifies participating public utilities of the upcoming excavation work so they can locate and mark their underground utilities in advance to prevent possible damage to underground utility lines, injury, property damage and service outages. Generally, a minimum of 48 hours is required for the public utility mark-outs to be performed. The "One Call" services are free to the public. Note that the "One Call" centers only coordinate with participating public utilities. There may be some public utilities that do NOT participate in the "One Call" center which may need to be contacted separately. The FTL should contact the appropriate one-call center to determine their scope of services.

A national listing of the "One Call" service centers for each state is presented on the web at http://www.underspace.com/refs/ocdir.htm.

Private Subcontractors

Utility-locating support is required at some level for most all CH2M HILL field projects in "clearing" proposed subsurface boring locations on the project site. Utility location and sample clearance can include a comprehensive effort of GIS map interpretation, professional land surveying, field locating, and geophysical surveying. Since we can usually provide our own GIS-related services for projects and our professional land surveying services are normally procured separately, utility-locating subcontractors will normally only be required for some level of geophysical surveying support in the field. This level of geophysical surveying support can range widely from a simple electromagnetic (EM) survey over a known utility line, to a blind geophysical effort, including a ground-penetrating radar (GPR) survey and/or a comprehensive EM survey to delineate and characterize all unknown subsurface anomalies.

The level of service required from the subcontractor will vary depending on the nature of the site. At sites where utility locations are well defined on the maps and recent construction is limited, CH2M HILL may be confident with a limited effort from a traditional utility-locating subcontractor providing a simple EM survey. At sites where utility locations are not well defined, where recent constructions may have altered utility locations, or the nature of the site makes utility location difficult, CH2M HILL will require the services of a comprehensive geophysical surveying subcontractor, with a wide range of GPR and EM services available for use on an "as-needed" basis.

Attachment C – Equipment Used for Identifying Underground Utilities

This attachment provides a summary of the various types of equipment used for subsurface utility location. It describes the capabilities and limitations of each in order to help the PM determine if the equipment being proposed is adequate.

Electromagnetic Induction (EMI) Methods

EMI instruments, in general, induce an electromagnetic field into the ground (the primary field) and then record the response (the secondary field), if any. Lateral changes in subsurface conductivity, such as caused by the presence of buried metal or by significant soil variations, cause changes in the secondary field recorded by the instrument and thus enable detection and mapping of the subsurface features. It should be noted that EMI only works for electrically conductive materials--plastic or PVC pipes are generally not detected with EMI. Water and gas lines are commonly plastic, although most new lines include a copper "locator" strip on the top of the PVC to allow for detection with EMI.

EMI technology encompasses a wide range of instruments, each with inherent strengths and weaknesses for particular applications. One major division of EMI is between "time-domain" and "frequency-domain" instruments that differ in the aspect of the secondary field they detect. Another difference in EMI instruments is the operating frequency they use to transmit the primary field. Audio- and radio-frequencies are often used for utility detection, although other frequencies are also used. Consideration of the type of utility expected, surface features that could interfere with detection, and the "congestion" of utilities in an area, should be made when choosing a particular EMI instrument for a particular site.

One common EMI tool used for utility location is a handheld unit that can be used to quickly scan an area for utilities and allows for marking locations in "real time". This method is most commonly used by "dig-safe" contractors marking out known utilities prior to excavation. It should be noted that this method works best when a signal (the primary field) can be placed directly onto the line (i.e., by clamping or otherwise connecting to the end of the line visible at the surface, or for larger utilities such as sewers, by running a transmitter through the utility). These types of tools also have a limited capability to scan an area for unknown utilities. Usually this requires having enough area to separate a hand held transmitter at least a hundred feet from the receiver. Whether hunting for unknown, or confirming known, utilities, this method will only detect continuous lengths of metallic conductors.

In addition to the handheld EMI units, larger, more powerful EMI tools are available that provide more comprehensive detection and mapping of subsurface features. Generally, data with these methods are collected on a regular grid in the investigation area, and are then analyzed to locate linear anomalies that can be interpreted as utilities. These methods will usually detect *all* subsurface metal (above a minimum size), including pieces of abandoned utilities. In addition, in some situations, backfill can be detected against native soils giving information on trenching and possible utility location. Drawbacks to these methods are that the secondary signals from utilities are often swamped (i.e., undetectable) close to buildings and other cultural features, and that the subsurface at heavily built-up sites may be too complicated to confidently interpret completely.

Hand-held metal detectors (treasure-finders) are usually based on EMI technology. They can be used to locate shallow buried metal associated with utilities (e.g., junctions, manholes, metallic locators). Advantages of these tools is the ease of use and real-time marking of anomalies. Drawbacks include limited depths of investigations and no data storage capacity.

Ground Penetrating Radar (GPR)

GPR systems transmit radio and microwave frequency (e.g., 80 megaHertz to 1,000 megaHertz) waves into the ground and then record reflections of those waves coming back to the surface. Reflections of the radar waves typically occur at lithologic changes, subsurface discontinuities, and subsurface structures. Plastic and PVC pipes can sometimes be detected in GPR data, especially if they are shallow, large, and full of a contrasting material such as air in a wet soil, or water in a dry soil. GPR data are usually collected in regular patterns over an area and then analyzed for linear anomalies that can be interpreted as utilities. GPR is usually very accurate in x-y location of utilities, and can be calibrated at a site to give very accurate depth information as well. A significant drawback to GPR is that depth of investigation is highly dependent on background soil conductivity, and it will not work on all sites. It is not uncommon to get only 1-2 feet of penetration with the signal in damp, clayey environments. Another drawback to GPR is that sites containing significant fill material (e.g., concrete rubble, scrap metal, garbage) will result in complicated anomalies that are difficult or impossible to interpret.

Magnetic Field Methods

Magnetic field methods rely on detecting changes to the earth’s magnetic field caused by ferrous metal objects. This method is usually more sensitive to magnetic metal (i.e., deeper detection) than EMI methods. A drawback to this method is it is more susceptible to being swamped by surface features such as fences and cars. In addition, procedures must usually be implemented that account for natural variations in the earth’s background field as it changes throughout the day. One common use of the method is to measure and analyze the gradient of the magnetic field, which eliminates most of the drawbacks to the method. It should be noted this method only detects ferrous metal, primarily iron and steel for utility location applications. Some utility detector combine magnetic and EMI methods into a single hand-held unit.

Optical Methods

Down the hole cameras may be useful in visually reviewing a pipe for empty conduits and/or vaults.

Attachment D – Buried Utility Location Tracking Form

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(Submit to CH2M HILLPM within 24 hrs of location activities)

Buried Utility Location Tracking Form

Project Location:
CH2M HILL Project No.:
CH2M HILL Project Manager: Name/Phone:
Fax:
Email:
CH2M HILL Field Team Leader: Name/Phone:

CH2M HILL Purchase Order:
Utility Location Subcontractor:
Subcontractor POC:

Dates of location activities:

	Check each box using an "X" if a buried utility is present within 5 feet of a marked Station ID. If color of the flag or paint differs from listed color, note change in color on the form.																
Station ID	**Gas (Yellow)**	**Electric (Red)**	**Fiber optic (Orange)**	**Cable (Orange)**	**Water (Blue)**	**San. Sewer (Green)**	**Storm Sewer (Green)**	**Steam (Yellow)**	**Petroleum (Yellow)**	**Compressed air (Yellow)**	**Other ____**	**Other ____**	**Other ____**	**Other ____**	**Date completed**	**Technician initials**	Notes (methods/tools used)

(Submit to CH2M HILLPM within 24 hrs of location activities)

Buried Utility Location Tracking Form

Project Location:

CH2M HILL Project No.:

CH2M HILL Project Manager: Name/Phone:
Fax:
Email:

CH2M HILL Field Team Leader: Name/Phone:

CH2M HILL Purchase Order:

Utility Location Subcontractor:

Subcontractor POC:

Dates of location activities:

Check each box using an "X" if a buried utility is present within 5 feet of a marked Station ID. If color of the flag or paint differs from listed color, note change in color on the form.

Station ID	Gas (Yellow)	Electric (Red)	Fiber optic (Orange)	Cable (Orange)	Water (Blue)	San. Sewer (Green)	Storm Sewer (Green)	Steam (Yellow)	Petroleum (Yellow)	Compressed air (Yellow)	Other ____	Other ____	Other ____	Other ____	Date completed	Technician initials	Notes (methods/tools used)

The findings of the buried utility location activities summarized herein were conducted in strict accordance with the CH2M HILL scope of work.

Subcontractor's Signature

Date

Attachment E – Utility Marking Color Codes

The following is the standard color code used by industry to mark various types of utilities and other features at a construction site.

White – Proposed excavations and borings

Pink – Temporary survey markings

Red – Electrical power lines, cables, conduits and lighting cables

Yellow – Gas, oil, steam, petroleum or gaseous materials

Orange – Communication, alarm or signal lines, cables, or conduits

Blue – Potable water

Purple – Reclaimed water, irrigation and slurry lines

Green – Sewer and storm drain lines

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Attachment 3
SOP: Magnetometry

STANDARD OPERATING PROCEDURE

Magnetometry

I. Purpose

This SOP provides general reference information and standard techniques for using magnetometry.

II. Scope

This SOP provides a description of the field procedures, equipment, and interpretation methods necessary to fully utilize this procedure.

III. Definitions

Diurnal variations - daily changes in the total magnetic field strength due to solar activity and which (may be as large as 100 gammas or more)

Gradient - change in magnetic field strength in a given vertical or horizontal distance

Magnetic storm - sudden and simultaneous variations of up to several hundred gammas throughout the world. Magnetic storms can occur as often as several times a month and can last one to several days.

Total magnetic field intensity - a scaler measurement of the magnitude of the earth's magnetic field vector independent of its direction.

IV. Responsibilities

Project Manager - The Project Manager is responsible for ensuring that the project-specific plans are in accordance with these procedures, where applicable, or that other approved procedures are developed. The Project Manager is responsible for ensuring that the personnel operating and interpreting the geophysical data are trained, skilled in that endeavor, so far as to receiving documentation on the training and experience of the operating personnel.

Field Team Leader - The Field Team Leader is responsible for selecting and detailing the geophysical technique and equipment to be used. It is the responsibility of the Field Team Leader to ensure that these procedures are implemented in the field and to ensure that the field investigation personnel performing the activities have been briefed and trained to execute these procedures.

V. Procedures

A. Overview

Magnetic surveying is a passive geophysical technique which measures the strength of the earth's magnetic field. The earth's field is a vector quantity having a unique magnitude and direction at every point on the earth's surface. A magnetometer is the instrument which measures the magnetic field strength in units of gammas or nanoteslas. In order to recognize a magnetic anomaly, it must be several times larger than the background noise level along that profile. Buried ferrous metal objects such as steel drums or tanks cause local variations or anomalies in the earth's magnetic field that can be detected by a magnetometer. Geologic features such as igneous intrusion or iron rich sands can also be mapped using magnetic surveying.

The earth's magnetic field is not completely stable. It undergoes long-term (secular) variations over centuries; small, daily (diurnal) variations (less than 1% of the total field magnitude); and transient fluctuations called magnetic storms resulting from solar flare phenomena. Both naturally-occurring and manmade magnetic materials can modify the earth's magnetic field locally.

Analysis of magnetic data by an experienced geophysicist can provide an estimate of the areal extent and quantity of buried ferrous objects. Depth of burial approximations can be made using graphical methods of interpretation such as slope techniques and half-width rules as described in Nettleton (1976).

B. Application and Uses

Buried ferrous metal objects such as pipelines, barrels, tanks, etc., generally produce a perturbation in the earth's naturally occurring magnetic field. The size (amplitude) of this perturbation is related to the size of, distance to, susceptibility and remnant magnetization of the buried object. The magnetic survey method, therefore, is a useful tool for site studies to locate and identify buried ferrous metal. Non-anomalous magnetic data acquired over EM conductivity anomalies is an indication of the existence of buried conductive, non-ferrous metal (copper, aluminum, brass) objects.

Magnetic data also can be helpful in determining the size and geometry of geologic features such as fault zones, mineralized zones, and bedrock valleys and depressions. These features are characterized generally by longer wavelength anomalies and are readily distinguishable from anomalies associated with buried metal. In many areas, such geologic features may control or affect the direction and magnitude of groundwater flow.

The total field proton precession magnetometer, the fluxgate magnetometer, and the magnetic gradiometer are commonly used magnetometers in environmental site investigations. The total field proton precession magnetometer is the most commonly used magnetometer because they are easy to operate, have no instrumental drift, and can acquire data rapidly. The fluxgate magnetometer can better define the boundaries of buried ferrous objects than the proton precession magnetometer but is subject to instrument drift, and needs to be exactly oriented.

Magnetic gradiometer measurements enhance anomalies resulting from shallow magnetic sources.

C. Equipment

Magnetometers commonly used in hazardous waste site investigations include the total field proton procession magnetometer, the flux gate magnetometer, and the magnetic gradiometer. Text books such as Telford (1976) and Nettleton (1976) discuss in detail the operation and construction of these and other magnetometers.

The total field proton procession magnetometer is the most commonly used magnetometer in hazardous waste investigations. This instrument utilizes the precession of spinning protons of hydrogen atoms in a sample fluid (kerosene, alcohol or water) to measure the total magnetic field intensity. Total field proton precession magnetometers are portable and do not require precise orientation and leveling; the sensor must be oriented with one side facing approximately north and the sensor held stationary during the cycling period. Proton precession magnetometers have no instrument drift, do not require calibrations, are easy to operate, and have an accuracy of 0.1 gamma. Most modern proton precession magnetometers have digital readouts and electronic storage of data.

Vertical magnetic gradiometers are magnetometers that measure vertical differences of the earth's total magnetic field. Gradient measurements enhance magnetic anomalies resulting from near surface magnetic source and discrimination between neighboring magnetic anomalies is also enhanced. These measurements are generally made using an instrument similar to a total field magnetometer that has two or more sensors mounted on a staff. The sensors are vertically separated by a constant distance, usually one to three feet. Gradient readings are adversely affected by ferrous metal surface debris since signals from this surface debris are also amplified. Consequently, removal of surface metal should be considered before conducting a gradiometer survey.

The flux gate magnetometer was developed during World War II as a submarine detector. Text books such as Telford (1976), RAO and Murthy (1978) explain in detail the principals of operation of the flux gate magnetometer. A fluxgate magnetometer can define the boundaries of regions of buried ferrous metal objects more precisely than the proton precession magnetometer. There are several sources of errors in flux gate magnetometers including unbalance in the two coils, thermal and shock noise, circuit drift and temperature sensitivity. The advantages are direct readout, no azimuth orientation, coarse leveling required, light weight and portability (Telford, 1976).

D. Field Procedures

Magnetic data are generally acquired at relatively close station spacings (5- to 50-foot intervals) along closely spaced (10 to 50 feet) parallel survey lines.

Magnetic data can be acquired in a rectangular grid pattern or along traverses. Grid data are readings acquired at the nodes of a rectangular grid; traverse data is acquired at fixed intervals along a line. Traverse data is often preferable to grid data because it generally is less expensive to acquire (heavily vegetated sites require time consuming brush cutting to establish a complete grid) and more useful for interpretation than an equal number of grid readings. Traverse lines generally ought to be oriented in a north-south direction so that the maximum amplitude of an anomaly can be detected. However, line orientations are often more dependent on site obstacles and sources of magnetic noise.

Station and line spacing intervals are determined on the basis of the desired resolution of the survey. If individual drums or clusters of deeply (greater than 25 feet) buried drums are the objective of the survey, then a detailed magnetic survey with relatively close station spacings (approximately 5 to 10 feet) and line spacings (approximately 10 to 25 feet) should be used. If large metal objects such as 10,000-gallon tanks or trenches filled with barrels are the objective of the magnetic survey, then a reconnaissance or screening survey with longer station spacings (25, 50, or 100 feet) and line spacings of (25, 50, or 100 feet) may be appropriate.

In conducting a survey, the field operator must avoid or note any sources of high magnetic gradients and alternating currents, such as power lines, buildings, and any large iron or steel objects. It is also important that the operator be relatively free of magnetic materials on his/her person and the magnetometer sensor be kept clean to avoid possible magnetic-bearing soil. Periodically during a survey, and particularly when an anomaly is detected, it is important to establish that the magnetometer is providing valid readings and not random, meaningless instrument noise. The simplest means of verifying magnetometer field readings is to take several successive readings at one location. These readings should repeat to within ± 1 gamma. Readings are taken at predetermined intervals which depend on the nature of the survey and which may have to be modified depending on the gradients encountered. For detailed surveys, a base station or the reoccupation of a set of stations several times a day or a continuous monitoring station (within 100 miles) is established to check for diurnal variations and magnetic storms. At the height of a magnetic storm, magnetic surveying may be impractical due to the large instantaneous changes in the total magnetic field.

E. Interpretation

1. Data Analysis

Magnetic data can be corrected for diurnal variations; however, diurnal changes are generally very gradual and linear and should not have the extreme fluctuations associated with buried ferrous metal objects. Magnetic data can be plotted in profile form or contoured depending upon the survey coverage. Noise sources (surface ferrous metal objects, fences, power lines, etc.) should be noted on the profiles or contour map so that anomalies due to these known sources can be accounted for. The amplitudes of similar sized surface metal objects should be compared. If similar sized ferrous metal surface objects have extremely different anomaly amplitudes, it may be an indication that buried ferrous metal objects exist in the vicinity of the higher amplitude anomalies.

2. Presentation of Results

The results of a magnetic survey should be presented in profile and/or contour map form. The orientation of the traverses should be indicated on profiles and lines of coverage on contour maps. Locations of observed ferrous metal and other cultural features (hills, valleys, streams, etc.) should be noted on both the profile and the contour maps.

3. Interpretation

Magnetic anomalies can be analyzed both qualitatively and quantitatively. The shape and gradient of an anomaly (slope, wave-length, amplitude, etc.) contains enough information to draw qualitative conclusions regarding the location and depth of the causative source.

Quantitative computer modeling interpretations of magnetic data are complicated both by the inherent complexity of dipole magnetic behavior and by the fact that a number of different types and configurations of sources can cause the same anomaly. Where the properties of the earth's field and the local geologic materials (inclination, declination, susceptibility, and remnant magnetization) are well known, reasonable assumptions regarding the nature of the source- can be made, and a fairly accurate model of the source generally can be derived.

F. Advantages and Limitations

Advantages of the magnetic survey method include:

- Rapid operation
- Low expense
- Identification of buried metal (ferrous)
- Sensitivity to small ferrous objects

Limitations of the magnetic survey method include:

- Susceptible to effects of manmade structures, utilities, buildings, fences, etc.
- Detection is limited to the distance to and quantity of ferrous metal present

VI. Quality Assurance Records

All data will be recorded in logbooks and/or data logging sheets designed for this procedure. All data will be entered with the following basic information: date, start and end times (military time), location, personnel on site, Contract Task Order number, and weather.

VII. References

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Telford, W.M., Geldart, L.P., Sheriff, R.E., Keys, D.A., 1976, “Applied Geophysics,” Cambridge University Press, New York, 860 p.

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Attachment 4
SOP: Decontamination of Personnel and Equipment

STANDARD OPERATING PROCEDURE

Decontamination of Personnel and Equipment

I. Purpose

To provide general guidelines for the decontamination of personnel, sampling equipment, and monitoring equipment used in potentially contaminated environments.

II. Scope

This is a general description of decontamination procedures.

III. Equipment and Materials

- Demonstrated analyte-free, deionized ("DI") water (specifically, ASTM Type II water or lab-grade DI water)
- Distilled water
- Potable water; must be from a municipal water supplier, otherwise an analysis must be run for appropriate volatile and semivolatile organic compounds and inorganic chemicals (e.g., Target Compound List and Target Analyte List chemicals)
- 2.5% (W/W) Liquinox® (or Alconox®)and water solution
- Concentrated (V/V) pesticide grade methanol (DO NOT USE ACETONE)
- Large plastic pails or tubs for Liquinox® and water, scrub brushes, squirt bottles for Liquinox® solution, methanol and water, plastic bags and sheets
- DOT approved 55-gallon drum for disposal of waste
- Phthalate-free gloves such as Nitrile
- Decontamination pad and steam cleaner/high pressure cleaner for large equipment

IV. Procedures and Guidelines

A. PERSONNEL DECONTAMINATION

To be performed after completion of tasks whenever potential for contamination exists, and upon leaving the exclusion zone.

1. Wash boots in Liquinox® solution, then rinse with water. If disposable latex booties are worn over boots in the work area, rinse with Liquinox® solution, remove, and discard into DOT-approved 55-gallon drum.
2. Wash outer gloves in Liquinox® solution, rinse, remove, and discard into DOT-approved 55-gallon drum.
3. Remove disposable coveralls ("Tyveks") and discard into DOT-approved 55-gallon drum.
4. Remove respirator (if worn).
5. Remove inner gloves and discard.
6. At the end of the work day, shower entire body, including hair, either at the work site or at home.
7. Sanitize respirator if worn.

B. SAMPLING EQUIPMENT DECONTAMINATION—GROUNDWATER SAMPLING PUMPS

Sampling pumps are decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Spread plastic on the ground to keep equipment from touching the ground
3. Turn off pump after sampling. Remove pump from well and remove and dispose of tubing. Place pump in decontamination tube.
4. Turn pump back on and pump 1 gallon of Liquinox® solution through the sampling pump.
5. Rinse with 1 gallon of 10% methanol solution pumped through the pump. (DO NOT USE ACETONE).
6. Rinse with 1 gallon of tap water.
7. Rinse with 1 gallon of deionized water.
8. Keep decontaminated pump in decontamination tube or remove and wrap in aluminum foil or clean plastic sheeting.
9. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.
10. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in DOT-approved 55-gallon drums.

C. SAMPLING EQUIPMENT DECONTAMINATION—OTHER EQUIPMENT

Reusable sampling equipment is decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Before entering the potentially contaminated zone, wrap soil contact points in aluminum foil (shiny side out).
3. Rinse and scrub with potable water.
4. Wash all equipment surfaces that contacted the potentially contaminated soil/water with Liquinox® solution.
5. Rinse with potable water.
6. Rinse with distilled or potable water and methanol solution (DO NOT USE ACETONE).
7. Air dry.
8. Rinse with deionized water.
9. Completely air dry and wrap exposed areas with aluminum foil (shiny side out) for transport and handling if equipment will not be used immediately.
10. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.
11. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in DOT-approved 55-gallon drums.

D. HEALTH AND SAFETY MONITORING EQUIPMENT DECONTAMINATION

1. Before use, wrap soil contact points in plastic to reduce need for subsequent cleaning.
2. Wipe all surfaces that had possible contact with contaminated materials with a paper towel wet with Liquinox® solution, then a towel wet with methanol solution, and finally three times with a towel wet with distilled water. Dispose of all used paper towels in a DOT-approved 55-gallon drum.

E. SAMPLE CONTAINER DECONTAMINATION

The outsides of sample bottles or containers filled in the field may need to be decontaminated before being packed for shipment or handled by personnel without hand protection. The procedure is:

1. Wipe container with a paper towel dampened with Liquinox® solution or immerse in the solution AFTER THE CONTAINERS HAVE BEEN SEALED. Repeat the above steps using potable water.
2. Dispose of all used paper towels in a DOT-approved 55-gallon drum.

F. HEAVY EQUIPMENT AND TOOLS

Heavy equipment such as drilling rigs, drilling rods/tools, and the backhoe will be decontaminated upon arrival at the site and between locations as follows:

1. Set up a decontamination pad in area designated by the Facility
2. Steam clean heavy equipment until no visible signs of dirt are observed. This may require wire or stiff brushes to dislodge dirt from some areas.

V. Attachments

None.

VI. Key Checks and Items

- Clean with solutions of Liquinox®, methanol, and distilled water.
- Do not use acetone for decontamination.
- Drum all contaminated rinsate and materials.
- Decontaminate filled sample bottles before relinquishing them to anyone.

Attachment 5
SOP: Preparing Field Logbooks

STANDARD OPERATING PROCEDURE

Preparing Field Logbooks

I. Purpose

To provide general guidelines for entering field data into logbooks during site investigation and remediation field activities.

II. Scope

This is a general description of data requirements and format for field logbooks. Logbooks are needed to properly document all field activities in support of data evaluation and possible legal activities.

III. Equipment and Materials

- Logbook
- Indelible pen

IV. Procedures and Guidelines

Properly completed field logbooks are a requirement for this work. Logbooks are legal documents and, as such, must be prepared following specific procedures and must contain required information to ensure their integrity and legitimacy. This SOP describes the basic requirements for field logbook entries.

A. Procedures for Completing Field Logbooks

1. Field notes commonly are kept in bound, consecutively numbered covered logbooks. Pages should be water-resistant and notes should be entered only with water-proof, non-erasable permanent ink.
2. On the inside cover of the logbook the following information should be included:
   - Company name and address
   - Log-holders name if logbook was assigned specifically to that person
   - Activity or location
   - Project name
   - Project manager's name

   - Phone numbers of the company, supervisors, emergency response, etc.

3. All lines of all pages should be used to prevent later additions of text, which could later be questioned. Any line not used should be marked through with a line and initialed and dated. Any pages not used should be marked through with a line, the author's initials, the date, and the note "Intentionally Left Blank."

4. If errors are made in the logbook, cross a single line through the error and enter the correct information. All corrections shall be initialed and dated by the personnel performing the correction. If possible, all corrections should be made by the individual who made the error.

5. Daily entries will be made chronologically.

6. Information will be recorded directly in the field logbook during the work activity. Information will not be written on a separate sheet and then later transcribed into the logbook.

7. Each page of the logbook will have the date of the work and the note takers initials.

8. The final page of each day's notes will include the note-takers signature as well as the date.

9. Only information relevant to the subject project will be added to the logbook.

10. The field notes will be copied and the copies sent to the Project Manager or designee in a timely manner (at least by the end of each week of work being performed).

B. Information to be Included in Field Logbooks

   1. Entries into the logbook should be as detailed and descriptive as possible so that a particular situation can be recalled without reliance on the collector's memory. Entries must be legible and complete.

   2. General project information will be recorded at the beginning of each field project. This will include the project title, the project number, and project staff.

   3. Scope: Describe the general scope of work to be performed each day.

   4. Weather: Record the weather conditions and any significant changes in the weather during the day.

   5. Tail Gate Safety Meetings: Record time and location of meeting, who was present, topics discussed, issues/problems/concerns identified, and corrective actions or adjustments made to address concerns/ problems, and other pertinent information.

   6. Standard Health and Safety Procedures: Record level of personal

protection being used (e.g., level D PPE), record air monitoring data on a regular basis and note where data were recording (e.g., reading in borehole, reading in breathing zone, etc). Also record other required health and safety procedures as specified in the project specific health and safety plan.

7. Instrument Calibration; Record calibration information for each piece of health and safety and field equipment.

8. Personnel: Record names of all personnel present during field activities and list their roles and their affiliation. Record when personnel and visitors enter and leave a project site and their level of personal protection.

9. Communications: Record communications with project manager, subcontractors, regulators, facility personnel, and others that impact performance of the project.

10. Time: Keep a running time log explaining field activities as they occur chronologically throughout the day.

11. Deviations from the Work Plan: Record any deviations from the work plan and document why these were required and any communications authorizing these deviations.

12. Heath and Safety Incidents: Record any health and safety incidents and immediately report any incidents to the Project Manager.

13. Subcontractor Information: Record name of company, record names and roles of subcontractor personnel, list type of equipment being used and general scope of work. List times of starting and stopping work and quantities of consumable equipment used if it is to be billed to the project.

14. Problems and Corrective Actions: Clearly describe any problems encountered during the field work and the corrective actions taken to address these problems.

15. Technical and Project Information: Describe the details of the work being performed. The technical information recorded will vary significantly between projects. The project work plan will describe the specific activities to be performed and may also list requirements for note taking. Discuss note-taking expectations with the Project Manager prior to beginning the field work.

16. Any conditions that might adversely affect the work or any data obtained (e.g., nearby construction that might have introduced excessive amounts of dust into the air).

17. Sampling Information; Specific information that will be relevant to most sampling jobs includes the following:

- Description of the general sampling area – site name, buildings and streets in the area, etc.
- Station/Location identifier
- Description of the sample location – estimate location in comparison to two fixed points – draw a diagram in the field logbook indicating sample location relative to these fixed points – include distances in feet.
- Sample matrix and type
- Sample date and time
- Sample identifier
- Draw a box around the sample ID so that it stands out in the field notes
- Information on how the sample was collected – distinguish between "grab," "composite," and "discrete" samples
- Number and type of sample containers collected
- Record of any field measurements taken (i.e. pH, turbidity, dissolved oxygen, and temperature, and conductivity)
- Parameters to be analyzed for, if appropriate
- Descriptions of soil samples and drilling cuttings can be entered in depth sequence, along with PID readings and other observations. Include any unusual appearances of the samples.

C. Suggested Format for Recording Field Data

1. Use the left side border to record times and the remainder of the page to record information (see attached example).
2. Use tables to record sampling information and field data from multiple samples.
3. Sketch sampling locations and other pertinent information.
4. Sketch well construction diagrams.

V. Attachments

Example field notes.

Attachment 6
SOP: Chain-of-Custody

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STANDARD OPERATING PROCEDURE

Chain-of-Custody

I. Purpose

The purpose of this SOP is to provide information on chain-of-custody procedures to be used under this project.

II. Scope

This procedure describes the steps necessary for transferring samples through the use of Chain-of-Custody Records. A Chain-of-Custody Record is required, without exception, for the tracking and recording of samples collected for on-site or off-site analysis (chemical or geotechnical) during program activities (except wellhead samples taken for measurement of field parameters). Use of the Chain-of-Custody Record Form creates an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis. This procedure identifies the necessary custody records and describes their completion. This procedure does not take precedence over region specific or site-specific requirements for chain-of-custody.

III. Definitions

Chain-of-Custody Record Form - A Chain-of-Custody Record Form is a printed two-part form that accompanies a sample or group of samples as custody of the sample(s) is transferred from one custodian to another custodian. One copy of the form must be retained in the project file.

Custodian - The person responsible for the custody of samples at a particular time, until custody is transferred to another person (and so documented), who then becomes custodian. A sample is under one's custody if:

- It is in one's actual possession.
- It is in one's view, after being in one's physical possession.
- It was in one's physical possession and then he/she locked it up to prevent tampering.
- It is in a designated and identified secure area.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the point and time that it was collected.

IV. Responsibilities

Project Manager - The Project Manager is responsible for ensuring that project-specific plans are in accordance with these procedures, where applicable, or that other, approved procedures are developed. The Project Manager is responsible for development of documentation of procedures which deviate from those presented herein. The Project Manager is responsible for ensuring that chain-of-custody procedures are implemented. The Project Manager also is responsible for determining that custody procedures have been met by the analytical laboratory.

Field Team Leader - The Field Team Leader is responsible for determining that chain-of-custody procedures are implemented up to and including release to the shipper or laboratory. It is the responsibility of the Field Team Leader to ensure that these procedures are implemented in the field and to ensure that personnel performing sampling activities have been briefed and trained to execute these procedures.

Sample Personnel - It is the responsibility of the field sampling personnel to initiate chain-of-custody procedures, and maintain custody of samples until they are relinquished to another custodian, the sample shipper, or to a common carrier.

V. Procedures

The term “chain-of-custody” refers to procedures which ensure that evidence presented in a court of law is valid. The chain-of-custody procedures track the evidence from the time and place it is first obtained to the courtroom, as well as providing security for the evidence as it is moved and/or passed from the custody of one individual to another.

Chain-of-custody procedures, recordkeeping, and documentation are an important part of the management control of samples. Regulatory agencies must be able to provide the chain-of-possession and custody of any samples that are offered for evidence, or that form the basis of analytical test results introduced as evidence. Written procedures must be available and followed whenever evidence samples are collected, transferred, stored, analyzed, or destroyed.

V.1 Sample Identification

The method of identification of a sample depends on the type of measurement or analysis performed. When *in situ* measurements are made, the data are recorded directly in bound logbooks or other field data records with identifying information.

Information which shall be recorded in the field logbook, when in-situ measurements or samples for laboratory analysis are collected, includes:

- Field Sampler(s),
- Project Number,
- Project Sample Number,
- Sample location or sampling station number,
- Date and time of sample collection and/or measurement,
- Field observations,

- Equipment used to collect samples and measurements, and
- Calibration data for equipment used

Measurements and observations shall be recorded using waterproof ink.

V.1.1 Sample Label

Samples, other than for *in situ* measurements, are removed and transported from the sample location to a laboratory or other location for analysis. Before removal, however, a sample is often divided into portions, depending upon the analyses to be performed. Each portion is preserved in accordance with the Sampling and Analysis Plan. Each sample container is identified by a sample label (see Attachment A). Sample labels are provided, along with sample containers, by the analytical laboratory. The information recorded on the sample label includes:

- Project Number.
- Station Location - The unique sample number identifying this sample.
- Date - A six-digit number indicating the day, month, and year of sample collection (e.g., 01/21/08).
- Time - A four-digit number indicating the 24-hour time of collection (for example: 0954 is 9:54 a.m., and 1629 is 4:29 p.m.).
- Medium - Water, soil, sediment, sludge, waste, etc.
- Sample Type - Grab or composite.
- Preservation - Type and quantity of preservation added.
- Analysis - VOA, BNAs, PCBs, pesticides, metals, cyanide, other.
- Sampled By - Printed name of the sampler.
- Remarks - Any pertinent additional information.

Using only the work assignment number of the sample label maintains the anonymity of sites. This may be necessary, even to the extent of preventing the laboratory performing the analysis from knowing the identity of the site (e.g., if the laboratory is part of an organization that has performed previous work on the site). The field team should always follow the sample ID system prepared by the project EIS and reviewed by the Project Manager.

V.2 Chain-of-Custody Procedures

After collection, separation, identification, and preservation, the sample is maintained under chain-of-custody procedures until it is in the custody of the analytical laboratory and has been stored or disposed of.

V.2.1 Field Custody Procedures

- Samples are collected as described in the site Sampling and Analysis Plan. Care must be taken to record precisely the sample location and to ensure that the sample number on the label matches the Chain-of-Custody Record exactly.

- The person undertaking the actual sampling in the field is responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

- When photographs are taken of the sampling as part of the documentation procedure, the name of the photographer, date, time, site location, and site description are entered sequentially in the site logbook as photos are taken. Once downloaded to the server or developed, the electronic files or photographic prints shall be serially numbered, corresponding to the logbook descriptions; photographic prints will be stored in the project files. To identify sample locations in photographs, an easily read sign with the appropriate sample/location number should be included.

- Sample labels shall be completed for each sample, using waterproof ink unless prohibited by weather conditions (e.g., a logbook notation would explain that a pencil was used to fill out the sample label if the pen would not function in freezing weather.)

V.2.2 Transfer of Custody and Shipment

Samples are accompanied by a Chain-of-Custody Record Form. A Chain-of-Custody Record Form example is shown in Attachment B. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the Record. This Record documents sample custody transfer from the sampler, often through another person, to the analyst in the laboratory. The Chain-of-Custody Record is filled out as given below:

- Enter header information (project number, samplers, and project name).

- Enter sample specific information (sample number, media, sample analysis required and analytical method grab or composite, number and type of sample containers, and date/time sample was collected).

- Sign, date, and enter the time under “Relinquished by” entry.

- Have the person receiving the sample sign the “Received by” entry. If shipping samples by a common carrier, print the carrier to be used in this space (i.e., Federal Express).

- If a carrier is used, enter the airbill number under “Remarks,” in the bottom right corner;

- Place the original (top, signed copy) of the Chain-of-Custody Record Form in a plastic zipper-type bag or other appropriate sample-shipping package. Retain the copy with field records.

- Sign and date the custody seal, a 1-inch by 3-inch white paper label with black lettering and an adhesive backing. Attachment C is an example of a custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field. Custody seals shall be provided by the analytical laboratory.

- Place the seal across the shipping container opening (front and back) so that it would be broken if the container were to be opened.

- Complete other carrier-required shipping papers.

The custody record is completed using waterproof ink. Any corrections are made by drawing a line through and initialing and dating the change, then entering the correct information. Erasures are not permitted.

Common carriers will usually not accept responsibility for handling Chain-of-Custody Record Forms; this necessitates packing the record in the shipping container (enclosed with other documentation in a plastic zipper-type bag). As long as custody forms are sealed inside the shipping container and the custody seals are intact, commercial carriers are not required to sign the custody form.

The laboratory representative who accepts the incoming sample shipment signs and dates the Chain-of-Custody Record, completing the sample transfer process. It is then the laboratory's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis.

VI. Quality Assurance Records

Once samples have been packaged and shipped, the Chain-of-Custody copy and airbill receipt become part of the quality assurance record.

VII. Attachments

A. Sample Label

B. Chain-of-Custody Form

C. Custody Seal

VIII. References

USEPA. *User's Guide to the Contract Laboratory Program*. Office of Emergency and Remedial Response, Washington, D.C. (EPA/540/P-91/002), January 1991.

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Attachment 7
SOP: Sampling Contents of Tanks and Drums

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STANDARD OPERATING PROCEDURE

Sampling Contents of Tanks and Drums

I. Scope and Application

This procedure provides an overview approach and guidelines for the routine sampling of drums and tanks. Its purpose is to describe standard procedures and precautions which are applied in sampling drums and tanks. Procedures for opening drums with the individual instruments are included in Attachment D.

The samples obtained may be used to obtain physical chemical or radiological data. The resulting data may be qualitative or quantitative in nature, and are appropriate for use in preliminary surveys as well as confirmatory sampling.

II. References

A. *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, U.S. Environmental Protection Agency, Washington, D.C., 1987.

B. *Data Quality Objectives for Remedial Activities - Development Process*, EPA/540/G-87/003, U.S. Environmental Protection Agency, Washington, D.C., 1987.

C. Annual Book of ASTM Standards, *Standard Recommended Practices for Sampling Industrial Chemicals*, ASTM-E-300, 1986.

D. *Test Method for Evaluating Solid Waste*, SW-846, Volume II, Field Methods, Second Edition, U.S. Environmental Protection Agency, Washington, D.C., 1982.

E. U.S. Environmental Protection Agency, *Characterization of Hazardous Waste Sites – A Method Manual: Volume II, Available Sampling Methods*, USEPA Environmental Monitoring Systems Laboratory, Las Vegas, EPA-600/4-84-076, December, 1984.

F. *Environmental Surveillance Procedures*, Quality Control Program, Martin Marietta Energy Systems, ESH/Sub/87-21706/1, Oak Ridge, TN, September 1988.

III. Summary of Methods

Drums are generally sampled by means of sampling tubes such as glass sample tubes or COLIWASA samplers. In either case, the sampling tube is manually inserted into the waste material. A sample of the drum contents is withdrawn by the sampling device. Should a drum contain bottom sludge, a glass tube will retrieve a sample of this as well.

Storage tank and tank trailers, because of their greater depths, require sampling devices that can be lowered from the top, filled at a particular depth, then withdrawn. Such devices are a COLIWASA, a Kemmerer depth sampler, or a Bacon Bomb. Where samples of bottom sludge are desired, a gravity corer can be utilized. This heavy tube with a tapered nose piece will penetrate the sludge as it free falls through the tank.

IV. Comments

The sampling of tanks, containers, and drums present unique problems not associated with environmental samples. Containers of this sort are generally closed except for small access ports, manways, or hatches on the larger vessels, or taps and bungs on smaller drums. The physical size, shape, construction material, and location of access limit the types of equipment and methods of collection that can be used.

When liquids are contained in sealed vessels, gas vapor pressure can build up, sludges can settle out, and density layerings (stratification) can develop. Bulging drums may be under pressure and extreme caution should be exercised. The potential exists for explosive reactions or the release of noxious gases when containers are opened. All vessels should be opened with extreme caution. Check the HSP for the level of personnel protection to be worn. A preliminary sampling of any headspace gases is warranted. As a minimum, a preliminary check with an explosimeter and an organic vapor analyzer may be of aid in selecting a sampling method.

In most cases it is impossible to observe the contents of these sealed or partially sealed vessels. Since some layering or stratification is likely in any solution left undisturbed over time, a sample must be taken that represents the entire depth of the vessel.

V. Required Equipment and Apparatus

A. **Health and safety equipment/materials**: As listed in the site safety plan.

B. **Sampling equipment**: COLIWASA, glass sample tubes, Kemmerer depth sampler, Bacon Bomb, gravity corer.

C. **Tools**: Rubber mallet, bung wrench, speed wrench with socket, etc., (all non-sparking), paint marker.

D. **Heavy equipment**: Backhoe equipped with explosion shield, drum grappler, and 3-foot copper-beryllium (non-sparking) spike with 6-inch collar (to puncture top of drums for sampling, if necessary).

E. **Sample Containers**: As specified in the field sampling plan.

VI. Procedures

A. Drums

NOTE: DO NOT open more than one drum at a time. Each drum must be handled and sampled as a separate entity to reduce vapors in the sampling area.

1. Drums will be sampled on an area-by-area basis. Drums will be sampled after they have been placed in overpack drums but before they are transferred from the excavation to the onsite storage area.
2. Record, in logbook, all pertinent information from visual inspection of drum (e.g., physical condition, leaks, bulges, and labels). Label each drum with a unique identifying number.
3. If possible, stage drums for easy access.
4. If necessary, attach ground strap to drums and grounding point.
5. Remove any standing material (water, etc.) from container top.
6. Using non-sparking tools, carefully remove the bung or lid while monitoring air quality with appropriate instruments. If necessary (and as a last resort), the non-sparking spike affixed to the backhoe can also be used to puncture the drum for sampling. See Attachment D for method of drum opening. Record air-quality monitoring results.
7. When sampling a previously sealed vessel, a check should be made for the presence of bottom sludge. This is accomplished by measuring the depth to apparent bottom, then comparing it to the known interior depth.
8. Agitation to disrupt the layers and rehomogenize the sample is physically difficult and almost always undesirable. If the vessel is greater than 3 feet in depth (say, a 55-gallon drum), the appropriate sampling method is to slowly lower the sampling device (i.e., suction line of peristaltic pump, glass tube) in known increments of length. Discrete samples can be collected from various depths, then combined or analyzed separately. If the depth of the vessel is greater than the lift capacity of the pump, an at-depth water sampler, such as the Kemmerer or Bacon Bomb type, may be required.
9. Extract a representative sample from the drum using a glass rod, COLIWASA, Bacon Bomb, Kemmerer bottle, or gravity corer (See Attachments). Ensure that the entire depth of material is penetrated. Depending on the size of the opening of the drum, three to four takes should be collected from random locations across the drum surface, to ensure a representative sample. Any observed stratification must be recorded in logbook, including number and thickness of the layers and a conceptualized sketch.
10. Record a visual description of the sample (e.g., liquid, solid, color, viscosity, and percent layers).
11. When possible, sampling equipment (like glass tubes) should be expendable and be left inside the drum for disposal with drum contents, once sampling is completed.

12. Place lid, bung, cap, etc., back in place on drum. Tighten hand tight. If necessary, the sampling port can be sealed using a cork.

13. Wipe up spilled material with lab wipes. Wipe off sample containers.

14. Mark the drum with a unique sample identification number and date using a paint marker.

15. Samples will be handled as high hazard samples. Samples will be placed in containers defined according to the analytical needs, wiped clean, and then packed in paint cans for shipping. Packaging, labeling, and preparation for shipment procedures will follow procedures as specified in the field sampling plan.

B. Underground Storage Tanks

1. A sampling team of at least two people is required for sampling—one will collect samples, the other will relay required equipment and implements.

2. Sampling team will locate a sampling port on the tank. Personnel should be wearing appropriate protective clothing at this time and carrying sampling gear.

3. Do not attempt to climb down into tank. Sampling MUST BE accomplished from the top.

4. Collect a sample from the upper, middle, and lower section of the tank contents with one of the recommended sampling devices.

5. If compositing is necessary, ship samples to laboratory in separate containers for laboratory compositing.

6. Samples will be handled as hazardous. Samples will be placed in appropriate containers and packed with ice in a cooler. Packaging, labeling, and preparation for shipment will follow procedures specified in the field sampling plan.

C. Tank Trailers or Above-Ground Storage Tanks

1. A sampling team of two is required. One will collect samples, the other will relay required equipment and implements.

2. Samples will be collected through the manhole (hatch) on top of the tanker or the fill port. Do not open valves at the bottom. Before opening the hatch, check for a pressure gauge or release valve. Open the release valve slowly to bring the tank to atmospheric pressure.

3. If tank pressure is too great, or venting releases large amounts of toxic gas, discontinue venting and sampling immediately. Measure vented gas with organic vapor analyzer and explosimeter.

4. If no release valve exists, slowly loosen hatch cover bolts to relieve pressure in the tank. (Again, stop if pressure is too great.)

5. Once pressure in tank has been relieved, open the hatch and withdraw sample using one of the recommended sampling devices.

6. Sample each trailer compartment.

7. If compositing is necessary, ship samples to laboratory in separate containers for laboratory compositing.

8. Samples will be handled as hazardous. Samples will be placed in appropriate containers and packed with ice in a cooler. Packaging, labeling, and preparation for shipment will follow procedures specified in the field sampling plan.

D. Refer to Attachment B for procedures for sampling with appropriate devices as follows:

<u>Drum</u>

Glass tube — Procedure 1
COLIWASA — Procedure 2

<u>Storage Tank and Tank Trailer</u>

COLIWASA — Procedure 2
Bacon Bomb — Procedure 3
Gravity Corer — Procedure 4
(for bottom sludge)

VII. Contamination Control

Sampling tools, instruments, and equipment will be protected from sources of contamination prior to use and decontaminated after use as specified in SOP *Decontamination of Personnel and Equipment*. Liquids and materials from decontamination operations will be handled in accordance with the waste management plan. Sample containers will be protected from sources of contamination. Sampling personnel shall wear chemical resistant gloves when handling any samples. Gloves will be decontaminated or disposed of between samples.

VIII. Attachments

A. Collection of Liquid-Containerized Wastes Using Glass Tubes

B. Sampling Containerized Wastes Using the Composite Liquid Waste Sample (COLIWASA)

C. Sampling Containerized Wastes Using the Bacon Bomb Sampler

D. Gravity Corer for sampling Sludges in Large Containers

E. Construction of a Typical COLIWASA

F. Drum Opening Techniques and Equipment

IX. Field Checklist

_______ Sampling Instruments

_______ Tools

_______ Rubber Mallet

_______ Logbook

_______ Safety Glasses or Monogoggles

_______ Safety Shoes

_______ Ice/Cooler, as required

_______ Custody Seals, as required

_______ Chain-of-Custody Forms

_______ Drum Labels, as required

_______ Paint Marker, if drum sampling

_______ Black Indelible Pen

_______ Monitoring Instruments

_____ Labels

_____ Sampling and Analysis Plan

_____ Health and Safety Plan

_____ Decontamination Equipment

_____ Lab Wipes

_____ Lab Spatulas or Stainless Steel Spoons

_____ Chemical Preservatives, as required

_____ Appropriate Containers for Waste and Equipment

_____ Duct Tape

_____ Plastic Sheeting

Attachment A Collection of Liquid-Containerized Wastes Using Glass Tubes

Discussion

Liquid samples from opened containers (i.e., 55-gallon drums) are collected using lengths of glass tubing. The glass tubes are normally 122 centimeters long and 6 to 16 millimeters inside diameter. Larger diameter tubes may be used for more viscous fluids if sampling with the small diameter tube is not adequate. The tubing is broken and discarded in the container after the sample has been collected, eliminating difficult cleanup and disposal problems. This method should not be attempted with less than a two-person sampling team.

Uses

This method provides for a quick, relatively inexpensive means of collecting concentrated containerized wastes. The major disadvantage is from potential sample loss that is especially prevalent when sampling low-viscosity fluids. Splashing can also be a problem and proper protective clothing should always be worn.

Note: A flexible tube with an aspirator attached is an alternative method to the glass tube, and allows various levels to be sampled discretely.

Procedures for Use

1. Remove cover from sample container.
2. Insert glass tubing almost to the bottom of the container. Tubing should be of sufficient length so that at least 30 centimeters extend above the top of the container.
3. Allow the waste in the drum to reach its natural level in the tube.
4. Cap the top of the tube with a safety-gloved thumb or a stopper.
5. Carefully remove the capped tube from the drum. If the tube has passed through more than one layer, the boundary should be apparent in the glass tube.
6. Insert the bottom, uncapped end into the sample container.
7. Partially release the thumb or stopper on the top of the tube and allow the sample to slowly flow into the sample container. If separation of phases is desired, cap off tube before the bottom phase has completely emptied. It may be advisable to have an extra container for "waste," so that the fluid on either side of the phase boundary can be directed into a separate container, allowing collection of pure phase liquids in the sample containers. The liquid remaining after the boundary fluid is removed is collected in yet a third container. NOTE: It is not necessary to put phases in separate containers if analysis of separate phases is not desired.
8. Repeat steps 2 through 6 if more volume is needed to fill the sample container.
9. Remove the tube from the sample container and replace the tube in the drum, breaking it, if necessary, in order to dispose of it in the drum.

Optional Method (if sample of bottom sludge is desired)

1. Remove the cover from the container opening.
2. Insert glass tubing slowly almost to the bottom of the container. Tubing should be of sufficient length so that at least 30 cm extends above the top of the container.
3. Allow the waste in the drum to reach its natural level in the tube.
4. Gently push the tube towards the bottom of the drum into the sludge layer. Do not force it.
5. Cap the top of the tube with a safety-gloved thumb or stopper.
6. Carefully remove the capped tube from the drum and insert the uncapped end into the sample container.
7. Release the thumb or stopper on the top of the tube and allow the sample container to fill to approximately 90 percent of its capacity. If necessary, the sludge plug in the bottom of the tube can be dislodged with the aid of the stainless steel laboratory spatula.
8. Repeat if more volume is needed to fill sample container and recap the tube.

Note:

1. If a reaction is observed when the glass tube is inserted (violent agitation, smoke, light, etc.), the investigators should leave the area immediately.
2. If the glass tube becomes cloudy or smoky after insertion into the drum, the presence of hydrofluoric acid maybe indicated, and a comparable length of rigid plastic tubing should be used to collect the sample.
3. When a solid is encountered in a drum (either layer or bottom sludge) the optional method described above may be used to collect a core of the material, or the material may be collected with a disposable scoop attached to a length of wooden or plastic rod.

Attachment B: Sampling Containerized Wastes using the Composite Liquid Waste Sampler (COLIWASA)

Discussion

The COLIWASA is a much-cited sampler designed to permit representative sampling of multiphase wastes from drums and other containerized wastes. The sampler is commercially available or can be easily fabricated from a variety of materials, including PVC, glass, or Teflon. In its usual configuration it consists of a 152 cm by 4 cm (inside diameter) section of tubing with a neoprene stopper at one end attached by a rod running the length of the tube to a locking mechanism at the other end. Manipulation of the locking mechanism opens and closes the sampler by raising and lowering the neoprene stopper. See Attachment E: Construction of a Typical COLIWASA.

Uses

The COLIWASA is primarily used to sample containerized liquids. The PVC COLIWASA is reported to be able to sample most containerized liquid wastes except for those containing ketones, nitrobenzene, dimethylforamide, mesityloxide, and tetrahydrofuran. A glass COLIWASA is able to handle all wastes unable to be sampled with the plastic unit except strong alkali and hydrofluoric acid solutions. Due to the unknown nature of many containerized wastes, it would therefore be advisable to eliminate the use of PVC materials and use samplers composed of glass or Teflon.

The major drawback associated with using a COLIWASA is concern for decontamination and costs. The sampler is difficult, if not impossible, to decontaminate in the field, and its high cost in relation to alternative procedures (glass tubes) makes it an impractical throwaway item. It still has applications, however, especially in instances where a true representation of a multiphase waste is absolutely necessary.

Procedures for Use

1. Check to make sure the sampler is functioning properly. Adjust the locking mechanism, if present, to make sure the neoprene rubber stopper provides a tight closure.

2. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the sampler's locking block.

3. Slowly lower the sampler into the liquid waste. Lower the sampler at a rate that permits the levels of the liquid inside and outside the sampler tube to be about the same. If the level of the liquid in the sample tube is lower than that outside the sampler, the sampling rate is too fast and will result in a non-representative sample.

4. When the sampler stopper hits the bottom of the waste container, push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the closed position by turning the T-handle until it is upright and one end rests tightly on the locking block.

5. Slowly withdraw the sampler from the waste container with one hand while wiping the sampler tube with a laboratory wipe with the other hand. A phase boundary, if present, can be observed through the tube.
6. Carefully discharge the sample into a suitable sample container by slowly pulling the lower end of the T-handle away from the locking block while the lower end of the sampler is positioned in a sample container.
7. Unscrew the T-handle of the sampler and disengage the locking block.

Attachment C: Sampling Containerized Wastes using the Bacon Bomb Sampler

Discussion

The Bacon Bomb is designed for the withdrawal of samples from various levels within a storage tank. It consists of a cylindrical body with an internal tapered plunger that acts as a valve to admit the sample. A line attached to the top of the plunger is used to open and close the valve. A removable cover provides a point of attachment for the sample line and has a locking mechanism to keep the plunger closed after sampling. The Bacon Bomb is usually constructed of chrome-plated brass and bronze with a rubber O-ring acting as the plunger-sealing surface. Stainless steel versions are also available. The volumemetric capacity is 8, 16, or 32 oz (237, 473, or 946 ml).

Uses

The Bacon Bomb is a heavy sampler suited best for viscous materials held in large storage tanks or in lagoons. If a more non-reactive sampler is needed, the stainless steel version would be used, or any of the samplers could be coated with Teflon.

Procedures for Use

1. Attach the sample line and the plunger line to the sampler.
2. Measure and then mark the sampling line at the desired depth.
3. Gradually lower the sampler by the sample line until the desired level is reached.
4. When the desired level is reached, pull up on the plunger line and allow the sampler to fill for a sufficient length of time before releasing the plunger line to seal off the sampler.
5. Retrieve the sampler by the sample line, being careful not to pull up on the plunger line, thereby accidentally opening the bottom valve.
6. Wipe off the exterior of the sampler body.
7. Position the sampler over the sample container and release its contents by pulling up on the plunger line.

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Attachment D: Gravity Corer for Sampling Sludges in Large Containers

Discussion

A gravity corer is a metal tube with a replaceable tapered nosepiece on the bottom and a ball or other type of check valve on the top. The check valve allows water to pass through the corer on descent but prevents a washout during recovery. The tapered nosepiece facilitates cutting and reduces core disturbance during penetration. Most corers are constructed of brass or steel and many can accept plastic liners and additional weights.

Uses

Corers are capable of collecting samples of most sludges and sediments. They collect essentially undisturbed samples that represent the strata profile that may develop in sediments and sludges during variations in the deposition process. Depending on the density of the substrate and the weight of the corer, penetration to depths of 75 cm (30 in.) can be attained. Exercise care when using gravity corers in vessels or lagoons that have liners because penetration depths could exceed those of the substrate; this could result in damage to the liner material.

Procedures for Use

1. Attach a precleaned corer to the required length of sample line. Solid braided 5-mm (3/16-in.) nylon line is sufficient; however, 20-mm (3/4-in.) nylon is easier to grasp during hand hoisting. An additional weight can be attached to the outside of the corer if necessary.
2. Secure the free end of the line to a fixed support to prevent accidental loss of the corer.
3. Allow corer to free fall through the liquid to the bottom.
4. Retrieve corer with a smooth, continuous, up-lifting motion. Do not bump corer because this may result in some sample loss.
5. Remove nosepiece from corer and slide sample out of corer into stainless steel or Teflon pan (preferred).
6. Transfer sample into appropriate sample bottle with a stainless steel lab spoon or laboratory spatula.

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Attachment E: Construction of a Typical COLIWASA

The sampling tube consists of a 1.52-m (5-ft) by 4.13-cm (1-5/8 in) I.D. translucent plastic pipe, usually polyvinyl chloride (PVC) or borosilicate glass plumbing tube. The closure-locking mechanism consists of a short-length, channeled aluminum bar attached to the sampler's stopper rod by an adjustable swivel. The aluminum bar serves both as a T-handle and lock for the samplers' closure system. When the sampler is in the open position, the handle is placed in the T-position and pushed down against the locking block. This manipulation pushes out the neoprene stopper and opens at the sampling tube. In the closed position, the handle is rotated until one leg of the T is squarely perpendicular against the locking block. This tightly seats the neoprene stopper against the bottom opening of the sampling tube and positively locks the sampler in the closed position. The closure tension can be adjusted by shortening or lengthening the stopper rod by screwing it in or out of the T-handle swivel. The closure system of the sampler consists of a sharply tapered neoprene stopper attached to a 0.95-cm (3/8-in) O.D. rod, usually PVC. The upper end of the stopper rod is connected to the swivel of the aluminum T-handle. The sharply tapered neoprene stopper can be fabricated according to specifications by plastic-products manufacturers at an extremely high price, or it can be made in-house by grinding down the inexpensive stopper with a shop grinder.

COLIWASA samplers are typically made out of plastic or glass. The plastic type consists of translucent plastic (usually PVC) sampling tube. The glass COLIWASA uses borosilicate glass plumbing pipe as the sampling tube and a Teflon plastic stopper rod. For purpose of multiphase sampling, clear plastic or glass is desirable in order to observe the profile of the multiphase liquid.

The sampler is assembled as follows:

a. Attach the swivel to the T-handle with the 3.18-cm (1-1/4 in) long bolt and secure with the 0.48-cm (3/16-in) National Coarse (NC) washer and lock nut.

b. Attach the PFTE stopper to one end of the stopper rod and secure with the 0.95-cm (3/8-in) washer and lock nut.

c. Install the stopper and stopper rod assembly in the sampling tube.

d. Secure the locking block sleeve on the block with glue or screw. This block can also be fashioned by shaping a solid plastic rod on a lathe to the required dimension.

e. Position the locking block on top of the sampling tube such that the sleeveless portion of the block fits inside the tube, the sleeve sits against the top end of the tube, and the upper end of the stopper rod slips though the center hole of the block.

f. Attach the upper end of the stopper rod to the swivel of the T-handle.

g. Place the sampler in the close position and adjust the tension on the stopper by screwing the T-handle in or out.

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Attachment F: Drum Opening Techniques and Equipment [1]

I. Introduction

The opening of closed drums prior to sampling entails considerable risk if not done with the proper techniques, tools, and safety equipment. The potential for vapor exposure, skin exposure due to splash or spraying, or even explosion resulting from sparks produced by friction of the tools against the drum, necessitate caution when opening any closed container. Both manual drum opening and remote drum opening will be discussed in the following paragraphs. When drums are opened manually risks are greater than when opened remotely; for this reason, the remote opening of drums is advised whenever possible.

Prior to sampling, the drums should be staged to allow easy access. Also, any standing water or other material should be removed from the container top so that the representative nature of the sample is not compromised when the container is opened. There is also the possibility of encountering a water-reactive substance.

II. Manual Drum Opening

A. Bung Wrench

A common method for opening drums manually is using a universal bung wrench. These wrenches have fittings made to remove nearly all commonly encountered bungs. They are usually constructed of cast iron, brass, or a bronze-beryllium (a non-sparking alloy formulated to reduce the likelihood of sparks). The use of bung wrenches marked "NON SPARKING" is encouraged. However, the use of a "NON SPARKING" wrench does not completely eliminate the possibility of spark being produced. Such a wrench only prevents a spark caused by wrench-to-bung friction, but it cannot prevent sparking between the threads on the drum and the bung.

A simple tool to use, the fitting on the bung wrench matching the bung to be removed is inserted into the bung and the tool is turned counterclockwise to remove the bung. Since the contents of some drums may be under pressure (especially, when the ambient temperature is high), the bung should be turned very slowly. If any hissing is heard, the person opening the drum should back off and wait for the hissing to stop. Since drums under pressure can spray out liquids when opened, the wearing of appropriate eye and skin protection in addition to respiratory protection is critical.

B. Drum Deheader

One means by which a drum can be opened manually when a bung is not removable with a bung wrench is by using a drum deheader. This tool is constructed of forged steel with an alloy steel blade and is designed to cut the lid of

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[1] Taken from EPA Training Course: "Sampling for Hazardous Materials," U.S. Environmental Protection Agency, Office of Emergency and Remedial Response Support Division, March 24, 1987.

a drum off or part way off by means of a scissors-like cutting action. A limitation of this device is that it can be attached only to closed head drums (i.e., DOT Specification 17E and 17F drums); drums with removable heads must be opened by other means.

Drums are opened with a drum deheader by first positioning the cutting edge just inside the top chime and then tightening the adjustment screw so that the deheader is held against the side of the drum. Moving the handle of the deheader up and down while sliding the deheader along the chime will enable the entire top to be rapidly cut off if so desired. If the top chime of a drum has been damaged or badly dented it may not be possible to cut the entire top off. Since there is always the possibility that a drum may be under pressure, the initial cut should be made very slowly to allow for the gradual release of any built-up pressure. A safer technique would be to employ a remote pressure release method prior to using the deheader.

C. Hand Pick or Spike

When a drum must be opened and neither a bung wrench nor a drum deheader is suitable, then it can be opened for sampling by using a hand pick, pickaxe, or spike. These tools are usually constructed of brass or a non-sparking alloy with a sharpened point that can penetrate the drum lid or head when the tool is swung. The hand picks or pickaxes that are most commonly used are commercially available, whereas the spikes are generally uniquely fabricated 4- foot long poles with a pointed end. Often the drum lid or head must be hit with a great deal of force in order to penetrate it. Because of this, the potential for splash or spraying is greater than with other opening methods and therefore this method of drum opening is not recommended, particularly when opening drums containing liquids. Some spikes used for drum opening have been modified by the addition of a circular splash plate near the penetrating end. This plate acts as a shield and reduces the amount of splash in the direction of the person using the spike. Even with this shield, good splash gear is essential.

Since drums, some of which may be under pressure, cannot be opened slowly with these tools, “sprayers” may result and appropriate safety measures must be taken. The pick or spike should be decontaminated after each drum is opened to avoid cross contamination and/or adverse chemical reaction from incompatible materials.

III. Remote Opening

A. Backhoe Spike

The most common means used to open drums remotely for sampling is the use of a metal spike attached or welded to a backhoe bucket. In addition to being very efficient, this method can greatly reduce the likelihood of personnel exposure.

Drums should be “staged,” or placed in rows with adequate aisle space to allow ease in backhoe maneuvering. Once staged, the drums can be quickly opened by punching a hole in the drum head or lid with the spike.

The spike should be decontaminated after each drum is opened to prevent cross contamination. Even though some splash or spray may occur when this method is used, the operator of the backhoe can be protected by mounting a large shatter-resistant shield in front of the operator's cage. This, combined with the normal sampling safety gear, should be sufficient to protect the operator. Additional respiratory protection can be afforded by providing the operator with an on-board airline system. The hole in the drum can be sealed with a cork.

B. Hydraulic Devices

Recently, remotely operated hydraulic devices have been fabricated to open drums remotely. One such device is discussed here. This device uses hydraulic pressure to pierce through the wall of a drum. It consists of a manually operated pump that pressurizes oil through a length of hydraulic line. A piercing device with a metal point is attached to the end of this line and is pushed into the drum by the hydraulic pressure. The piercing device can be attached so that a hole for sampling can be made in either the side or the head/lid of the drum. Some of the metal piercers are hollow or tube-like so that they can be left in place, if desired, and serve as a permanent tap or sampling port. The piercer is designed to establish a tight seal after penetrating the container.

C. Pneumatic Devices

Pneumatically-operated devices utilizing compressed air have been designed to remove drum bungs remotely. A pneumatic bung remover consists of a compressed air supply (usually SCBA cylinders) that is controlled by a heavy-duty, 2-stage regulator. A high pressure air line of desired length delivers compressed air to a pneumatic drill that is adapted to turn a bung fitting (preferably, a bronze-beryllium alloy) selected to fit the bung to be removed. An adjustable bracketing system has been designed to position and align the pneumatic drill over the bung. This bracketing system must be attached to the drum before the drill can be operated. Once the bung has been loosened, the bracketing system must be removed before the drum can be sampled. This attachment and removal procedure is time-consuming and is the major drawback of this device. This remote bung opener does not permit the slow venting of the container, and therefore appropriate precautions must be taken. It also requires the container to be upright and relatively level. Bungs that are rusted shut cannot be removed with this device.

IV. Summary

The opening of closed containers is one of the most hazardous site activities. Maximum efforts would be made to ensure the safety of the sampling team. Proper protective equipment and a general wariness of the possible dangers will minimize the risk inherent to sampling operations. Employing proper drum opening techniques and equipment will also safeguard personnel. The use of remote sampling equipment whenever feasible is highly recommended.

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Attachment 8
SOP: Disposal of Waste Fluids and Solids

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STANDARD OPERATING PROCEDURE

Disposal of Waste Fluids and Solids

I. Purpose and Scope

This SOP describes the procedures used to dispose of hazardous fluid and solid materials generated as a result of the site operations. This SOP does not provide guidance on the details of Department of Transportation regulations pertaining to the transport of hazardous wastes; the appropriate Code of Federal Regulations (49 CFR 171 through 177) should be referenced. Also, the site investigation-derived waste management plan should be consulted for additional information and should take precedence over this SOP.

II. Equipment and Materials

A. Fluids

- DOT-approved 55-gallon steel drums or Baker® Tanks
- Tools for securing drum lids
- Funnel for transferring liquid into drum
- Labels
- Paint Pens
- Marking pen for appropriate labels
- Seals for 55-gallon steel drums

B. Solids

- DOT-approved 55-gallon steel drums or rolloffs
- Tools for securing drum lids
- Paint Pens
- Plastic sheets
- Labels
- Marking pen for appropriate labels

III. Procedures and Guidelines

A. Methodology

Clean, empty drums or rolloffs or Baker® Tanks will be brought to the site by the drilling subcontractor for soil and groundwater collection and storage. The empty drums will be located at the field staging area and moved to drilling locations as required. The drums will be filled with the drilling and well installation wastes, capped, sealed, and moved to the onsite drum storage area by the drilling subcontractor. The full drums will separate types of wastes by media. The drums will be labeled as they are filled in the field and labels indicating that the contents are potentially hazardous affixed.

The drum contents will be sampled to determine the disposal requirements of the drilling wastes. The drum sampling will be accomplished through the collection and submittal of composite samples, one sample per 10 drums containing the same media. Similar compositing will be performed in each rolloff to obtain a representative sample. The compositing of the sample will be accomplished by collecting a specific volume of the material in each drum into a large sample container. When samples from each of the drums being sampled in a single compositing are collected, the sample will be submitted for TCLP, ignitability, corrosivity, and reactivity analysis. The analysis will be used to determine if drilling wastes are covered by land disposal restrictions.

If rolloffs are used, compositing and sampling of soil will comply with applicable state and federal regulations.

B. Labels

Drums and other containers used for storing wastes from drilling operations will be labeled when accumulation in the container begins. Labels will include the following minimum information:

- Container number
- Container contents
- Origin (source area including individuals wells, piezometers, and soil borings)
- Date that accumulation began
- Date that accumulation ended
- Generator Contact Information
- When laboratory results are received, drum labels will be completed or revised to indicate the hazardous waste constituents in compliance with Title 40 of the Code of Federal Regulations, Part 262, Subpart C.

C. Fluids

Drilling fluids generated during soil boring and groundwater discharged during development and purging of the monitoring wells will be collected in 55-gallon, closed-top drums. When a drum is filled, the bung will be secured tightly. Fluids may also be transferred to Baker® Tanks after being temporarily contained in drums to minimize the amount of drums used.

When development and purging is completed, the water will be tested for appropriate hazardous waste constituents. Compositing and sampling of fluids will comply with applicable state and federal regulations.

D. Solids

The soil cuttings from well and boring drilling will constitute a large portion of the solids to be disposed of.

The solid waste stream also will include plastic sheeting used for decontamination pads, Tyveks, disposable sampling materials, and any other disposable material used during the field operations that appears to be contaminated. These materials will be placed in designated drums.

E. Storage and Disposal

The wastes generated at the site at individual locations will be transported to the fenced drum storage area by the drilling services subcontractor. Drums should be stored on pallets on plastic sheeting to capture small spills.

Waste solid materials that contain hazardous constituents will be disposed of at an offsite location in a manner consistent with applicable solid waste, hazardous waste, and water quality regulations. Transport and disposal will be performed by a commercial firm under subcontract.

The liquid wastes meeting acceptable levels of discharge contamination may be disposed of through the sanitary sewer system at the site. Prior to disposal to the sanitary sewer system, contract arrangements will be made with the appropriate authorities. Wastes exceeding acceptable levels for disposal through the sanitary sewer system will be disposed of through contract with a commercial transport and disposal firm.

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

- Check that representative samples of the containerized materials are obtained.
- Be sure that all state and federal regulations are considered when classifying waste for disposal.

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Attachment 9
SOP: Daily Quality Control Report

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DAILY QUALITY CONTROL REPORT

Contract No. W91ZLK-05-D-0014	Task Order No. 0001
Date:	Report No:

LOCATION OF WORK: Fort Rucker, Alabama

DESCRIPTION:

WEATHER:

TEMPERATURE: MIN °F MAX °F

1. Work performed today:

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

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

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

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

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

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

8. Non-conformances/deficiencies reported:

9. Site safety monitoring activities performed today:

10. Remarks:

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

MEC QCS (or designee) Signature:

CH2M HILL Quality Control Specialist

Part II- Quality Assurance Project Plan

MEC RCRA Facility Investigation
Fort Rucker, Alabama

Contract W91ZLK-05-D-0014

Task Order 0001

December 7, 2010

Prepared for

Army Environmental Command

Prepared by

CH2MHILL

Atlanta Georgia

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Contents

Attachments

1 DoD Environmental Laboratory Accreditation Program (ELAP) Certification
2 Precision and Accuracy Limits for EPA Method 6010B/7000 - Metals
3 Precision and Accuracy Limits for EPA Method 8330A – Explosives
4 Precision and Accuracy Limits for TCLP
5 Container, Preservative, and Holding Time Requirements for Soil
6 Analytical Method Detection Limits for EPA Method 6010B/7471A
7 Analytical Method Detection Limits for EPA Method 8330A
8 TCLP Target Parameters Lists and Reporting Limits
9 Electronic Data Deliverable Format for CH2M HILL

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Acronyms and Abbreviations

ADEM	Alabama Department of Environmental Management
AEC	Army Environmental Command
ASTM	American Society for Testing and Materials
CAS	Chemical Abstract Service
CCV	continuing calibration verification
CD	compact disc
CLs	control limits
COC	chain of custody
DL	Detection Limit
DO	dissolved oxygen
DoD	Department of Defense
DQE	data quality evaluation
DQO	data quality objective
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EM	Engineering Manual
ERIS	Environmental Restoration Information System
ERPIMS	Environmental Resources Program Information Management System
ERB	equipment rinsate blank
GFAA	graphite furnace atomic absorption
ICP	inductively coupled plasma
ICS	interference check sample
IDW	investigation-derived waste
IS	internal standard
LCS	laboratory control sample
LOD	Limit of Detection
LOQ	Limit of Quantitation
MB	method blank
MD	matrix duplicate
MDL	method detection limit
mg/kg	milligrams per kilogram
MMRP	Military Munitions Response Program
MRL	method reporting limit
MS	matrix spike

MS/MSD	matrix spike/matrix spike duplicate
MSD	matrix spike duplicate
P	percent recovery
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PC	project chemist
PDS	post-digestion spike
PM	Project Manager
QA	quality assurance
QAM	quality assurance manual
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
QSM	Quality Systems Manual
RBSL	risk-based screening level
RF	response factor
RFI	Resource Conservation and Recovery Act Facility Investigation
RL	reporting limit
RPD	relative percent difference
SD	spike duplicate
SDG	sample delivery group
SM	Site Manager
SOP	standard operating procedure
SPLP	synthetic precipitation leaching procedure
SQL	sample quantitation limit
SUXOS	Senior Unexploded Ordnance Supervisor
TCLP	toxicity characteristic leaching procedure
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

SECTION 1

Project Laboratory Organization and Responsibilities

This section identifies key project team members associated with the planned sampling work and lists the responsibilities associated with each position. The organizational structure and responsibilities are designed to provide project control and quality assurance (QA) for the proposed investigation. This investigation takes place under the Military Munitions Response Program (MMRP) and focuses on three locations:

- The Anti-Tank/Rocket Grenade Range- FTRU-001-R-01
- The Infiltration/Grenade Range- FTRU-003-R-01
- The .22-Caliber Target Butt FTRU-004-R-01

The exact number of samples to be analyzed at these locations is not known at this time.

1.1 Laboratory Work Group

The selected laboratory is responsible for analyzing samples collected during field activities in accordance with this Quality Assurance Project Plan (QAPP) and its own quality assurance manual (QAM). Empirical Laboratories, LLC in Nashville, Tennessee, will be performing all of the analyses. Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) certification for Empirical Laboratories in included in **Attachment 1**. Sonya Gordon has been identified as the laboratory project manager and her back-up is Rick Davis. The laboratory project manager acts as a liaison between the project chemist (PC), the field team, and laboratory operations and is responsible for the following:

- Receipt of sample custody from the field team members, verification of sample integrity, and transfer of sample fractions to the appropriate analytical departments
- Coordination of sample analyses to meet project objectives
- Ensuring that laboratory personnel understand technical requirements, including chain-of-custody (COC) procedures
- Preparation of analytical reports
- Review of laboratory data for compliance with method requirements
- Review of any quality control (QC) deficiencies reported by the analytical department manager
- Coordination of necessary changes
- Completion of data package deliverables

- Communication with the PC concerning analytical and QC issues
- Response to questions from the project team during the data quality evaluation (DQE) process

1.2 Subcontracted Laboratory

No subcontracted laboratories will be performing analytical work associated with this project.

1.3 Quality Assurance Laboratory

As directed by the U.S. Army Corps of Engineers (USACE) Contracting Officer, up to 10% QA samples may be collected and submitted to a contracted laboratory during this project.

1.4 Project Communication

Effective communication among all project personnel will be established and maintained. Project and task instructions will be distributed to all applicable project team members as needed throughout the project.

During field investigation phases of this project, the field team will meet daily to review the status of the project and to discuss technical and safety issues. When necessary, other meetings will be scheduled, or the Senior Unexploded Ordnance Supervisor (SUXOS)/Site Manager (SM) will meet individually with field personnel to resolve problems.

During the field effort, the SUXOS/SM will be in regular telephone or personal contact with the project team. When significant problems or decisions requiring additional authority occur, the SUXOS/SM will immediately contact the CH2M HILL Project Manager (PM) for assistance. The PC will coordinate communication with the laboratory through sample collection, sample analysis, and the DQE process and will consult with the CH2M HILL PM.

SECTION 2

Data Assessment Organization and Responsibilities

Whenever chemical data are generated, their quality must be assessed prior to use. The type and degree of assessment required depends on the project data quality objectives (DQOs). Several levels of data assessment can be used, including data verification, data review, data evaluation, and data validation.

The data will undergo several steps of review at the laboratory. Upon receipt of the hard copy data packages and electronic data deliverables, all data will be validated by CH2M HILL chemists.

After the data have been validated and a DQE report written, the data will be evaluated against risk criteria and the results presented in the Resource Conservation and Recovery Act Facility Investigation (RFI) report.

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SECTION 3

Data Quality Objectives

3.1 DQO Development

DQOs are both qualitative and quantitative statements that define the type, quality, and quantity of data necessary to support decision making during project activities. The intended final use of the data determines the DQOs, which are developed before sampling and analysis plans.

The credibility of the data is strengthened by the level of the supporting QA/QC documentation. The greater the importance of the data or the resulting decision, the more QA/QC information is needed to validate the data. This reasoning must be applied to the data collected for any project. The DQO process to be used for this project follows the Engineering Manual (EM) 200-1-2 (1998) and U.S. Environmental Protection Agency (USEPA) QA/G-4 guidance (USEPA, 2006) and is as follows:

1. **State the problem.** Describe concisely the problem to be studied.
2. **Identify the decisions.** State the decisions to be made to solve the problem.
3. **Identify inputs to the decisions.** Identify the information and supporting measurements needed to make the decisions and describe the source(s) of the information.
4. **Define the boundaries of the study.** Specify conditions (that is, time periods and spatial locations).
5. **Develop a decision rule.** Define the conditions by which a decision maker will select alternatives, usually specified as "if/then" statements (for example, *if* average concentration in soil is less than cleanup level, *then* the site achieves remedial action goals).
6. **Specify tolerable limits on decision errors.** Define in statistical terms.
7. **Optimize the design for obtaining data.** Evaluate the results of the previous steps and develop the most resource-efficient design for data collection.

3.2 Quality Objectives for Chemical Data Measurement

The sampling approach and rationale are based on the DQOs and are presented in the Field Sampling Plan. One activity associated with developing the sampling approach and rationale is developing a list of samples to be collected, sample types, sampling intervals, analytical parameters, and required detection/quantitation limits (QLs) for each required parameter.

Once the number and type of samples and analytical parameters are defined, the quality objectives are developed. The quality objectives focus on setting the level of QA/QC and identifying the data package deliverables for all analyses needed to meet specified DQOs. To meet a minimum level of certainty about the quality of the field data, the following elements will be addressed to meet the objectives specified by the client and regulatory agencies:

- Field operations will be conducted in accordance with written procedures.
- To maintain accuracy within necessary limits, measuring and test equipment used in field investigations will be calibrated against traceable standards at specific intervals, using approved standard operating procedures (SOPs) or manufacturer's instructions.
- When measuring and test equipment is found to be out of specification, the previous inspection or test results will be evaluated for validity and acceptability. This evaluation will be documented.
- Before project fieldwork begins, all project personnel conducting fieldwork will be trained to be familiar with the project Work Plan and associated documents.
- Internal audits may be performed to assess the quality of project activities and to evaluate compliance with established QA requirements.
- QC samples will be used to monitor the quality of field and laboratory techniques and data.

3.3 Levels of Data Quality and Data Reporting

The level of data quality is dependent on the use of the results supported by the data.

The data use determines the required levels of data quality. The two categories of data quality established by the USEPA are "screening" and "definitive." These categories are defined as follows:

Screening data are generated by rapid methods of analysis with less-rigorous sample preparation, calibration, and/or QC requirements compared with the requirements for producing definitive data. Sample preparation steps are commonly restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data may provide analyte identification and quantitation, although the quantitation may be relatively imprecise, unless USEPA reference methods are used. Physical test methods, such as dissolved oxygen (DO) measurements, temperature and pH measurements, moisture content, turbidity, and conductance have been designated by definition as screening techniques.

Depending on the DQOs, screening methods may require confirmation samples that generate definitive data. Confirmation samples will be selected to include both detected and nondetected results from the screening technique.

Definitive data are generated using rigorous analytical methods such as approved USEPA reference methods, as discussed in Section 5 of this QAPP. Data are analyte-specific, and both identification and quantitation are confirmed. These methods have standardized QC and documentation requirements, as discussed in Section 5 and in the analytical method.

Definitive data are not restricted in their use unless quality problems require data qualification.

Four levels of data reporting may be performed as part of this field effort, with each level having different supporting QA/QC documentation. The four levels correspond to QC Levels I, II, III, and IV. Screening or Levels I and II data reporting includes field monitoring activities, such as measurements of pH, temperature, conductivity, DO, oxidation-reduction potential, turbidity, and limited analytical results from the laboratory. Definitive or Level III data reporting provides definitive and/or confirmation data. Comprehensive or Level IV data reporting includes the highest level of QC with significant additional documentation.

These levels are described in greater detail in Section 7.

3.4 Quality of Data

To ensure that quality data are continually produced during analysis, systematic QC checks are incorporated into the sampling and analyses to show that procedures and test results remain reproducible and that the analytical method is actually measuring the quantity of target analytes without unacceptable bias. Systematic QC checks include the scheduled analyses of field and laboratory replicates, standards, surrogates, spiked samples, and blanks.

Analytical performance requirements are expressed in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS). Brief definitions for each PARCCS parameter and the equations used for calculations are presented below. The precision and accuracy QC limits for each method and matrix are identified in **Attachments 2, 3 and 4**.

3.4.1 Precision

Precision is a measure of the agreement or repeatability of a set of replicate results obtained from duplicate analyses made under identical conditions. Precision can be estimated by comparing duplicate matrix spike (MS) concentrations with field duplicate sample results. Long-term analytical precision for an analyte in a method can be calculated from multiple determinations of the analyte from a homogeneous sample or a laboratory control sample (LCS) over a period of time. LCS values obtained over a period of time should be used to construct a control chart and to evaluate long-term analytical precision. The laboratory-established long-term analytical precision is not a reporting requirement for the data packages. The laboratory-established control limits (CLs) (a measure of precision) for each analyte should not be wider than the limits specified in the U.S. Department of Defense guidance, **Quality Systems (QSM 4.1).** Single analytical batch precision can be measured from laboratory duplicates (for example, LCS and LCS duplicate). The precision of a duplicate determination can be expressed as the relative percent difference (RPD), calculated as:

$$\text{RPD} = \left\{ \frac{\left| X_1 - X_2 \right|}{\frac{\left(X_1 + X_2 \right)}{2}} \right\} x\,100$$

where:

X_1 is the result from the native sample, and X_2 is the result from the duplicate sample.

3.4.2 Accuracy

Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. Accuracy is calculated through the use of known reference materials and MSs. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, internal standards, MSs, blank samples, LCSs, and surrogate standards will be used to assess the accuracy of the analytical data. Accuracy is calculated from analytical data and is not measured directly. Spiking of reference materials into a sample matrix provides a measure of the matrix effects on analytical accuracy. Spiking of reference materials into a "non-matrix," such as de-ionized water or Ottawa sand, provides a measure of the accuracy of the analytical method itself. Accuracy, defined as percent recovery (P), is calculated as:

$$P = \left[\frac{(SSR - SR)}{SA}\right] x\ 100$$

where:

SSR is the spiked sample result, SR is the sample result (native), and SA is the spike concentration added to the spiked sample.

3.4.3 Representativeness

Representativeness is a measure of the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. Representativeness is demonstrated by providing full descriptions in the project planning documents of the sampling techniques and by making certain that the sampling locations are selected and the number of samples collected such that the accuracy and precision criteria are met.

3.4.4 Completeness

The data completeness of laboratory analyses results will be assessed for compliance with the amount of data required for decision making. Complete data are data that are not rejected. Data qualified with qualifiers such as a "J" or a "UJ" are still deemed acceptable and can still be used to make project decisions. Completeness is defined as the percentage of measurements judged to be valid compared with the total number of measurements made for a specific sample matrix and analysis. Completeness is calculated using the formula:

$$Completeness = \frac{Valid\ Measurements}{Total\ Measurements} x100$$

Experience on similar projects has shown that laboratories typically achieve approximately 90 percent completeness. All validated data will be used. During the data validation process, an assessment will be made of whether the valid data are sufficient to meet project objectives. If sufficient valid data are not obtained, the CH2M HILL PM will initiate corrective action.

3.4.5 Comparability

Comparability is another qualitative measure designed to express the confidence with which one data set may be compared with another. Sample collection and handling techniques, sample matrix type, and analytical method all affect comparability. Comparability is limited by the other PARCCS parameters because data sets can be compared with confidence only when precision and accuracy are known. Data from one phase of an investigation can be compared with others when similar methods are used and similar data packages are obtained.

3.4.6 Sensitivity

Sensitivity is the measure of the concentration at which an analytical method can positively identify and report analytical results. The sensitivity of a given method is commonly referred to as the detection limit. The terms and definitions of detection limits that will be used for this program are discussed in greater detail in Section 6.3 of this QAPP.

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SECTION 4

Sample Receipt, Handling, Custody, and Holding Time Requirements

4.1 Sample Custody

The sample custody and documentation procedures described in this subsection will be followed throughout all sample collection activities. Proper sample handling, preservation, shipment, and maintenance of COC are key components to building the documentation and support for data within the evidentiary process so that the data can be used for decision making. It is essential that all sample handling and sample COC requirements be met completely, accurately, and consistently. Components of sample custody procedures include the use of field logbooks, sample labels, custody seals, and COC forms. Sample handling and custody requirements must be followed for all samples collected as part of the investigation. Each person involved with sample handling must be trained in COC procedures before the start of the field project. The COC form must accompany the samples during shipment from the field to the laboratory.

A sample is under custody under the following conditions:

- It is in one's actual possession.
- It is in one's view, after being in one's physical possession.
- It was in one's physical possession and that person locks it up to prevent tampering.
- It is in a designated and identified secure area.

4.2 Field Custody

The procedures used to document, establish, and maintain custody of field samples are addressed in the Field SOPs. The following procedures, at a minimum, must be used to document, establish, and maintain custody of field samples:

- Sample labels must be completed for each sample with waterproof ink, ensuring that the labels are legible and affixed firmly on the sample container.

- All sample-related information must be recorded in the project logbook.

- The field sampler must retain custody of samples until they are transferred or properly dispatched.

- One individual from the field sampling team should be designated as the individual responsible for all sample transfer activities. This field investigator will be responsible for the care and custody of samples until they are properly transferred to another person or facility.

- All samples will be accompanied by a COC record. This record documents the transfer of custody of samples from the field investigator to another person, to the laboratory, or to other organizational entities. Each change of possession must be accompanied by an authorized signature for relinquishment and receipt of the samples. The original record must accompany the shipment, and the SUXOS/SM must retain a copy.

- Completed COC forms will be enclosed in sealed, Zip-Lock®-type bags and placed inside the shipping container used to transport samples from the field to the laboratory.
- When samples are relinquished to a shipping company for transport, the tracking number from the shipping bill or receipt will be recorded on the COC form.
- Custody seals must be affixed on shipping containers when samples are shipped to the laboratory to prevent sample tampering during transportation. If seals are numbered, record the numbers on the COC and in the field logbook.

4.3 Sample Packing and Shipping

Samples will be delivered to the designated laboratory by a common carrier such as Federal Express. Hard plastic ice chests or coolers with similar durability will be used for shipping samples. The coolers must be able to withstand a 4-foot drop onto solid concrete in the position most likely to cause damage. The samples must be cushioned to cause the least amount of damage if such a fall occurs.

For characterization of investigation-derived waste (IDW), all aqueous volatile organic compound (VOC) sample vials will be shipped in the same cooler on a given day. A trip blank will be included in each cooler with aqueous VOC samples. (In cases where soil samples may contain high levels of target compounds, it is advisable to ship the aqueous and soil samples in separate coolers.) After packing is complete, the cooler will be taped with COC seals affixed across the top and bottom joints. Each container will be clearly marked with a sticker containing the originator's address.

The procedures used to pack and ship samples are addressed in the Field Sampling Plan. The following procedures, at a minimum, must be used when transferring samples for shipment:

- All sample coolers and packages must be accompanied by a COC form identifying the contents. When transferring possession of samples, the individuals relinquishing and receiving the sample must sign, date, and note the time on the record. This record documents the transfer of custody of samples from the field sampler to another person or to the laboratory. The original COC record must accompany the shipment, and the SUXOS/SM must retain a copy.
- Samples must be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed COC form enclosed in each sample box or cooler.

4.4 Laboratory Sample Receipt

Each laboratory receiving samples must comply with the laboratory sample custody requirements outlined in the subcontract document and its own QAM. The SUXOS/SM or PC will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped and the expected date of arrival.

The following procedures will be used by the laboratory sample custodian, once the samples have arrived at the laboratory:

- The laboratory will designate a sample custodian, who will be responsible for maintaining custody of the samples and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check the original COC and request-for-analysis documents and compare them with the labeled contents of each sample container for corrections and traceability. The sample custodian will sign the COC and record the date and time received. The sample custodian also will assign a unique laboratory sample number to each sample.
- Each individual cooler will have the temperature (via the temperature blank) checked and recorded for analytical method compliance.
- Care will be exercised to annotate any labeling or descriptive errors. If discrepancies occur in the documentation, the laboratory will immediately contact the SUXOS/SM as part of the corrective action process. A qualitative assessment of each sample container will be performed to note anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming COC procedure.
- If all data and samples are correct and there has been no tampering with the custody seals, the "Received by Laboratory" box will be signed and dated.
- All samples will be accompanied by a COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the field sampler to another person or to the laboratory. Overnight carriers will be treated as a single entity, and a single signature will be required when samples are delivered to the laboratory.
- Copies of the COC and request-for-analysis forms will accompany the laboratory report and will become a permanent part of the project records.
- The laboratory will send a sample acknowledgment letter to the PC as a record that the shipment arrived and noting the conditions of the containers upon arrival.

4.5 Laboratory Sample Storage

After the samples have been received and labeled by the laboratory, they will be moved to the locked refrigerators/freezers where they will be maintained at the proper temperature. Sample extracts will be stored in designated secure, refrigerated storage areas. Samples and sample extracts will be maintained in secure storage until disposal. No samples or extracts will be disposed of without prior written approval from an appropriate member of the project team. The sample custodian will note sample disposal date in the sample ledger. The laboratory, in accordance with applicable regulations, will dispose of samples. The laboratory will be required to retain the sample for a minimum of 90 days and sample extracts for a minimum of 60 days after submission, pending the need for re-analysis.

4.6 Corrective Actions for Incoming Samples

Any discrepancy will be identified and corrective actions performed. These remarks will be documented on a “sample receipt checklist” or its equivalent. The PC may need to be contacted to provide guidance concerning additional corrective actions or guidance.

4.7 Analytical Holding Times

The holding times for the requested analyses are listed in **Attachment 5**.

SECTION 5

Analytical Procedures

This subsection summarizes analytical methods that will be performed for this project, including the laboratory facilities and calibration requirements. The analytical methods, specific target parameter lists, and reporting limits (RLs) are listed in **Attachments 5, 6, 7 and 8.**

Samples will be analyzed using USEPA-approved methods or other recognized standard methods. The principal source for analytical methods is *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (USEPA SW-846, Third Edition, and its updates, 1998).

5.1 Laboratory Facility and Equipment

5.1.1 Laboratory Facility Requirements

The laboratory will provide a secure testing facility that can accommodate the proper performance for the type, range, and volume of analytical services it provides. Facility entries must be controlled and monitored as necessary to restrict access, especially for areas affecting the quality of activities or data. The design of the facility must provide effective separation of incompatible testing activities and adequate energy sources, lighting, heating/cooling, and ventilation to ensure stability of voltage, temperature, humidity, and other pertinent environmental conditions. This may involve inclusion of an area under positive pressure for analysis of VOCs. Adequate monitoring of environmental conditions and general housekeeping should be maintained to avoid any influence on the testing activities performed.

5.1.2 Laboratory Equipment Requirements

The laboratory will provide sufficient equipment, instruments, and related supplies for proper performance of work. All equipment used will be reflective of the measurement accuracy necessary. The laboratory will ensure that all equipment and supplies purchased are inspected, a unique identifier assigned to them, and the equipment verified as compliant with all relevant requirements prior to their initial use. Records of all suppliers used to obtain support services and materials will be maintained.

Equipment Preventative Maintenance

To minimize downtime and interruption of analytical work, preventive maintenance will be routinely performed on each analytical instrument. Designated laboratory personnel should be trained in routine maintenance procedures for all major instrumentation. When repairs are necessary, the equipment will be taken out of service, repairs performed by either trained staff members or trained service engineers, and an evaluation of the impact on previous calibrations or tests performed. It is generally recommended that maintenance contracts be maintained on all major analytical instruments. Detailed SOPs will be on file or the information incorporated into method SOPs/laboratory quality management plan that describes preventive maintenance procedures and schedules. The laboratory will maintain detailed logs for each instrument that document the preventive maintenance and repairs performed.

Equipment Backup Capabilities

Backup instruments will be designated in case of an extended breakdown for an analytical instrument. It is the laboratory's responsibility to have a backup plan in force to ensure that all sample holding times can be met. This plan can include the rental of backup instruments for specific analytical procedures. All equipment outside of the laboratory's permanent control will be evaluated to ensure that all relevant requirements are met prior to its initial use. Before any subcontracting is performed, USACE must be informed and its approval given, in writing. The laboratory will ensure and be able to document that all subcontractors employed are competent to perform the duties requested and comply with all of the requirements established within this QAPP and EM 200-1-1, as appropriate.

Laboratory Equipment Records

The laboratory will maintain appropriate records or documentation for all instruments and support equipment. Documentation includes:

- Type of equipment
- Manufacturer's name or equipment make, model, and any serial numbers or unique identifiers
- Dates received and placed into service
- Condition when purchased (new, used, etc.)
- Current location
- Manufacturer's instructions/manuals
- History of any damage, modification, or repair
- Instrument maintenance logs
- Calibration/calibration verification run logs

5.2 Calibration Procedures and Frequency

Calibration procedures for field instruments and laboratory equipment are discussed below.

5.2.1 Field Instruments

Homogenized surface soil samples will be collected and field screened using an Innov-X Model 440 portable X-ray fluorescence analyzer (or equivalent) that is registered for use in the State of Alabama.

The analyzer will be set to soil mode and to a minimum test time of 120 seconds. Before beginning the field screening and at periodic intervals throughout the day, the analyzer will be standardized using a standardization clip that is typically included with the device. In addition, precision measurements will be performed on factory-created standards of low, medium, and high analyte concentrations. Then the instrument precision will be assessed through calculation of the relative standard deviation of the analyte concentrations detected in the standards. Suggested frequency is a minimum of one precision measurement per day.

5.2.2 Laboratory Equipment

Laboratory instruments will be calibrated in accordance with the manufacturer's directions and applicable method specifications. Laboratory instrument calibration procedures will be summarized in the laboratory QAM, which will be reviewed and approved by the CH2M HILL PM or designee before samples are submitted for analysis. The calibration of all laboratory equipment will be documented in the specific maintenance logbook, or analytical logbook, as described in the laboratory's QAM.

Analytical instruments will be calibrated in accordance with the analytical methods. All target analytes reported will be present in the initial and continuing calibrations. All results reported will be within the calibration range. Records of standard preparation and instrument calibration will be maintained. Records will unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration standards will be traceable to standard materials.

Instrument calibration will be checked using all of the target analytes, including multi-response analytes. All calibration criteria will satisfy SW-846, Update III requirements at a minimum. The initial calibration will be checked at the frequency specified in the method, using materials prepared independently of the calibration standards. Multipoint calibrations will contain the minimum number of calibration points specified in the applicable method, including a standard at or below the corresponding RL. Analyte concentrations are determined with either calibration curves or response factors (RFs). For gas chromatography and gas chromatography/mass spectrometry methods, when using RFs to determine analyte concentrations, the average RF from the initial five-point calibration will be used. The continuing calibration will not be used to update the RFs from the initial five-point calibration. The continuing calibration verification (CCV) cannot be used as the LCS.

If more than the required minimum number of standard concentrations are used in the initial calibration, all standard concentrations must be included in calculating the acceptance of the initial curve. All results for field samples will be reported only within the calibration linearity range.

5.3 Field and Laboratory QC Procedures

Type and frequencies of specific QC samples performed by the laboratory depend on the specified analytical method. Internal QC methods require performance on a sample batch basis and include analyses of method blanks (MBs), LCSs, and actual environmental samples as duplicates, MSs, and matrix spike duplicates (MSDs). Additional QC is incorporated into the analytical sequence. The following text gives a brief description of QC sample requirements. A detailed discussion of internal QC procedures can be found in Appendix I of EM 200-1-3.

5.3.1 Field QC Blank Samples and Duplicate Field Samples

Equipment Rinsate Blank Samples

Equipment rinsate blank (ERB) samples are samples of American Society for Testing and Materials (ASTM) Type II water passed through and over the surface of decontaminated sampling equipment. The rinse water is collected in sample bottles, preserved, and handled in the same manner that is used when collecting aqueous samples, even if the ERB samples are being collected for soil samples. ERB samples are used to monitor the effectiveness of the decontamination process. ERBs will be collected at a rate of 10 percent of the field samples per matrix, per type of sampling equipment, and will be analyzed for the same parameters as the corresponding samples.

Temperature Blanks

Temperature blanks are sent with each cooler shipped to the offsite laboratory containing samples requiring preservation at 4 °C. Temperature blanks consist of a non-preserved VOC vial, or similar laboratory container, filled with ASTM reagent grade water. Temperature blanks are measured at the laboratory upon receipt to verify the temperature of the samples contained in the cooler. One temperature blank will be shipped with each cooler to each offsite laboratory.

Duplicate Field Samples

Duplicate field samples are collected to monitor the precision of the field sampling process. The identity of the duplicate samples is not noted on the laboratory COC form. The SUXOS/SM will choose at least 10 percent (per matrix) of the total number of sample locations known or suspected to contain moderate contamination, and duplicate field samples will then be collected at these locations. The identity of the duplicate samples will be recorded in the field sampling logbook, and this information will be forwarded to the DQE team to aid in reviewing and evaluating the data.

5.3.2 Laboratory QC Blank and MS Samples

Laboratory Method/Preparation Blanks

Laboratory MBs are blank matrices (such as ASTM Type II water or Ottawa sand) that are treated as environmental samples, being prepared and analyzed along with the field samples. Laboratory MBs are used to monitor laboratory performance and to check for contamination introduced during sample preparation and analytical procedures. An MB is required for every 20 field samples or for each analytical batch, whichever is more frequent.

Blank samples should not contain any target parameter of interest. Certain organic compounds are known to be common laboratory contaminants, such as acetone, methylene chloride, and the common phthalates. However, the laboratory must make all efforts to eliminate these compounds as contaminants. The concentration of all target compounds must be less than the RL, except for the common laboratory contaminants; the concentration of the common laboratory contaminants must be less than five times the RL.

MS/MSD Samples. For MS/MSD samples, three aliquots of a single sample are analyzed—one native and two spiked with target compounds or metals. Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. The duplicate spike results (MS and MSD) are compared to evaluate precision. MS/MSDs will be collected at a frequency of 5 percent (1 MS/MSD sample set for every 20 field samples) of the number of field samples.

Surrogate Spikes. Surrogate spike compounds are added to each sample for the organic analytical methods. Surrogate spike compounds are structurally similar (but not identical) to target compounds and should behave in a similar manner during analysis. Surrogate spike recoveries are used to monitor both laboratory performance and matrix interferences. Surrogate spike recoveries from field and laboratory blanks are used to evaluate laboratory performance because these blanks represent an ideal sample matrix. Surrogate spike recoveries for field samples are used to evaluate the potential for matrix interferences. When surrogate spike recoveries for field samples fall outside the method target acceptance windows, the samples are re-extracted if appropriate, then re-analyzed. If the surrogate spike recovery is still outside the acceptance window for the re-analyzed sample, then the sample results are qualified as affected by matrix interferences.

LCS Samples. The LCSs are analyte-free water (for aqueous analyses) or Ottawa sand (for soil analyses) (except metals, where glass beads of 1 millimeter in diameter or smaller may be used) spiked with all target analytes. The appropriate spiking solution will be spiked at a concentration less than or equal to the midpoint of the calibration curve for each analyte.

The LCS will be carried through the complete sample preparation and analysis procedure to evaluate each preparation and analytical batch and to determine if the method is in control. The LCS cannot be used as the CCV. One LCS will be included in every preparation and analytical batch. If more than one LCS is analyzed in an analytical batch, results from all LCSs analyzed will be reported.

Whenever an analyte in an LCS is outside the acceptance limit, corrective action will be performed. After the system problems have been resolved and system control has been reestablished, all samples in the analytical batch will be reanalyzed for the out-of-control analyte(s). When an analyte in an LCS exceeds the upper or lower control limit and no corrective action is performed or the corrective action was ineffective, the laboratory should discuss the issue with the PC or QA personnel.

Interference Check Samples. The interference check sample (ICS), used in inductively coupled plasma (ICP) analyses only, contains both interfering and analyte elements of known concentrations. The ICS is used to verify background and interelement correction factors and is run at the beginning and end of each run sequence.

When the ICS results are outside of the acceptance limits as prescribed in the method, corrective action will be performed. After the system problems have been resolved and system control has been re-established, re-analyze the ICS. If the ICS result is acceptable, reanalyze all affected samples.

Internal Standards

Internal standards (ISs) are known amounts of certain compounds added after preparation or extraction of a sample. These compounds are used in an IS calibration method to correct sample results affected by column injection losses, purging losses, or viscosity effects. ISs will be added to environmental samples, control samples, and blanks in accordance with the method requirements.

When the IS results are outside of the acceptance limits, corrective actions will be performed. After the system problems have been resolved and system control has been reestablished, all samples analyzed while the system was malfunctioning will be reanalyzed.

5.4 Performance and System Audits

Performance and system audits will be performed both in the field and at the laboratory. Laboratory audits should be conducted internally by the laboratory QC staff, as well as by external agencies. USACE may perform laboratory audits in conjunction with the laboratory validation process.

5.4.1 System Audits and Surveillances

During the course of the field activities, USACE personnel may perform QA system audits or QA surveillances, at USACE discretion. The primary purpose of the system audits and surveillances is to verify and document that field activities are being performed efficiently and in conformance with approved standards and procedures, federal and state regulatory requirements, sound engineering and environmental practices, and contract requirements.

The audits will include an objective examination of work areas, activities, and processes; review of documents and records; interviews with project personnel; and review of procedures associated with the project. Surveillances are generally less formal and generally will focus on one specific area of review rather than entire program effectiveness. Audit/surveillance results will be documented and the audit report submitted to the Task Order Manager for action. The Task Order Manager will investigate any adverse audit findings, identify the root cause (if necessary), schedule corrective action, and respond in writing to the report as requested. The Task Order Manager will report periodically on the status of corrective actions taken, until all required actions are completed.

5.4.2 Laboratory Evaluation

The laboratory chosen to perform chemical analysis of the project samples will be approved by USACE. Current DoD ELAP certification for the selected laboratory, Empirical Laboratories, is provided in Attachment 1.The laboratory will have the current regulatory certifications for all analytes and matrices specific to this project. A copy of the laboratory's QAM will be reviewed, and the laboratory’s experience, capability, and adequacy will be evaluated before samples are submitted for analysis.

5.5 Nonconformance/Corrective Actions

Specific corrective actions must be implemented if method quality objectives are not met.

To correct errors, deficiencies, or out-of-control situations, the laboratory's QA program will include a system of QC activities that measure the system performance to verify that it meets stated requirements and objectives. When the analytical system performance does not meet defined standards, the laboratory will employ systematic procedures, called corrective actions, to resolve problems and restore proper functioning to the analytical system(s).

Laboratory personnel are alerted that corrective actions are necessary under the following conditions:

- QC data are outside the warning or acceptable windows for precision and accuracy established for laboratory samples.
- Blanks contain contaminants at concentrations above the levels specified in the laboratory quality assurance plan for any target compound.
- Undesirable trends are detected in spike recoveries or RPD between duplicates.
- There are unusual changes in method detection limits (MDLs).
- Deficiencies are detected by the laboratory QA director during internal or external audits, or from the results of performance evaluation samples.

Corrective actions are implemented immediately when nonconformances in QC sample results are identified by the bench analyst. Corrective action procedures are handled initially at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors and checks such parameters as instrument calibration, spike and calibration mixes, and instrument sensitivity.

The analyst immediately notifies his or her supervisor of the problem and the investigation being conducted. If the problem persists or cannot be identified, the matter must be referred to the laboratory supervisor and the QA/QC officer for further investigation. At this point, the PC and the CH2M HILL PM must be notified about the nonconformance. All laboratory QC problems that will affect the final data must be discussed with the PC as part of the corrective action process. Once resolved, full documentation of the corrective action procedure must be filed with the laboratory supervisor, and the QA/QC officer must be provided with a corrective action memorandum for inclusion in the project file if data are affected. A copy of the corrective action memorandum must be included in the laboratory data package deliverable.

Corrective actions may include:

- Reanalyzing suspect samples
- Recalibrating with new standards
- Eliminating blank contamination
- Resampling and analyzing new samples
- Evaluating and amending sampling and analytical procedures
- Accepting data with an acknowledged level of uncertainty
- Recalibrating analytical instruments
- Qualifying or rejecting the data

After implementation of the required corrective action measures, data that are deemed unacceptable may not be accepted by the CH2M HILL PM, and follow-up corrective actions may be explored. Details of laboratory corrective actions are provided in the laboratory QAM.

In the absence of project-specific requirements, the following discussion identifies measurement quality objectives and the corrective actions necessary.

5.5.1 Incoming Samples

Problems noted during sample receipt will be documented on an appropriate form (the "Cooler Receipt Form"). The CH2M HILL PM or appropriate technical personnel will be contacted immediately for problem resolution.

5.5.2 Sample Holding Times

If samples cannot be prepared or analyzed within the method required holding times, the CH2M HILL PM or appropriate technical personnel will be immediately notified so that an appropriate corrective action plan can be generated. If holding times are exceeded and results reported, the resulting data will be flagged, and a discussion of the impact included within the case narrative.

5.5.3 Instrument Calibration

Sample analysis will not be allowed until all initial calibrations, initial calibration verifications, and instrument blanks meet the appropriate requirements. All CCV standards that do not meet method requirements will result in a review of the calibration, rerun of the appropriate calibration standard for the failed analytes, and, if necessary, reanalysis of all samples affected, back to the previous acceptable CCV check, for the target analytes that failed. Continued failure of the CCV will result in the construction of a new initial calibration curve, followed by the reanalysis of all samples affected. If results are reported when a calibration criterion has been exceeded, then all results reported will be flagged, and a discussion of the impact included within the case narrative. Instrument blanks should be implemented as outlined in the prescribed method.

5.5.4 Method QC Samples

Each preparatory batch and analysis sequence must include the appropriate batch and matrix-specific QC samples and standards; that is, MBs, LCSs, MSs, matrix duplicates (MDs), MSDs, surrogate spikes, and other method-specified QC measures. All QC measures will meet the appropriate project-specific measurement quality objectives and associated corrective actions. In the absence of such criteria or actions, the corrective actions as described in the following sections will be required. Failure of method QC will result in the review of all affected data. If no errors can be noted, the affected sample(s) may need to be reanalyzed or reprepared and reanalyzed within method holding times, if possible. All repreparation and reanalysis necessary because of method failure will be performed at no cost to CH2M HILL. If the situation is not corrected and results of the corrective measures reported, the corresponding data will be flagged and a discussion of the impact included within the case narrative. The CH2M HILL PM or appropriate technical personnel will be notified as soon as possible to discuss possible corrective actions should unusually difficult sample matrices be encountered.

MBs

The following criteria will be used to evaluate the acceptability of the MB data if project DQOs do not specify otherwise: 1) the concentration of all target analytes will be below one-half of the method reporting limit (MRL) for each target analyte, or 2) less than 5 percent of the regulatory limit associated with that analyte, or 3) less than 5 percent of the sample result for the same analyte, whichever is greater for the MB to be acceptable. When these criteria are exceeded, corrective action should be taken to find/reduce/eliminate the source of this contamination in the MB. However, sample corrective action may be limited to qualification for blank contamination (that is, B-flag). When the concentrations of any target analytes within the MB are above one-half the MRL for the majority of target analytes or above the MRL for target analytes known to be common laboratory contaminants, the effect this may have had on the samples should be assessed. If an analyte is found only in the MB, but not in any batch samples, no further corrective action may be necessary. Steps will be taken to find/reduce/eliminate the source of this contamination in the MB. The case narrative should also discuss the situation. If an analyte is found in the MB and in some, or all, of the other batch samples, additional corrective action is required to reanalyze the MB and any samples containing the same contaminant. If the contamination remains, the contaminated samples of the batch should be reprepared and reanalyzed with a new MB and batch-specific QC samples. Sporadic cases of contamination may be difficult to control; however, daily contamination would not be acceptable.

LCS

The LCS is evaluated by comparing the percent recovery for all of the target analytes to the recovery measurement quality objectives as determined by project-specific DQOs, or the default ranges established in this guidance. If target analytes are outside the acceptance windows, corrective action is required. Project DQOs will dictate the corrective actions necessary. Initially, the effect the QC failure has on the samples should be evaluated. Regardless of this assessment, steps will be taken to find the source of the problem and correct it. The case narrative will discuss the corrective action taken and any other information. Typically, the LCS would be reanalyzed for the failed analytes only. If the second analysis fails, then the LCS, MB, and all associated samples of the batch would be reprepared and reanalyzed for the failed analytes only. If sufficient sample is not available for repreparation and reanalysis or if the corrective action is ineffective, the sample results reported within that batch will be flagged accordingly, and a discussion of the impact included within the case narrative. When multiple (more than 5) target analytes are reported, the acceptance criteria may allow for the sporadic marginal failure of a few target analytes included within the LCS without requiring reanalysis of the entire batch. For methods that report several (more than 5) target analytes, a small percentage of sporadic marginal failures may be tolerated (that is, will not trigger re-extraction and analysis of the entire batch). The number of target analytes reported for the method will dictate the number of allowable marginal QC failures. Refer to the individual method Attachments for details of this concept as it pertains to each of the methods discussed. The marginal failure allowance entails the application of an expanded acceptance criterion.

MS Samples

The MS is evaluated by comparing the recovery for target analytes to the recovery windows established within project documents, or those established in the Attachments. MS data evaluation is more complex than MB or LCS data evaluation because MSs measure matrix effects in addition to sample preparation and analysis errors. The heterogeneity of soil, grab samples, and sequentially collected water samples further complicates the evaluation because matrix-specific bias assumes that the native concentrations in the duplicate analyses are constant. In addition, concentrations of the target analytes in the sample can also far exceed the spike amounts added, making the resulting recoveries invalid. MSs that fail to meet the appropriate acceptance criteria would indicate that a potential matrix effect is present. If the native concentration of target analytes in the sample chosen for spiking is high relative to the spiking concentration, the differences between the native concentration of the unspiked sample and the spiked samples may not be significant, making the bias measures unrepresentative of the true method and matrix performance. For this reason, if the native concentration is two or more times the spiking level, corrective actions would be based on project DQOs. Regardless, steps should be taken to find the cause of failure and corrective actions taken to remedy it. If possible, the sample should be respiked, as outlined in the following sections, at a higher level (for example, at two to four times the sample concentration), and then reanalyzed based on project-specific requirements. A review of the MSD result, if available, may confirm the matrix effect, if it is the same direction and same order of magnitude. If the native concentration is low and the MS/MSD recoveries confirm matrix interference, the MS/MSD sample/extract should be reanalyzed after employing cleanup procedures (organic analyses) or dilution techniques to minimize matrix interference. If the matrix effect cannot be resolved, the impact on the data should be discussed in the case narrative.

Inorganic analyses. Corrective action for unacceptable MS recoveries for ICP and graphite furnace atomic absorption (GFAA) analyses will include implementation of a post-digestion spike (PDS) from the same sample used to prepare the MS. In this way, information can be obtained to discover whether matrix interference is occurring during the digestion or analytical procedures.

Organic analyses. When multiple (more than 5) target analytes are reported, the acceptance criteria may allow for the sporadic marginal failure of a few target analytes included within the MS without requiring reanalysis. When only a subset of target analytes is included in the MS, only one sporadic marginal failure should be allowed.

MD and MSD Samples

The MSD is evaluated using the same bias criteria as described for the MS. The MD or MSD is evaluated by comparing the precision for all target analytes to the windows as determined by project-specific DQOs, or as stated herein. These criteria should be applied only to concentrations of target analytes that are above the MDL of each analyte. MDs or MSDs that fail to meet the appropriate acceptance criteria would indicate that a potential matrix effect is present. Corrective actions will be performed as described for the MS.

Surrogates

A surrogate is evaluated by comparing its recovery in each sample to the windows as determined by project-specific DQOs, or as stated within the Attachments. Surrogate spikes in matrix-specific samples that fail to meet the appropriate acceptance criteria would indicate that a potential matrix effect is present. If significant non-target interference occurs, corrective action will include implementing additional cleanup procedures and reanalyses. If this does not reduce the interference, the impact on the data should be discussed in the case narrative. Recommendations to Army Environmental Command (AEC) and USACE may include method modifications, such as repreparation and reanalysis with smaller sample aliquots to reduce the effects of the matrix. The consequences to detection limits must also be considered in this instance. Surrogate failures in MBs or LCSs are indicative of a general method failure and should be thoroughly investigated.

PDS Samples

Default recovery CLs for the PDS samples are noted in the Attachments. Similar to the MS, if historic data or information on native sample concentrations is available, the MS or PDS should be spiked at a concentration at least twice the native sample concentration for the following evaluation to be considered valid. Professional judgment should be used to identify the corrective action necessary when the MS recovery for an analyte fails but the PDS recovery passes. For instance, when the MS recovery fails because it falls below the lower control limit but the PDS recovery passes, confirmatory redigestion and reanalysis may not be required if allowed by project DQOs. When both the MS and PDS indicate matrix interference is present, the laboratory must attempt to correct for the interference by the use of standard additions, an internal standard technique for ICP (for example, with yttrium), a different matrix modifier for GFAA, or different digestion or analytical procedures to achieve a representative result, before qualifying the sample for matrix interference. This does not apply to sporadic failures but rather to target analytes exhibiting out-of-control recoveries on consecutive batches. Also, verify overall batch control for the analysis by evaluation of the LCS.

Calculation Errors

Reports will be reissued if calculation or reporting errors are noted with any given data package. The case narrative will clearly state the reason(s) for re-issuance of the report.

5.6 Field Screening and Analysis Method Descriptions

5.6.1 USEPA Method 6200 – Field Portable X-Ray Fluorescence Spectrometry

An aliquot of the homogenized soil sample will be placed in a laboratory-supplied, polyethylene container, and the surface of the sample will be graded flat, lightly tamped, and covered with a Mylar® screen. Sample cups will be deep enough to maintain a minimum soil thickness of 2 inches between the analyzer window and testing stand. The analyzer window will be held tightly against the Mylar® screen until the testing is complete. The X-ray fluorescence results will be stored in the analyzer and will be written in the field logbook. After screening, each sample will be retained until the field screening task is complete and the laboratory sample set has been selected.

The person taking the measurement should follow the manufacturer's recommended instructions for instrument calibration, operation, and maintenance.

5.7 Analytical Methods for Organics and Inorganics

The RLs and associated QC criteria are provided in the Attachments.

5.7.1 SW846 6010B

SW846 Method 6010B will be used for the determination of metals. SW846 Method 6010B – ICP emission spectrometry determines trace elements. All matrices—excluding filtered groundwater samples but including groundwater, aqueous samples, toxicity characteristic leaching procedure (TCLP) extracts, soils, sludges, sediments, and other solid wastes—require digestion before analysis **(Attachment 8).** Groundwater samples that have been prefiltered and acidified will not need acid digestion.

5.7.2 SW846 7471 – Mercury

SW846 Method 7471 will be used for the determination of mercury. This method uses a chemical reduction to reduce mercury selectively.

5.7.3 SW846 8330A – Explosives

Method 8330A is intended for the trace analysis of explosives residues by high performance liquid chromatography using an ultraviolet detector.

SECTION 6

Data Reduction/Calculation or Data Quality Indicators

The laboratory will perform in-house analytical data reduction and review of chemical analyses under the direction of the laboratory's technical staff, QA officer, and laboratory delivery order manager for each project. These individuals are responsible for evaluating the quality of the data and indicating which, if any, data may be listed as "unacceptable" and/or which should be considered potentially unreliable.

6.1 Precision

The descriptions of the precision indicator and calculations are provided in Section 3.4 of this QAPP. **Attachments 2, 3 and 4** list the laboratories' acceptance criteria.

6.2 Accuracy/Bias

The descriptions of the accuracy indicator and calculations are provided in Section 3.4 of this QAPP. **Attachments 2, 3 and 4** list the laboratories' precision and accuracy limits.

6.3 Detection, Quantitation, and Reporting Limits

The RLs are provided in **Attachments 5, 6, 7 and 8**.

The laboratory will supply analyte-specific QLs, with laboratory-specific MDL studies, as part of its laboratory QA plan.

6.3.1 Detection Limit/Method Detection Limit (DL/MDLs)

The MDL is the minimum amount of an analyte that can be routinely identified using a specific method and instrument measured and reported with 99 percent confidence that the analyte concentration is greater than zero. MDLs are operationally determined as three times the standard deviation of seven replicate spiked samples run according to the complete method. However, the evaluation is routinely completed on reagent grade water. As a result, potentially significant matrix interferences that decrease analyte recoveries are not addressed.

The MDL for each analyte is determined as follows:

$$\text{MDL} = 3.14(s), \text{ where:}$$

s = the standard deviation for each analyte from the seven replicate analyses

3.14 = the one-sided t-statistic at the 99 percent confidence level appropriate for determining the MDL using seven replicates

When the concentration of concern (or project-specific action level) is greater than the MDL, to the extent that the confidence limits of both the MDL and concentration of concern do not overlap, then both “non-detect” and “detect” results can be used with confidence. There will be a possibility of false positives and false negatives if the confidence limits of the MDL and the concentration of concern overlap. When the concentration of concern is sufficiently less than the MDL that the confidence limits do not overlap, there is a strong possibility of false negatives and only “detect” results are useable.

The laboratory will establish MDLs for each method, matrix, and analyte for each instrument the laboratory plans to use for the project. The laboratory will revalidate these MDLs at least once every 12 months. The laboratory will provide the MDL at the beginning of the project. Project-/laboratory-specific MDLs will be included in the project-specific addendum.

Where multiple instruments are used, the MDL used for reporting purposes will represent the least-sensitive instrument.

6.3.2 Limit of Detection (LOD)

The laboratory will utilize a test method that provides an LOD that is appropriate and relevant for the intended use of the data. An LOD is not required for a test method when test results are not reported outside of the calibration range. LODs will be determined by the protocol in the mandated test method or applicable regulation. If the protocol for determining LODs is not specified, the selection of the procedure must reflect instrument limitations and the intended application of the test method. The Method Detection Limit (MDL) is one way to establish a Detection Limit, not a Limit of Detection. For the procedure of LOD determination and verification, please see the QSM.

All results will be reported on a dry-weight basis.

6.3.3 Limit of Quantitation/Method Reporting Limit (LOQs/MRLs)

The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects the LOQ will be set at or above the concentration of the lowest initial calibration standard. The recoveries for all target analytes should be between 70 and 130 percent.

All non-detected results will be reported at the LOQ/MRL values. No numerical results will be reported below the DL; however, for those results falling between the DL and the LOQ, a “J” flag will be applied to the results indicating the variability associated with the result.

The DLs, LODs and LOQs are provided in **Attachments 6 and 7. RLs are provided for the IDW sample in Attachment 8.**

6.4 Completeness

The descriptions of the completeness indicator and calculations are provided in Section 3.4.4 of this QAPP. The completeness goal of this project is that greater than 90 percent of the data are useable.

SECTION 7

Laboratory Operations Documentation

7.1 Sample Management Records

All associated instrument printouts, raw data and logbooks, and reported data packages must be retained by the laboratory for a minimum of 5 years, or as dictated by project requirements (if longer than 5 years). In the event of laboratory closure, all applicable documents must be transferred to USACE.

7.2 Data Reporting Procedures

The chemistry data package should contain enough information to demonstrate that the project DQOs have been fulfilled. In general, one should be able to determine the precision, accuracy, representativeness, completeness, comparability, and sensitivity of the data from information contained in the data package. The amount of information required to demonstrate attainment of DQOs depends upon the acceptable level of uncertainty for the intended data use. In general, the type of data package required will fall into one of three general categories: Screening, Definitive, and Comprehensive.

7.2.1 Screening / Level I – Field Surveys and Screening / Level II - Physical Parameters, and Investigation-derived Waste Analyses

Level I data reporting encompasses field monitoring or screening activities and does not require formal data package deliverables. These activities are focused on easily measured bulk characteristics of a sample such as pH, conductivity, oxidation-reduction potential, and DO. Monitoring results, as well as pertinent data concerning the sampling event, will be documented in the bound field book. Screening/Level II data reporting may be performed for analyses submitted to the laboratories for physical parameter testing, and analyses associated with the characterization of the IRW samples.

Screening data are generated by methods of analysis that tend to be relatively rapid, are performed in the field or submitted to an offsite laboratory, and may require less-rigorous sample preparation. Screening data provide analyte identification but may tend to report false positives. Their ability to quantify analytes is in general less precise and less accurate than "definitive" type methods (see next section). The contents of the screening data package will depend on the screening method used. A typical screening data package will include the following:

- Sample identification number
- Preparation method
- Determinative method
- Detection limits
- Identity and quantity of analyte(s) present
- Date and time of sample collection
- Date of sample analysis

- Field equipment calibration

More-sophisticated field screening methods will involve QC samples such as duplicate samples, calibration standards, spiked samples, or blank samples. Results for these associated QC samples should also be included in the screening data package.

7.2.2 Definitive / Level III Data Package

The definitive data package format allows for the review of the data by an independent organization. However, this data package does not allow for complete independent reconstruction of the analytical data. Definitive data are produced using rigorous analytical methods, such as USEPA standard reference methods (for example, SW-846, Contract Laboratory Program). Analyte presence and quantitation are confirmed through extensive QC procedures at the laboratory, which may be onsite or offsite. As discussed in more detail in the following sections, the definitive data package should include a cover sheet, table of contents, case narrative, the analytical results, laboratory RLs, sample management records, and internal laboratory QA/QC information. The laboratory data package should be organized such that the analytical results are reported on a per-batch basis unless otherwise specified.

Cover Sheet

The cover sheet should specify the following information:

- Title of report (that is, Test Report, Test Certificate)
- Name and location of laboratory (to include a point of contact, phone and facsimile numbers)
- Name and location of any subcontractor laboratories, and appropriate test method performed
- Contract number
- Client name and address
- Project name and site location
- Statement of data authenticity and official signature and title of person authorizing report release
- Amendments to previously released reports, clearly identifying the serial number for the previous report and the reason(s) for reissuance of the report

Table of Contents

Laboratory data packages should be organized in a format that allows for easy identification and retrieval of information. An index or table of contents should be included for this purpose.

Case Narrative

A case narrative should be included in each report. The case narrative should contain a table(s) summarizing samples received, providing a correlation between field sample numbers and laboratory sample numbers, and identifying which analytical test methods were performed and by which laboratories. Samples that were received but not analyzed should also be identified. Extractions or analyses that are performed out of holding times should be appropriately noted. The case narrative should define all data qualifiers or flags used. Deviations of any calibration standards or QC sample results from appropriate acceptance limits should be noted, and associated corrective actions taken by the laboratory should be discussed. Any other factors that could affect the sample results (for example, air bubbles in VOC sample vials, excess headspace in soil VOC containers, the presence of multiple phases, sample temperature and sample pH excursions, container type or volume, and others) should be noted as well.

Analytical Results

The results for each sample should contain the following information at a minimum:

- Laboratory name and location (city and state)
- Project name and unique ID number
- Field sample ID number as written on custody form
- Laboratory sample ID number
- Matrix (soil, water, oil, and others)
- Sample description
- Sample preservation or condition at receipt
- Date sample collected
- Date sample received
- Date sample extracted or prepared
- Date sample analyzed
- Analysis time when holding time limit <48 hours
- Method (and SOP) numbers for all preparation, cleanup, and analysis procedures employed
- Preparation, analysis, and other batch numbers
- Analyte or parameter
- Method RLs adjusted for sample-specific factors (for example, aliquot size, dilution/concentration factors, moisture content)
- Method QLs (low-level standard concentration)
- MDLs
- Analytical results with correct number of significant figures
- All confirmation data

- Any data qualifiers assigned
- Concentration units
- Dilution factors. All reported data will reflect any dilutions or concentrations. The dilution factor, if applicable, should be noted on the analytical report. If undiluted and/or diluted results are available, data from all runs should be recorded and reported.
- Percent moisture or percent solids (all soils, sediments, sludges, etc. are to be reported on a dry weight basis)
- Chromatograms, as needed
- Sample aliquot analyzed
- Final extract volume

Laboratory RLs

The laboratory may use an RL expressed in terms of detection limit, QL, regulatory action level, or project-specific threshold limits. However, the laboratory's use of these terms must be well-defined.

Sample Management Records

These types of records include the documentation accompanying the samples (that is, original COC record, shipping documents, laboratory notification sheets), records generated by the laboratory that detail the condition of the samples upon receipt at the laboratory (that is, sample cooler receipt forms, any telephone conversation records, etc.), and any records generated to document sample custody, transfer, analysis, and disposal.

QA/QC Information

The minimum data package must include the calibration, calibration verification, and internal laboratory QA/QC data with their respective acceptance criteria. The data package should also include the laboratory's method quantitation and RLs for project-specific parameters. The calibration data will include a summary of the initial calibration verification, all calibration verification standards, and any performance standards analyzed in conjunction with the test method. All calibration deviations will be discussed within the case narrative. The data package should correlate the method QC data with the corresponding environmental samples on a per-preparation batch basis, with batch numbers clearly shown. Method QC data must include all spike target concentration levels; the measured spike concentration and calculated recoveries; all measures of precision, including relative percent difference; and all CLs for bias and precision. This would include laboratory performance information such as results for MBs, recoveries for LCSs, and recoveries for QC sample surrogates; and matrix-specific information such as MD RPDs, MS and MSD recoveries, MS/MSD RPDs, field sample surrogate recoveries, spike duplicates (SD), and PDS duplicates, etc. At a minimum, internal QC samples should be analyzed and reported at rates specified in the specific methods, within USACE guidance, or as specified in the contract, whichever is greater. Any deviations from the measurement quality objectives should be noted. Any data review, nonconformance, or corrective action forms should be included in the data package as well.

7.2.3 Comprehensive Data Package

A comprehensive/Level IV data package contains sufficient information to completely reconstruct the chemical analyses that were performed. This means that comprehensive data packages include all batch QC results, instrument QC results (for example, initial calibration verification, CCV, and instrument performance checks), MDL studies, and raw data (for example, run logs, sample preparation logs, standard preparation logs, and printed instrumental output such as chromatograms). Typically, comprehensive data packages are required if third-party data validation is to be performed. The data validation guidelines for performance-based methods established in other USACE guidance on data review and data validation, USEPA national functional guidelines, USEPA regional functional guidelines, and project-specific guidelines for validation may all have distinct reporting formats**. The laboratory's QC limits must be equal to or within the established criteria of U.S. Department of Defense QSM 4.1.**

7.2.4 Data Package Deliverables

The various data QC packages are described in the previous section. The data submitted for this project will be Definitive / Level III.

In addition, the laboratory must have the capability of providing the data package on compact disc (CD) in a scanned PDF format. At this time, it is anticipated that the laboratory will provide one hardcopy data package and one CD to the PC, and one CD to the CH2M HILL PM.

7.2.5 Electronic Deliverables

The project data manager will be responsible for uploading sample collection data into the database. Data received from analytical labs in electronic data deliverable (EDD) format will be checked for completeness by comparing them to the sample collection form before appending them directly into the database, and will be considered preliminary until validated. One EDD will be generated by the laboratory(s) per each sample delivery group (SDG). The EDD specifications are provided in **Attachment 9**. After validation the data is considered final and is transferred to CH2M HILL SQL Server Data warehouse.

CH2M HILL will provide an electronic deliverable submission in the Environmental Restoration Information System (ERIS) format. ERIS is a web based data management system designed to accommodate analytical and geographical data collected at Fort Rucker sites. Specific codes and data forms have been developed to allow consistent and efficient input of information to the system. CH2M HILL will provide the database information via TEXT (*.txt) files specific to ERIS file structure. The information transferred will include all required chemical analysis results and sample location information. Where applicable information such as; well characteristics; and hydrogeologic, geologic, physical, information will also be uploaded.

7.2.6 Laboratory Turnaround Time

The requested turnaround time for the majority of the definitive data will be 21 days from the time of sample receipt at the laboratory. The laboratory will be notified if there are any fast turnaround requirements.

7.2.7 Data Archival/Retention Requirements

All reported data packages must be retained by the laboratory for a minimum of 5 years, or as dictated by project requirements (if longer than 5 years).

SECTION 8

Data Assessment Procedures

8.1 Data QC Review

All analytical data generated by the laboratory will be reviewed extensively before report release to ensure its validity. This internal data evaluation process will cover the areas of data generation, reduction, and a minimum of three levels of documented review. For each level, the review process will be documented using an appropriate checklist that is signed and dated by the reviewer. The analyst who generates the analytical data has the prime responsibility for the correctness and completeness of the data. Each step of this review process involves evaluation of data quality based on both the results of the QC data and the professional judgment of those conducting the review. This application of technical knowledge and experience to the data evaluation is essential in ensuring that data of known quality are generated consistently. All data generated and reduced will follow well-documented in-house protocols. The lab will apply the review processes discussed below.

8.1.1 Analyst Review

Each analyst reviews the quality of his/her work based on an established set of guidelines. The review criteria as established in each method or within the laboratory will be used. This review will, at a minimum, ensure the following:

- Sample preparation information is correct and complete.
- Analysis information is correct and complete.
- The appropriate SOPs have been followed.
- Analytical results are correct and complete.
- Raw data, including all manual integrations, have been correctly interpreted.
- QC samples are within established QC CLs.
- Special sample preparation and analytical requirements have been met.
- Data transfers were verified.
- Documentation is complete (for example, all anomalies in the preparation and analysis have been documented; anomaly forms are complete; holding times are documented; etc.) Level I analyst review will be documented by using a checklist and by the signature of the reviewer and date.

8.1.2 Peer Review

Peer reviews will be performed by a supervisor, another analyst, or data review specialist whose performance for all areas for which he/she provides review has been documented. The function of this review is to provide an independent, complete peer review of the analytical batch data package. This review will also be conducted according to an established set of guidelines and is structured to ensure the following:

- All appropriate laboratory SOPs have been referenced.
- Calibration data are scientifically sound, appropriate to the method, and completely documented.
- QC samples are within established guidelines.
- Qualitative identification of sample components is correct.
- Quantitative results, including calculations and any associated flags, are correct.
- Raw data, including manual integrations, have been correctly interpreted.
- Documentation is complete and correct (for example, anomalies in the preparation and analysis have been documented; nonconformance forms are complete; holding times are documented; etc.).
- The data are ready for incorporation into the final report.

Peer reviews will be structured so that all calibration data and QC sample results are reviewed and all of the analytical results are checked back to the raw data or bench sheets. If no problems are found with the data package, the review is complete. If any problems are found with the data package, then all sample results will be returned to the analyst and rechecked. All errors and corrections noted will be documented. Peer reviews will also be documented on a checklist with the signature of the reviewer and date.

8.1.3 Administrative Review

Administrative reviews are performed by the project administrator or designee at the laboratory. This review will provide a total overview of the data package, including sample receipt, to ensure its consistency and compliance with project-specific requirements. All errors noted will be corrected and documented. Based on the errors noted, samples may need to be reprepared and reanalyzed. Administrative reviews will also be documented on a checklist with the signature of the reviewer and date.

8.1.4 QA Review

QA review is performed by the laboratory QA officer. This review is not part of the normal production data review process. The QA officer would typically review at least 10 percent of the data produced by the laboratory using the procedures outlined in the QA data reviews. Additional technical details should be reviewed in this QA review, similar to analyst and peer reviews, along with a total package review—that is, correlation of results from differing but related chemical parameters. The data packages reviewed would be randomly selected by the QA officer. Nonconformance reports would be required for any errors noted.

8.2 Data Verification, Validation and Usability

This subsection discusses the QA activities that occur after the data collection has been completed. Implementation of these elements, which include data verification, validation, and reconciliation to DQOs, will determine the extent to which the data conform to the specified criteria and satisfy the project objectives.

Data verification and validation are processes whereby data generated in support of this project are reviewed against the QA/QC requirements. The data are evaluated for precision, accuracy, and completeness against the analytical protocol requirements. Non-conformances or deficiencies that could affect the usability of data are identified as noted. The types of data that will be validated are described further in the following subsections.

All analytical data will be supported by a data package as defined in previous sections. The data package will contain the supporting QC data for the associated field. Before the laboratory releases each data package, the laboratory quality assurance manager (or the analytical section supervisor) must carefully review the sample and laboratory performance QC data to verify sample identity, the completeness and accuracy of the sample and QC data, and compliance with method specifications.

8.2.1 Data Verification

Before the analytical results are released by the laboratory, both the sample and QC data will be reviewed carefully to verify sample identity, instrument calibration, detection limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. Additionally, the QC data will be reduced and spike recoveries will be included in control charts, and the resulting data will be reviewed to ascertain whether they are within the laboratory-defined limits for accuracy and precision. Any non-conforming data will be discussed in the data package cover letter and case narrative. The laboratory will retain all of the analytical and QC documentation associated with each data package.

The data are also verified to assess whether the EDDs and the hard-copy data deliverables are consistent with one another to ensure an accurate database.

8.2.2 Data Validation

Data validation is at times based on professional judgment. To achieve consistent data validation, worksheets will be completed for each data validation effort. A data validation worksheet is a summary form on which the data validator records data validation notes and conclusions specific to each analytical method. The worksheets will help the validator track and summarize the overall quality of the data. Sample resuts will then be assigned a degree of usability based upon the overall data quality.

One hundred percent of the laboratory data reporting packages will be validated.

The data package will be validated by the PC using QC criteria established in this QAPP or in the analytical method and using a process analogous to that outlined in the following guidance documents:

- EM 200-1-3, Requirements for the Preparation of Sampling and Analysis Plans, February 1, 2001
- EM 200-1-6, Chemical Quality Assurance for HTRW Projects, October 10, 1997
- Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2002)

- Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, 1999)

The data review and validation process is independent of the laboratory's checks; it focuses on the usability of the data to support the project data interpretation and decision making process.

Sample results that do not meet the acceptance limit criteria will be indicated with a qualifying flag, which is a one- or two-letter abbreviation that indicates a possible problem with the data. Flags used in the text may include the following:

U	Undetected. Samples were analyzed for this analyte, but it was not detected above the MDL or instrument detection limit.
UJ	Detection limit estimated. Samples were analyzed for this analyte, but the results were qualified as not detected. The result is estimated.
J	Estimated. The analyte was present, but the reported value may not be accurate or precise.
R	Rejected. The data are unusable. (Note: Analyte/compound may or may not be present.)
X	Data are excluded due to a more-accurate result, such as a rerun selected where the original analysis was above the linear range.

It is important to note that laboratory qualifying flags are included on the data summary forms (Form I) that are submitted to the project by the laboratory. However, during the data review and validation process, the laboratory qualifying flags are evaluated and replaced with the project-specific validation flags.

8.2.3 DQE Process

The PC or designee will perform the DQE. The DQE process is used to assess the effect of the overall analytical process on the usability of the data. The two major categories of data evaluation are laboratory performance and matrix interferences. Evaluation of laboratory performance is a check for compliance with the method requirements. It is a straightforward examination—either the laboratory did, or did not, analyze the samples within the limits of the analytical method. Evaluation of the matrix interferences is more subtle and involves analysis of several results, including surrogate spike recoveries, MS recoveries, and duplicate sample results. The project team will evaluate the data validation results. This evaluation will assess how the data, as qualified by the data validation, can be used on the project.

Once each of the data packages has been validated, and the data validation worksheets completed, then the entire data set will be evaluated for overall trends in data quality and usability. Information summarized as part of the DQE may include chemical compound frequencies of detection, dilution factors that might affect data usability, and patterns of target compound distribution. The data set also will be evaluated to identify potential data limitations or uncertainties in the laboratory.

8.3 Reconciliation with DQOs

The final activity of the data evaluation process is to assess whether these data meet the planned DQOs for the project. The final results, as adjusted for the findings of any data validation and data evaluation, will be checked against the DQOs, and an assessment will be made as to whether the data are of sufficient quality to support the DQOs. The decision as to data sufficiency may be affected by the overall precision, accuracy, and completeness of the data, as demonstrated by the data validation process.

8.4 Project Completeness Assessment

The main project objective should be met when the 90 percent completeness goal is obtained after all of the data have undergone sufficient data validation. If the data, after validation and evaluation, are sufficient to achieve project objectives, the data quality and project managers will release the data and work may proceed.

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Attachments

ATTACHMENT 1:

DoD Environmental Laboratory Accreditation Program Certification: Empirical Laboratories

LABORATORY
ACCREDITATION
BUREAU

Certificate of Accreditation

ISO/IEC 17025:2005 ***Certificate Number L2226***

Empirical Laboratories, LLC

621 Mainstream Drive, Suite 270
Nashville, TN 37228

has met the requirements set forth in L-A-B's policies and procedures, all requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the U.S. Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP).*

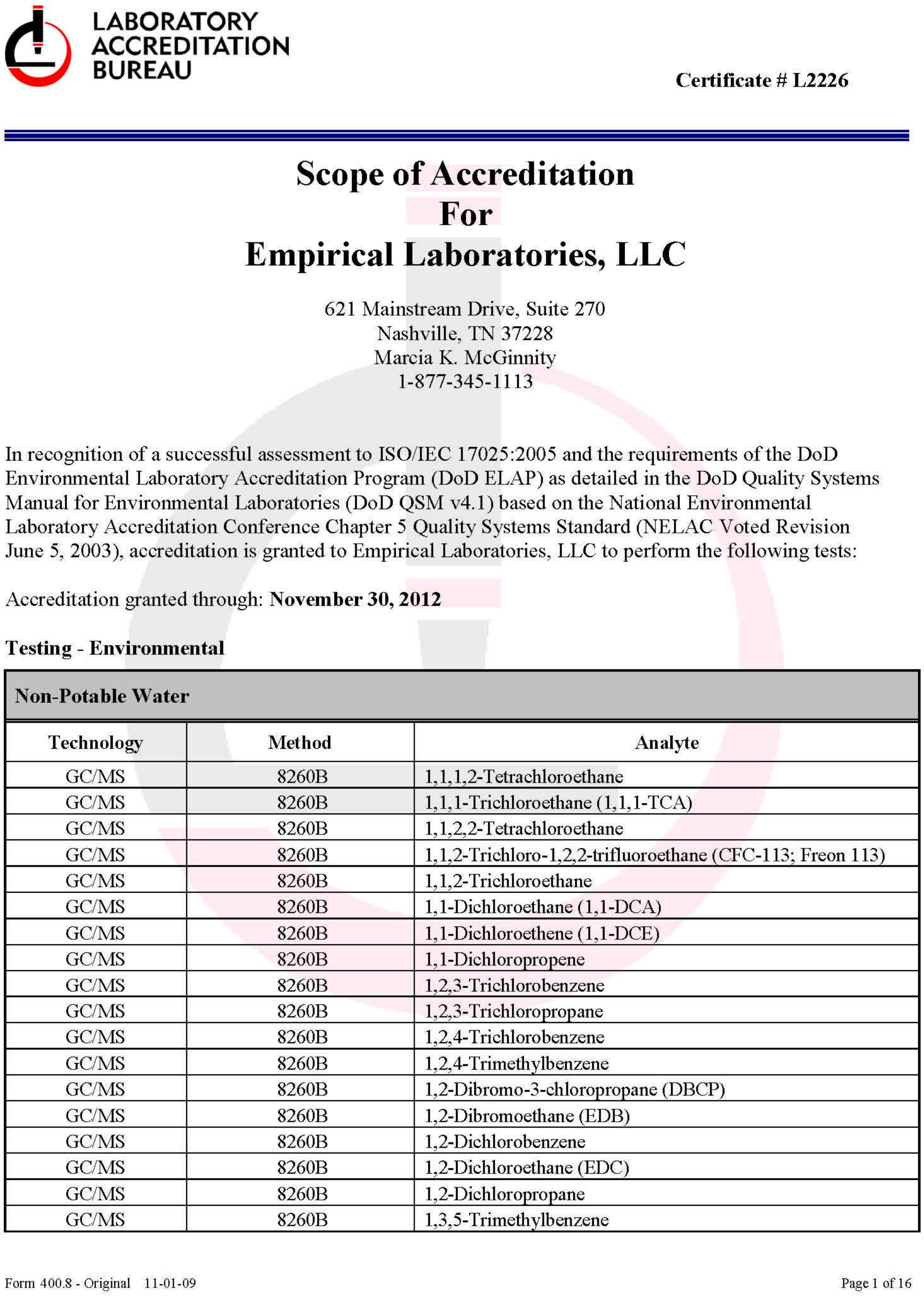
The accredited lab has demonstrated technical competence to a defined "Scope of Accreditation" and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Accreditation Granted through: November 30, 2012

R. Douglas Leonard, Jr., Managing Director
Laboratory Accreditation Bureau
Presented the 30th of November 2009

*See the laboratory's Scope of Accreditation for details of the DoD ELAP requirements

Laboratory Accreditation Bureau is found to be in compliance with ISO/IEC 17011: 2004 and recognized by ILAC (International Laboratory Accreditation Cooperation) and NACLA (National Cooperation for Laboratory Accreditation).



LABORATORY ACCREDITATION BUREAU

Certificate # L2226

Scope of Accreditation For Empirical Laboratories, LLC

621 Mainstream Drive, Suite 270
Nashville, TN 37228
Marcia K. McGinnity
1-877-345-1113

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to Empirical Laboratories, LLC to perform the following tests:

Accreditation granted through: **November 30, 2012**

Testing - Environmental

Non-Potable Water

Technology	Method	Analyte
GC/MS	8260B	1,1,1,2-Tetrachloroethane
GC/MS	8260B	1,1,1-Trichloroethane (1,1,1-TCA)
GC/MS	8260B	1,1,2,2-Tetrachloroethane
GC/MS	8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)
GC/MS	8260B	1,1,2-Trichloroethane
GC/MS	8260B	1,1-Dichloroethane (1,1-DCA)
GC/MS	8260B	1,1-Dichloroethene (1,1-DCE)
GC/MS	8260B	1,1-Dichloropropene
GC/MS	8260B	1,2,3-Trichlorobenzene
GC/MS	8260B	1,2,3-Trichloropropane
GC/MS	8260B	1,2,4-Trichlorobenzene
GC/MS	8260B	1,2,4-Trimethylbenzene
GC/MS	8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	8260B	1,2-Dibromoethane (EDB)
GC/MS	8260B	1,2-Dichlorobenzene
GC/MS	8260B	1,2-Dichloroethane (EDC)
GC/MS	8260B	1,2-Dichloropropane
GC/MS	8260B	1,3,5-Trimethylbenzene

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Non-Potable Water

Technology	Method	Analyte
GC/MS	8260B	1,3-Dichlorobenzene
GC/MS	8260B	1,3-Dichloropropane
GC/MS	8260B	1,4-Dichlorobenzene
GC/MS	8260B	1-Chlorohexane
GC/MS	8260B	2,2-Dichloropropane
GC/MS	8260B	2-Butanone (Methyl ethyl ketone; MEK)
GC/MS	8260B	2-Chloroethyl vinyl ether
GC/MS	8260B	2-Chlorotoluene
GC/MS	8260B	2-Hexanone (Methyl butyl ketone; MBK)
GC/MS	8260B	4-Chlorotoluene
GC/MS	8260B	4-Methyl-2-pentanone (Methyl isobutyl ketone; MIBK)
GC/MS	8260B	Acetone
GC/MS	8260B	Acrolein
GC/MS	8260B	Acrylonitrile
GC/MS	8260B	Benzene
GC/MS	8260B	Bromobenzene
GC/MS	8260B	Bromochloromethane
GC/MS	8260B	Bromodichloromethane
GC/MS	8260B	Bromoform
GC/MS	8260B	Bromomethane
GC/MS	8260B	Carbon Disulfide
GC/MS	8260B	Carbon Tetrachloride
GC/MS	8260B	Chlorobenzene
GC/MS	8260B	Chloroethane
GC/MS	8260B	Chloroform
GC/MS	8260B	Chloromethane
GC/MS	8260B	cis-1,2-Dichloroethene (cis-1,2-DCE)
GC/MS	8260B	cis-1,3-Dichloropropene
GC/MS	8260B	Cyclohexane
GC/MS	8260B	Dibromochloromethane
GC/MS	8260B	Dibromomethane
GC/MS	8260B	Dichlorodifluoromethane (CFC-12)
GC/MS	8260B	Di-isopropyl ether
GC/MS	8260B	ETBE
GC/MS	8260B	Ethyl methacrylate
GC/MS	8260B	Ethylbenzene
GC/MS	8260B	Hexachlorobutadiene
GC/MS	8260B	Iodomethane
GC/MS	8260B	Isopropylbenzene (Cumene)

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Certificate # L2226

Non-Potable Water

Technology	Method	Analyte
GC/MS	8260B	Methyl Acetate
GC/MS	8260B	Methyl methacrylate
GC/MS	8260B	Methyl Tertiary Butyl Ether (MTBE)
GC/MS	8260B	Methylcyclohexane
GC/MS	8260B	Methylene Chloride, or Dichloromethane
GC/MS	8260B	Naphthalene
GC/MS	8260B	n-Butylbenzene
GC/MS	8260B	n-Propylbenzene
GC/MS	8260B	p-Isopropyltoluene
GC/MS	8260B	sec-Butylbenzene
GC/MS	8260B	Styrene
GC/MS	8260B	t-Butyl alcohol
GC/MS	8260B	tert-Amyl methyl ether
GC/MS	8260B	tert-Butylbenzene
GC/MS	8260B	Tetrachloroethene (PCE; PERC)
GC/MS	8260B	Tetrahydrofuran
GC/MS	8260B	Toluene
GC/MS	8260B	trans-1,2-Dichloroethene (trans-1,2-DCE)
GC/MS	8260B	trans-1,3-Dichloropropene
GC/MS	8260B	Trichloroethene (TCE)
GC/MS	8260B	Trichlorofluoromethane (CFC-11)
GC/MS	8260B	Vinyl acetate
GC/MS	8260B	Vinyl Chloride (VC)
GC/MS	8260B	Xylenes (Total)
GC/MS	8270C/D	1,1'-Biphenyl
GC/MS	8270C/D	1,2,4,5-Tetrachlorobenzene
GC/MS	8270C/D	1,2,4-Trichlorobenzene
GC/MS	8270C/D	1,2-Dichlorobenzene
GC/MS	8270C/D	1,2-Diphenylhydrazine
GC/MS	8270C/D	1,3-Dichlorobenzene
GC/MS	8270C/D	1,4-Dichlorobenzene
GC/MS	8270C/D	1,4-Dioxane
GC/MS	8270C/D	1-Methylnaphthalene
GC/MS	8270C/D	2,3,4,6-Tetrachlorophenol
GC/MS	8270C/D	2,4,5-Trichlorophenol
GC/MS	8270C/D	2,4,6-Trichlorophenol (TCP)
GC/MS	8270C/D	2,4-Dichlorophenol (DCP)
GC/MS	8270C/D	2,4-Dimethylphenol
GC/MS	8270C/D	2,4-Dinitrophenol

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Non-Potable Water

Technology	Method	Analyte
GC/MS	8270C/D	2,4-Dinitrotoluene (DNT)
GC/MS	8270C/D	2,6-Dichlorophenol
GC/MS	8270C/D	2,6-Dinitrotoluene
GC/MS	8270C/D	2-Chloronaphthalene
GC/MS	8270C/D	2-Chlorophenol
GC/MS	8270C/D	2-Methylnaphthalene
GC/MS	8270C/D	2-Methylphenol (o-Cresol)
GC/MS	8270C/D	2-Nitroaniline
GC/MS	8270C/D	2-Nitrophenol (ONP)
GC/MS	8270C/D	3,3'-Dichlorobenzidine (DCB)
GC/MS	8270C/D	3-Methylphenol
GC/MS	8270C/D	3-Nitroaniline
GC/MS	8270C/D	4,6-Dinitro-2-methylphenol (DNOC)
GC/MS	8270C/D	4-Bromophenyl phenyl ether
GC/MS	8270C/D	4-Chloro-3-methylphenol
GC/MS	8270C/D	4-Chloroaniline
GC/MS	8270C/D	4-Chlorophenyl phenyl ether
GC/MS	8270C/D	4-Methylphenol (p-Cresol)
GC/MS	8270C/D	4-Nitroaniline (PNA)
GC/MS	8270C/D	4-Nitrophenol (PNP)
GC/MS	8270C/D	7,12-Dimethylbenz(a)anthracene
GC/MS	8270C/D	Acenaphthene
GC/MS	8270C/D	Acenaphthylene
GC/MS	8270C/D	Acetaphenone
GC/MS	8270C/D	Aniline
GC/MS	8270C/D	Anthracene
GC/MS	8270C/D	Atrazine
GC/MS	8270C/D	Benzaldehyde
GC/MS	8270C/D	Benzidine
GC/MS	8270C/D	Benzo(a)anthracene
GC/MS	8270C/D	Benzo(a)pyrene
GC/MS	8270C/D	Benzo(b)fluoranthene
GC/MS	8270C/D	Benzo(g,h,i)perylene
GC/MS	8270C/D	Benzo(k)fluoranthene
GC/MS	8270C/D	Benzoic Acid
GC/MS	8270C/D	Benzyl alcohol
GC/MS	8270C/D	bis(2-Chloroethoxy)methane
GC/MS	8270C/D	bis(2-Chloroethyl)ether (BCEE)
GC/MS	8270C/D	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)

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Non-Potable Water

Technology	Method	Analyte
GC/MS	8270C/D	bis(2-Ethylhexyl)phthalate (BEHP)
GC/MS	8270C/D	Butyl benzyl phthalate (BBP)
GC/MS	8270C/D	Caprolactam
GC/MS	8270C/D	Carbazole
GC/MS	8270C/D	Chrysene
GC/MS	8270C/D	Dibenz(a,h)anthracene
GC/MS	8270C/D	Dibenzofuran (DBF)
GC/MS	8270C/D	Diethyl phthalate (DEP)
GC/MS	8270C/D	Dimethyl phthalate (DMP)
GC/MS	8270C/D	Di-n-butyl phthalate (DBP)
GC/MS	8270C/D	Di-n-octyl phthalate (DNOP)
GC/MS	8270C/D	Fluoranthene
GC/MS	8270C/D	Fluorene
GC/MS	8270C/D	Hexachlorobenzene (HCB)
GC/MS	8270C/D	Hexachlorobutadiene (HCBD)
GC/MS	8270C/D	Hexachlorocyclopentadiene (HCCPD)
GC/MS	8270C/D	Hexachloroethane (HCE)
GC/MS	8270C/D	Indeno(1,2,3-cd)pyrene
GC/MS	8270C/D	Isophorone
GC/MS	8270C/D	Naphthalene
GC/MS	8270C/D	Nitrobenzene
GC/MS	8270C/D	N-Nitrosodimethylamine
GC/MS	8270C/D	N-Nitroso-di-n-propylamine (NDPA)
GC/MS	8270C/D	N-nitrosodiphenylamine (NDPHA)
GC/MS	8270C/D	Pentachlorophenol
GC/MS	8270C/D	Phenanthrene
GC/MS	8270C/D	Phenol
GC/MS	8270C/D	Pyrene
GC/MS	8270C/D	Pyridine
GC/ECD	8081A/B	4,4'-DDD
GC/ECD	8081A/B	4,4'-DDE
GC/ECD	8081A/B	4,4'-DDT
GC/ECD	8081A/B	Aldrin
GC/ECD	8081A/B	alpha-BHC (alpha-HCH)
GC/ECD	8081A/B	alpha-Chlordane
GC/ECD	8081A/B	beta-BHC (beta-HCH)
GC/ECD	8081A/B	delta-BHC (delta-HCH)
GC/ECD	8081A/B	Dieldrin
GC/ECD	8081A/B	Endosulfan I

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Non-Potable Water

Technology	Method	Analyte
GC/ECD	8081A/B	Endosulfan II
GC/ECD	8081A/B	Endosulfan sulfate
GC/ECD	8081A/B	Endrin
GC/ECD	8081A/B	Endrin aldehyde
GC/ECD	8081A/B	Endrin ketone
GC/ECD	8081A/B	gamma-BHC (Lindane; gamma-HCH)
GC/ECD	8081A/B	gamma-Chlordane
GC/ECD	8081A/B	Heptachlor
GC/ECD	8081A/B	Heptachlor epoxide
GC/ECD	8081A/B	Methoxychlor
GC/ECD	8081A/B	Chlordane
GC/ECD	8081A/B	Toxaphene
GC/ECD	8082 /A	Aroclor-1016
GC/ECD	8082 /A	Aroclor-1221
GC/ECD	8082 /A	Aroclor-1232
GC/ECD	8082 /A	Aroclor-1242
GC/ECD	8082 /A	Aroclor-1248
GC/ECD	8082 /A	Aroclor-1254
GC/ECD	8082 /A	Aroclor-1260
GC/ECD	8151A	2,4,5-T
GC/ECD	8151A	2,4,5-TP (Silvex)
GC/ECD	8151A	2,4-D
GC/ECD	8151A	2,4-DB
GC/ECD	8151A	Dalapon
GC/ECD	8151A	Dicamba
GC/ECD	8151A	Dichlorprop
GC/ECD	8151A	Dinoseb
GC/ECD	8151A	MCPA
GC/ECD	8151A	MCPP (Mecoprop)
HPLC/UV	8330A	1,3,5-Trinitrobenzene
HPLC/UV	8330A	1,3-Dinitrobenzene
HPLC/UV	8330A	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	8330A	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	8330A	2,4-Dinitrotoluene (DNT)
HPLC/UV	8330A	2,6-Dinitrotoluene
HPLC/UV	8330A	2-Amino-4,6-dinitrotoluene
HPLC/UV	8330A	2-Nitrotoluene (ONT)
HPLC/UV	8330A	3-Nitrotoluene
HPLC/UV	8330A	4-Amino-2,6-dinitrotoluene

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Non-Potable Water

Technology	Method	Analyte
HPLC/UV	8330A	4-Nitrotoluene (PNT)
HPLC/UV	8330A	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	8330A	Nitrobenzene
HPLC/UV	8330A	Nitroglycerin
HPLC/UV	8330A	Nitroguanidine
HPLC/UV	8330A	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	8330A	3,5-Dinitroaniline
HPLC/UV	8330A	PETN
GC/FID	FLPRO	Petroleum Range Organics
GC/FID	8015B	TPH DRO
GC/FID	8015B	TPH GRO
GC/FID	RSK-175	Methane
GC/FID	RSK-175	Ethane
GC/FID	RSK-175	Ethene
GC/ECD	8011	1,2-Dibromoethane (EDB)
GC/ECD	8011	1,2-Dibromo-3-chloropropane (DBCP)
HPLC/MS	6850	Perchlorate
ICP	6010B/C	Aluminum
ICP	6010B/C	Antimony
ICP	6010B/C	Arsenic
ICP	6010B/C	Barium
ICP	6010B/C	Beryllium
ICP	6010B/C	Cadmium
ICP	6010B/C	Calcium
ICP	6010B/C	Chromium, total
ICP	6010B/C	Cobalt
ICP	6010B/C	Copper
ICP	6010B/C	Iron
ICP	6010B/C	Lead
ICP	6010B/C	Magnesium
ICP	6010B/C	Manganese
CVAA	7470A	Mercury
ICP	6010B/C	Molybdenum
ICP	6010B/C	Nickel
ICP	6010B/C	Potassium
ICP	6010B/C	Selenium
ICP	6010B/C	Silver
ICP	6010B/C	Sodium
ICP	6010B/C	Strontium
ICP	6010B/C	Thallium

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Technology	**Method**	**Analyte**
ICP	6010B/C	Tin
ICP	6010B/C	Titanium
ICP	6010B/C	Vanadium
ICP	6010B/C	Zinc
IC	300.0	Chloride
IC	300.0	Fluoride
IC	300.0	Nitrate
IC	300.0	Nitrite
IC	300.0	Sulfate
IC	9056A	Chloride
IC	9056A	Fluoride
IC	9056A	Nitrate
IC	9056A	Nitrite
IC	9056A	Sulfate
Titration	SM 2320B 20th ed.	Alkalinity
Colorimetric	SM 4500 B, G, $20^{th}/21^{st}$ edition	Ammonia
UV/Vis	7196A	Hexavalent Chromium
Colorimetric	353.2	Nitrocellulose
Colorimetric	353.2	Nitrate/Nitrite
Titration	Chap.7, Sect. 7.3.4 Mod.	Reactive Sulfide
Titration	SM 4500 S-2CF, 20th edition	Sulfide
UV/Vis	SM 4500 P B5, E, 20th edition	Total Phosphorus (as P)
UV/Vis	SM 4500 PE, 20th edition	Ortho-Phosphate (as P)
TOC	9060A/SM5310C, 20^{th} edition	Total Organic Carbon
Gravimetric	SM 2540C, 20th edition	TDS
Colorimetric	9012A/B	Cyanide
Physical	1010A	Ignitability
Physical	9095B	Paint Filter
Probe	9040B/C	pH
Preparation	**Method**	**Type**
Preparation	1311	TCLP
Preparation	3005A	Metals digestion
Preparation	3010A	Metals digestion
Preparation	3510C	Organics Liquid Extraction
Preparation	5030A/B	Purge and Trap Water

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Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	8260B	1,1,1-Trichloroethane (1,1,1-TCA)
GC/MS	8260B	1,1,1,2-Tetrachloroethane
GC/MS	8260B	1,1,2,2-Tetrachloroethane
GC/MS	8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)
GC/MS	8260B	1,1,2-Trichloroethane
GC/MS	8260B	1,1-Dichloroethane (1,1-DCA)
GC/MS	8260B	1,1-Dichloroethene (1,1-DCE)
GC/MS	8260B	1,1-Dichloropropene
GC/MS	8260B	1,2,3-Trichlorobenzene
GC/MS	8260B	1,2,3-Trichloropropane
GC/MS	8260B	1,2,4-Trichlorobenzene
GC/MS	8260B	1,2,4-Trimethylbenzene
GC/MS	8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	8260B	1,2-Dibromoethane (EDB)
GC/MS	8260B	1,2-Dichlorobenzene
GC/MS	8260B	1,2-Dichloroethane (EDC)
GC/MS	8260B	1,2-Dichloropropane
GC/MS	8260B	1,3,5-Trimethylbenzene
GC/MS	8260B	1,3-Dichlorobenzene
GC/MS	8260B	1,3-Dichloropropane
GC/MS	8260B	1,4-Dichlorobenzene
GC/MS	8260B	2,2-Dichloropropane
GC/MS	8260B	2-Butanone (Methyl ethyl ketone; MEK)
GC/MS	8260B	2-Chlorotoluene
GC/MS	8260B	2-Hexanone (Methyl butyl ketone; MBK)
GC/MS	8260B	4-Chlorotoluene
GC/MS	8260B	4-Methyl-2-pentanone (Methyl isobutyl ketone; MIBK)
GC/MS	8260B	Acetone
GC/MS	8260B	Acrolein
GC/MS	8260B	Acrylonitrile
GC/MS	8260B	Benzene
GC/MS	8260B	Bromobenzene
GC/MS	8260B	Bromochloromethane
GC/MS	8260B	Bromodichloromethane
GC/MS	8260B	Bromoform
GC/MS	8260B	Bromomethane
GC/MS	8260B	Carbon Disulfide
GC/MS	8260B	Carbon Tetrachloride
GC/MS	8260B	Chlorobenzene
GC/MS	8260B	Chloroethane

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Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	8260B	Chloroform
GC/MS	8260B	Chloromethane
GC/MS	8260B	cis-1,2-Dichloroethene (cis-1,2-DCE)
GC/MS	8260B	cis-1,3-Dichloropropene
GC/MS	8260B	Cyclohexane
GC/MS	8260B	Dibromochloromethane
GC/MS	8260B	Dibromomethane
GC/MS	8260B	Dichlorodifluoromethane (CFC-12)
GC/MS	8260B	Ethyl methacrylate
GC/MS	8260B	Ethylbenzene
GC/MS	8260B	Hexachlorobutadiene
GC/MS	8260B	Iodomethane
GC/MS	8260B	Isopropylbenzene (Cumene)
GC/MS	8260B	Methyl Acetate
GC/MS	8260B	Methyl methacrylate
GC/MS	8260B	Methyl Tertiary Butyl Ether (MTBE)
GC/MS	8260B	Methylcyclohexane
GC/MS	8260B	Methylene Chloride, or Dichloromethane
GC/MS	8260B	Naphthalene
GC/MS	8260B	n-Butylbenzene
GC/MS	8260B	n-Propylbenzene
GC/MS	8260B	p-Isopropyltoluene
GC/MS	8260B	sec-Butylbenzene
GC/MS	8260B	Styrene
GC/MS	8260B	tert-Butylbenzene
GC/MS	8260B	Tetrachloroethene (PCE; PERC)
GC/MS	8260B	Toluene
GC/MS	8260B	trans-1,2-Dichloroethene (trans-1,2-DCE)
GC/MS	8260B	trans-1,3-Dichloropropene
GC/MS	8260B	Trichloroethene (TCE)
GC/MS	8260B	Trichlorofluoromethane (CFC-11)
GC/MS	8260B	Vinyl acetate
GC/MS	8260B	Vinyl Chloride (VC)
GC/MS	8260B	Xylenes (Total)
GC/MS	8270C/D	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)
GC/MS	8270C/D	1,1'-Biphenyl
GC/MS	8270C/D	1,2,4,5-Tetrachlorobenzene
GC/MS	8270C/D	1,2,4-Trichlorobenzene
GC/MS	8270C/D	1,2-Dichlorobenzene
GC/MS	8270C/D	1,2-Diphenylhydrazine

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Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	8270C/D	1,4-Dioxane
GC/MS	8270C/D	1-Methylnaphthalene
GC/MS	8270C/D	2,3,4,6-Tetrachlorophenol
GC/MS	8270C/D	2,4,5-Trichlorophenol
GC/MS	8270C/D	2,4,6-Trichlorophenol (TCP)
GC/MS	8270C/D	2,4-Dichlorophenol (DCP)
GC/MS	8270C/D	2,4-Dimethylphenol
GC/MS	8270C/D	2,4-Dinitrophenol
GC/MS	8270C/D	2,4-Dinitrotoluene (DNT)
GC/MS	8270C/D	2,6-Dichlorophenol
GC/MS	8270C/D	2,6-Dinitrotoluene
GC/MS	8270C/D	2-Chloronaphthalene
GC/MS	8270C/D	2-Chlorophenol
GC/MS	8270C/D	2-Methylnaphthalene
GC/MS	8270C/D	2-Methylphenol (o-Cresol)
GC/MS	8270C/D	2-Nitroaniline
GC/MS	8270C/D	2-Nitrophenol (ONP)
GC/MS	8270C/D	3,3'-Dichlorobenzidine (DCB)
GC/MS	8270C/D	3-Methylphenol
GC/MS	8270C/D	3-Nitroaniline
GC/MS	8270C/D	4,6-Dinitro-2-methylphenol (DNOC)
GC/MS	8270C/D	4-Bromophenyl phenyl ether
GC/MS	8270C/D	4-Chloro-3-methylphenol
GC/MS	8270C/D	4-Chloroaniline
GC/MS	8270C/D	4-Chlorophenyl phenyl ether
GC/MS	8270C/D	4-Methylphenol (p-Cresol)
GC/MS	8270C/D	4-Nitroaniline (PNA)
GC/MS	8270C/D	4-Nitrophenol (PNP)
GC/MS	8270C/D	Acenaphthene
GC/MS	8270C/D	Acenaphthylene
GC/MS	8270C/D	Acetaphenone
GC/MS	8270C/D	Aniline
GC/MS	8270C/D	Anthracene
GC/MS	8270C/D	Atrazine
GC/MS	8270C/D	Benzaldehyde
GC/MS	8270C/D	Benzidine
GC/MS	8270C/D	Benzo(a)anthracene
GC/MS	8270C/D	Benzo(a)anthracene
GC/MS	8270C/D	Benzo(a)pyrene
GC/MS	8270C/D	Benzo(b)fluoranthene

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Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270C/D	Benzo(g,h,i)perylene
GC/MS	8270C/D	Benzo(k)fluoranthene
GC/MS	8270C/D	Benzoic Acid
GC/MS	8270C/D	Benzyl alcohol
GC/MS	8270C/D	bis(2-Chloroethoxy)methane
GC/MS	8270C/D	bis(2-Chloroethyl)ether (BCEE)
GC/MS	8270C/D	bis(2-Ethylhexyl)phthalate (BEHP)
GC/MS	8270C/D	Butyl benzyl phthalate (BBP)
GC/MS	8270C/D	Caprolactam
GC/MS	8270C/D	Carbazole
GC/MS	8270C/D	Chrysene
GC/MS	8270C/D	Dibenz(a,h)anthracene
GC/MS	8270C/D	Dibenzofuran (DBF)
GC/MS	8270C/D	Diethyl phthalate (DEP)
GC/MS	8270C/D	Dimethyl phthalate (DMP)
GC/MS	8270C/D	Di-n-butyl phthalate (DBP)
GC/MS	8270C/D	Di-n-octyl phthalate (DNOP)
GC/MS	8270C/D	Fluoranthene
GC/MS	8270C/D	Fluorene
GC/MS	8270C/D	Hexachlorobenzene (HCB)
GC/MS	8270C/D	Hexachlorobutadiene (HCBD)
GC/MS	8270C/D	Hexachlorocyclopentadiene (HCCPD)
GC/MS	8270C/D	Hexachloroethane (HCE)
GC/MS	8270C/D	Indeno(1,2,3-cd)pyrene
GC/MS	8270C/D	Isophorone
GC/MS	8270C/D	Naphthalene
GC/MS	8270C/D	Nitrobenzene
GC/MS	8270C/D	N-Nitrosodimethylamine
GC/MS	8270C/D	N-Nitroso-di-n-propylamine (NDPA)
GC/MS	8270C/D	N-nitrosodiphenylamine (NDPHA)
GC/MS	8270C/D	Pentachlorophenol
GC/MS	8270C/D	Phenanthrene
GC/MS	8270C/D	Phenol
GC/MS	8270C/D	Pyrene
GC/MS	8270C/D	Pyridine
GC/ECD	8081A/B	4,4'-DDD
GC/ECD	8081A/B	4,4'-DDE
GC/ECD	8081A/B	4,4'-DDT
GC/ECD	8081A/B	Aldrin
GC/ECD	8081A/B	alpha-BHC (alpha-HCH)

Solid and Chemical Materials

Technology	Method	Analyte
GC/ECD	8081A/B	alpha-Chlordane
GC/ECD	8081A/B	beta-BHC (beta-HCH)
GC/ECD	8081A/B	delta-BHC (delta-HCH)
GC/ECD	8081A/B	Chlordane
GC/ECD	8081A/B	Dieldrin
GC/ECD	8081A/B	Endosulfan I
GC/ECD	8081A/B	Endosulfan sulfate
GC/ECD	8081A/B	Endrin
GC/ECD	8081A/B	Endrin aldehyde
GC/ECD	8081A/B	Endrin ketone
GC/ECD	8081A/B	gamma-BHC (Lindane; gamma-HCH)
GC/ECD	8081A/B	gamma-Chlordane
GC/ECD	8081A/B	Heptachlor
GC/ECD	8081A/B	Heptachlor epoxide
GC/ECD	8081A/B	Methoxychlor
GC/ECD	8081A/B	Toxaphene
GC/ECD	8082 /A	Aroclor-1016
GC/ECD	8082 /A	Aroclor-1221
GC/ECD	8082 /A	Aroclor-1232
GC/ECD	8082 /A	Aroclor-1242
GC/ECD	8082 /A	Aroclor-1248
GC/ECD	8082 /A	Aroclor-1254
GC/ECD	8082 /A	Aroclor-1260
GC/ECD	8151A	2,4,5-T
GC/ECD	8151A	2,4,5-TP (Silvex)
GC/ECD	8151A	2,4-D
GC/ECD	8151A	2,4-DB
GC/ECD	8151A	Dalapon
GC/ECD	8151A	Dicamba
GC/ECD	8151A	Dichlorprop
GC/ECD	8151A	Dinoseb
GC/ECD	8151A	MCPA
GC/ECD	8151A	MCPP (Mecoprop)
HPLC/UV	8330A	1,3,5-Trinitrobenzene
HPLC/UV	8330A	1,3-Dinitrobenzene
HPLC/UV	8330A	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	8330A	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	8330A	2,4-Dinitrotoluene (DNT)
HPLC/UV	8330A	2,6-Dinitrotoluene

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Solid and Chemical Materials

Technology	Method	Analyte
HPLC/UV	8330A	2-Amino-4,6-dinitrotoluene
HPLC/UV	8330A	2-Nitrotoluene (ONT)
HPLC/UV	8330A	3-Nitrotoluene
HPLC/UV	8330A	4-Amino-2,6-dinitrotoluene
HPLC/UV	8330A	4-Nitrotoluene (PNT)
HPLC/UV	8330A	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	8330A	Nitroglycerin
HPLC/UV	8330A	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	8330A	Nitrobenzene
HPLC/UV	8330A	Nitroguanidine
HPLC/UV	8330A	PETN
HPLC/UV	8330B	1,3,5-Trinitrobenzene
HPLC/UV	8330B	1,3-Dinitrobenzene
HPLC/UV	8330B	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	8330B	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	8330B	2,4-Dinitrotoluene (DNT)
HPLC/UV	8330B	2,6-Dinitrotoluene
HPLC/UV	8330B	2-Amino-4,6-dinitrotoluene
HPLC/UV	8330B	2-Nitrotoluene (ONT)
HPLC/UV	8330B	3-Nitrotoluene
HPLC/UV	8330B	3,5-Dinitroaniline
HPLC/UV	8330B	4-Amino-2,6-dinitrotoluene
HPLC/UV	8330B	4-Nitrotoluene (PNT)
HPLC/UV	8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	8330B	Nitroglycerin
HPLC/UV	8330B	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	8330B	Nitrobenzene
HPLC/UV	8330B	Nitroguanidine
HPLC/UV	8330B	PETN
GC/FID	FLPRO	Petroleum Range Organics
GC/FID	8015B	TPH DRO
GC/FID	8015B	TPH GRO
HPLC/MS	6850	Perchlorate
ICP	6010B/C	Aluminum
ICP	6010B/C	Antimony
ICP	6010B/C	Arsenic
ICP	6010B/C	Barium
ICP	6010B/C	Beryllium
ICP	6010B/C	Cadmium

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Solid and Chemical Materials

Technology	Method	Analyte
ICP	6010B/C	Calcium
ICP	6010B/C	Chromium, total
ICP	6010B/C	Cobalt
ICP	6010B/C	Copper
ICP	6010B/C	Iron
ICP	6010B/C	Lead
ICP	6010B/C	Magnesium
ICP	6010B/C	Manganese
CVAA	7471A/B	Mercury
ICP	6010B/C	Molybdenum
ICP	6010B/C	Nickel
ICP	6010B/C	Potassium
ICP	6010B/C	Selenium
ICP	6010B/C	Silver
ICP	6010B/C	Sodium
ICP	6010B/C	Strontium
ICP	6010B/C	Tin
ICP	6010B/C	Titanium
ICP	6010B/C	Thallium
ICP	6010B/C	Vanadium
ICP	6010B/C	Zinc
UV/Vis	7196A	Hexavalent Chromium
TOC	Lloyd Kahn	Total Organic Carbon
Colorimetric	353.2	Nitrocellulose
Colorimetric	9012A/B	Cyanide
Titration	Chap.7, Sect. 7.3.4 Mod.	Reactive Sulfide
Titration	9034	Sulfide
Probe	9045D	pH

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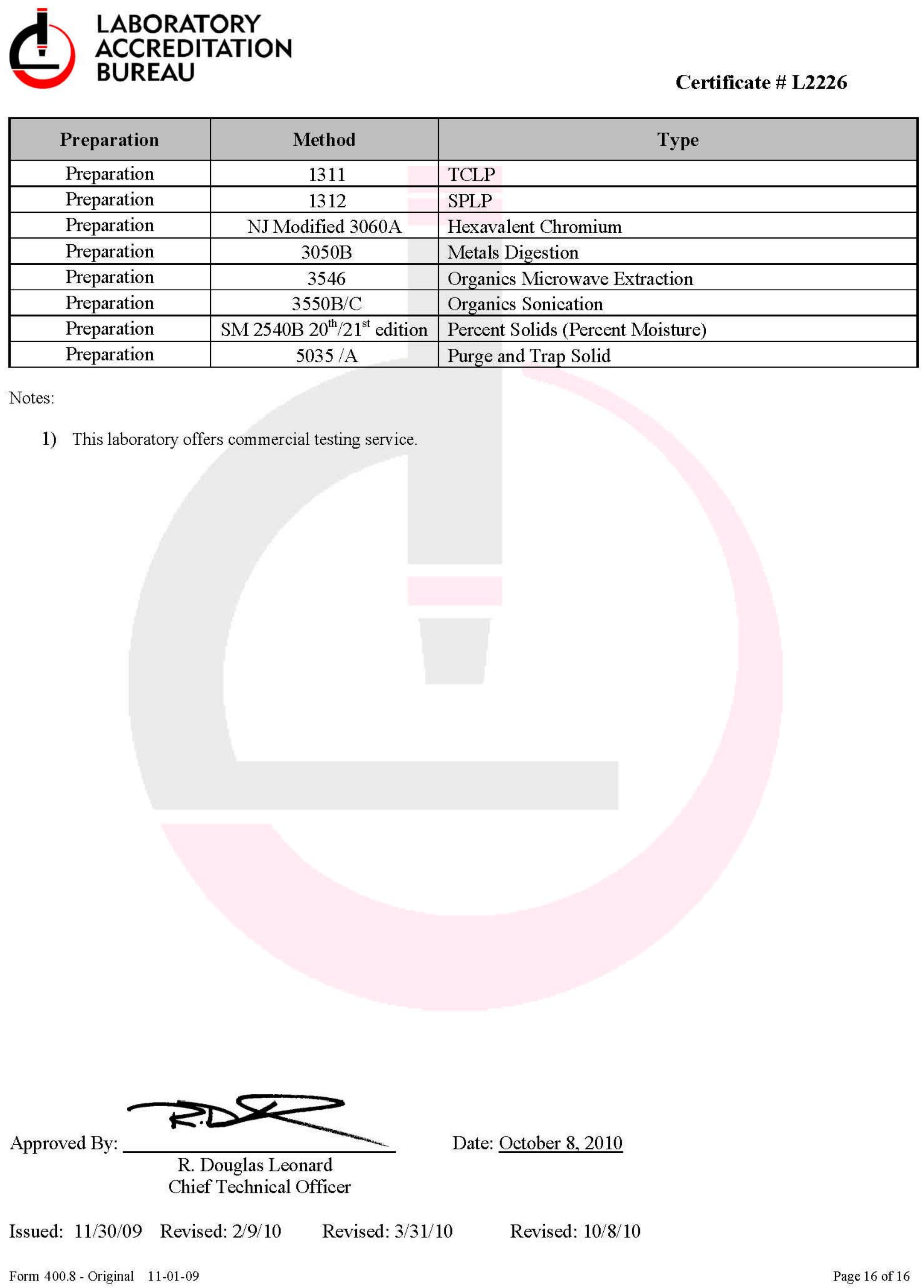

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Preparation	Method	Type
Preparation	1311	TCLP
Preparation	1312	SPLP
Preparation	NJ Modified 3060A	Hexavalent Chromium
Preparation	3050B	Metals Digestion
Preparation	3546	Organics Microwave Extraction
Preparation	3550B/C	Organics Sonication
Preparation	SM 2540B 20th/21st edition	Percent Solids (Percent Moisture)
Preparation	5035 /A	Purge and Trap Solid

Notes:

1) This laboratory offers commercial testing service.

Approved By: ______________________ Date: October 8, 2010

R. Douglas Leonard
Chief Technical Officer

Issued: 11/30/09 Revised: 2/9/10 Revised: 3/31/10 Revised: 10/8/10

ATTACHMENT 2

Precision and Accuracy Limits for USEPA Method 6010B/7000 - Metals

MEC RFI , Fort Rucker, Alabama

Analyte	Method	Limits (%)	RPD(%)
Arsenic	3050A/6010B	80-120	+/-20
Cadmium	3050A/6010B	80-120	+/-20
Chromium	3050A/6010B	80-120	+/-20
Copper	3050A/6010B	80-120	+/-20
Lead	3050A/6010B	80-120	+/-20
Selenium	3050A/6010B	80-120	+/-20
Antimony	3050A/6010B	80-120	+/-20
Zinc	3050A/6010B	80-120	+/-20
Mercury	7470/7471	80-120	+/-20

ATTACHMENT 3

Precision and Accuracy Limits for USEPA Method 8330A – Explosives

MEC RFI, Fort Rucker, Alabama

Analyte	Method	Limits (%)	RPD(%)
1,3,5-Trinitrobenzene	8330A	75-125	+/-30
1,3-Dinitrobenzene	8330A	80-125	+/-30
2,4,6-Trinitrotoluene	8330A	55-140	+/-30
2,4-Dinitrotoluene	8330A	80-125	+/-30
2,6-Dinitrotoluene	8330A	80-120	+/-30
2-Amino-4,6-dinitrotoluene	8330A	80-125	+/-30
2-Nitrotoluene	8330A	80-125	+/-30
3,5-Dinitroaniline	8330A	60-120	+/-30
3-Nitrotoluene	8330A	75-120	+/-30
3-Nitrotoluene/4-Nitrotoluene	8330A	60-120	+/-30
4-Amino-2,6-dinitrotoluene	8330A	80-125	+/-30
4-Nitrotoluene	8330A	75-125	+/-30
HMX	8330A	75-125	+/-30
Nitrobenzene	8330A	75-125	+/-30
Nitroglycerine	8330A	60-120	+/-30
PETN	8330A	60-120	+/-30
RDX	8330A	70-135	+/-30
Tetryl	8330A	10-150	+/-30

ATTACHMENT 4

Precision and Accuracy Limits for TCLP

MEC RFI , Fort Rucker, Alabama

Analyte	Method	Limits (%)	RPD (%)
TCLP VOLATILES			
Benzene	1311/8260B	80-120	+/-30
Butanone, 2- (Methyl ethyl ketone) (MEK)	1311/8260B	30-150	+/-30
Carbon Tetrachloride	1311/8260B	65-140	+/-30
Chlorobenzene	1311/8260B	80-120	+/-30
Chloroform (Trichloromethane) (THM)	1311/8260B	65-135	+/-30
Dichlorobenzene, 1,4 -	1311/8260B	75-125	+/-30
Dichloroethane, 1,2- (EDC)	1311/8260B	70-130	+/-30
Dichloroethene, 1,1-	1311/8260B	70-130	+/-30
Tetrachloroethene (PCE)	1311/8260B	45-150	+/-30
Trichloroethene (TCE)	1311/8260B	70-125	+/-30
Vinyl Chloride	1311/8260B	50-145	+/-30
TCLP SEMIVOLATILES			
Cresol (o, m, p-isomers)	1311/8270C	o 40-110, m & p 30-110	+/-30
Dinitrotoluene, 2,4-	1311/8270C	50-120	+/-30
Hexachlorobenzene	1311/8270C	50-110	+/-30
Hexachlorobutadiene	1311/8270C	25-105	+/-30
Hexachloroethane	1311/8270C	30-95	+/-30
Nitrobenzene	1311/8270C	30-110	+/-30
Pentachlorophenol	1311/8270C	40-115	+/-30
Pyridine	1311/8270C	5-110	+/-30
Trichlorophenol, 2,4,5-	1311/8270C	50-110	+/-30
Trichlorophenol, 2,4,6-	1311/8270C	50-115	+/-30
TCLP ORGANOCHLORINE PESTICIDES			
Chlordane, technical	1311/8081	50-150	+/-30
Endrin	1311/8081	55-135	+/-30
HCH, gamma- (BHC, gamma-) (Lindane)	1311/8081	75-125	+/-30
Heptachlor (and epoxide)	1311/8081	40-130	+/-30
Heptachlor epoxide	1311/8081	60-130	+/-30
Methoxychlor	1311/8081	55-150	+/-30
Toxaphene	1311/8081	50-150	+/-30
TCLP HERBICIDES			
2,4-D	1311/8151	35-115	+/-30
2,4,5-TP (Silvex)	1311/8151	50-115	+/-30
TCLP METALS			
Arsenic	1311/6010B	80-120	+/-20
Barium	1311/6010B	80-120	+/-20
Cadmium	1311/6010B	80-120	+/-20
Chromium (total)	1311/6010B	80-120	+/-20
Lead	1311/6010B	80-120	+/-20
Mercury	1311/7470/7471	80-120	+/-20
Selenium	1311/6010B	80-120	+/-20

ATTACHMENT 4

Precision and Accuracy Limits for TCLP

MEC RFI , Fort Rucker, Alabama

Analyte	Method	Limits (%)	RPD (%)
Silver	1311/6010B	80-120	+/-20
Reactive Sulfide	1311/7.3.4.2	LCS: 80-120, MS: 75-125	+/-20
Cyanide	1311/9012	LCS: 80-120, MS: 75-125	+/-20
Corrosivity	1311/9045	80-120	+/-20
Ignitability	1311-1010A	97.4-102.3	+/-20

ATTACHMENT 5

Container, Preservative, and Holding Time Requirements for Soil
MEC RFI, Fort Rucker, Alabama

Matrix	Test	Method	Container	Preservative	Holding Time
Soil	Metals	6010B	4 oz. Glass jar	None / 4°C	180 days
Soil	Explosives	8330A	4 oz. Glass jar	None / 4°C	14 days to ext/40 days to analyze
Soil	TCLP–Volatile Organic Compounds	SW-846 1311/5030B /8260B	2-4oz glass	None / 4°C	14 days to ext/7 days to analyze
Soil	TCLP–Semivolatile Organic Compounds	SW-846 1311/3510C or 3520C/8270C	8-oz glass[2]	None / 4°C	14/7/40 days[1]
Soil	TCLP–Organochlorine Pesticides	SW-846 1311/3510C/8081A	8-oz glass[2]	None / 4°C	14/7/40 days[1]
Soil	TCLP–Herbicides	SW-846 1311/3510/8151A	8-oz glass[2]	None / 4°C	14/7/40 days[1]
Soil	TCLP–Metals (Total)	SW-846 1311/3010/;6010B	8-oz glass[2]	None / 4°C	6 months
Soil	TCLP–Mercury	SW-846 1311/7471A	8-oz glass[2]	None / 4°C	28 days
Soil	Reactive Sulfide	SW-846 7.3.4.2	8-oz glass	None / 4°C	14 days
Soil	Reactive Cyanide	SW-846 9012	8-oz glass[2]	None / 4°C	14 days
Soil	Corrosivity	SW-846 9045	8-oz glass[2]	None / 4°C	As soon as possible
Soil	Ignitability	SW-846 1010A	8-oz glass[2]	None / 4°C	14 days

[1] 14 days to TCLP extraction, 7 days for extraction, 40 days for analysis
[2] All analyses can be combined into 2 8-oz containers

ATTACHMENT 6

Analytical Method Detection Limits for USEPA Method 6010B/7471A

MEC RFI, Fort Rucker, Alabama

Method	CAS Number	Analyte	MDL	LOD	LOQ/MRL	Units	ADEM Criteria (mg/kg)
6010B/C	7440-36-0	Antimony	1.00	1.60	3.00	mg/kg	4.10E+01
6010B/C	7440-38-2	Arsenic	0.600	1.20	2.00	mg/kg	1.60E+00
6010B/C	7440-43-9	Cadmium	0.200	0.400	1.00	mg/kg	4.50E+01
6010B/C	7440-47-3	Chromium	0.400	0.800	2.00	mg/kg	6.40E+01
6010B/C	7440-50-8	Copper	0.800	1.60	2.00	mg/kg	4.10E+03
6010B/C	7439-92-1	Lead	0.300	0.600	0.600	mg/kg	8.00E+02
6010B/C	7782-49-2	Selenium	0.600	1.00	1.20	mg/kg	5.10E+02
6010B/C	7440-22-4	Silver	0.200	0.400	2.00	mg/kg	5.10E+02
6010B/C	7440-66-6	Zinc	1.00	2.00	4.00	mg/kg	1.00E+05
7471A/B	7439-97-6	Mercury	0.0130	0.0260	0.0330	mg/kg	3.10E+01

mg/kg = milligrams per kilogram

[1] No criteria found in Table 2 of Alabama Department of Environmental Management (ADEM) Risk-based Corrective Action Guidance Manual (June 2007) or USEPA risk-based screening levels (RBSLs) (May 20, 2008), so the lab reporting limit was used.

ATTACHMENT 7
Analytical Method Detection Limits for USEPA Method 8330A
MEC RFI, Fort Rucker, Alabama

Method	CAS Number	Analyte	MDL	LOD	LOQ/MRL	Units	[2] USEPA Criteria (mg/kg)
8330A	99-35-4	1,3,5-Trinitrobenzene	0.100	0.200	0.400	mg/kg	2.70E+04
8330A	99-65-0	1,3-Dinitrobenzene	0.100	0.200	0.400	mg/kg	6.20E+01
8330A	118-96-7	2,4,6-Trinitrotoluene (TNT)	0.100	0.200	0.400	mg/kg	7.90E+01
8330A	121-14-2	2,4-Dinitrotoluene (DNT)	0.100	0.200	0.400	mg/kg	5.50E+00
8330A	606-20-2	2,6-Dinitrotoluene	0.100	0.200	0.400	mg/kg	6.20E+02
8330A	35572-78-2	2-Amino-4,6-dinitrotoluene	0.100	0.200	0.400	mg/kg	2.00E+03
8330A	88-72-2	2-Nitrotoluene (ONT)	0.100	0.200	0.400	mg/kg	1.30E+01
8330A	618-87-1	3,5-Dinitroaniline	0.100	0.200	0.400	mg/kg	3.00E+00
8330A	99-08-1	3-Nitrotoluene	0.100	0.200	0.400	mg/kg	1.20E+04
8330A	99-99-0	3-Nitrotoluene/4-Nitrotoluene	0.100	0.200	0.400	mg/kg	1.1E+02
8330A	19406-51-0	4-Amino-2,6-dinitrotoluene	0.100	0.200	0.400	mg/kg	1.90E+03
8330A	99-99-0	4-Nitrotoluene (PNT)	0.100	0.200	0.400	mg/kg	1.10E+02
8330A	2691-41-0	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	0.100	0.200	0.400	mg/kg	4.90E+04
8330A	98-95-3	Nitrobenzene	0.100	0.200	0.400	mg/kg	2.20E+01
8330A	55-63-0	Nitroglycerin	0.250	0.500	1.00	mg/kg	6.20E+01
8330A	78-11-5	PETN	0.250	0.500	1.00	mg/kg	1.50E+01
8330A	121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.100	0.200	0.400	mg/kg	2.40E+01
8330A	479-45-8	2,4,6-Trinitrophenylmethylnitramine (Tetryl)	0.100	0.200	0.400	mg/kg	2.50E+03

[1] No criteria found in Table 2 of Alabama Department of Environmental Management (ADEM) Risk-based Corrective Action Guidance Manual (June 2007) or USEPA RBSLs (May 20, 2008), so the lab reporting limit was used.

[2] USEPA RBSLs (May 20, 2008).

ATTACHMENT 8
TCLP Target Parameters Lists and Reporting Limits

MEC RFI, Fort Rucker, Alabama

TCLP VOLATILES	**CAS #**	**mg/L**	**Regulatory Levels (mg/L)**
Benzene	71432	0.1	0.5
Butanone, 2- (Methyl ethyl ketone) (MEK)	78933	0.4	200
Carbon Tetrachloride	56235	0.1	0.5
Chlorobenzene	108907	0.1	100
Chloroform (Trichloromethane) (THM)	67663	0.1	6.0
Dichlorobenzene, 1,4 -	106467	0.1	7.5
Dichloroethane, 1,2- (EDC)	107062	0.1	0.5
Dichloroethene, 1,1-	75354	0.1	0.7
Tetrachloroethene (PCE)	127184	0.1	0.7
Trichloroethene (TCE)	79016	0.1	0.5
Vinyl Chloride	75014	0.1	0.2
TCLP SEMIVOLATILES	**CAS #**	**mg/L**	
Cresol (o, m, p-isomers)		0.2	200
Dinitrotoluene, 2,4-	121142	0.1	0.13
Hexachlorobenzene	118741	0.1	0.13
Hexachlorobutadiene	87683	0.1	0.5
Hexachloroethane	67721	0.1	3.0
Nitrobenzene	98953	0.1	2.0
Pentachlorophenol	87865	0.1	100
Pyridine	110861	0.1	5.0
Trichlorophenol, 2,4,5-	95954	0.1	400
Trichlorophenol, 2,4,6-	88062	0.1	2.0
TCLP ORGANOCHLORINE PESTICIDES	**CAS #**	**mg/L**	
Chlordane, technical	57749	0.02	0.03
Endrin	72208	0.002	0.02
HCH, gamma- (BHC, gamma-) (Lindane)	58899	0.002	0.4
Heptachlor (and epoxide)	76448	0.002	0.008
Heptachlor epoxide	1024573	0.002	See above
Methoxychlor	72435	0.02	10.0
Toxaphene	8001352	0.1	0.5
TCLP HERBICIDES	**CAS #**	**mg/L**	
2,4-D	94757	0.002	10.0
2,4,5-TP (Silvex)	93721	0.002	1.0
TCLP METALS	**CAS #**	**mg/L**	
Arsenic	7440382	0.05	5.0
Barium	7440393	5	100
Cadmium	7440439	0.2	1.0
Chromium (total)	7440473	0.5	5.0
Lead	7439921	0.5	5.0
Mercury (Inorganic) (7470/7471)	7439976	0.005	0.2
Selenium	7782492	0.05	1.0
Silver	7440224	0.2	5.0
Reactive Sulfide		25	
Cyanide		0.13	
Corrosivity		pH units	
Ignitability		<100°C	

ATTACHMENT 9

Electronic Data Deliverables Format for CH2M HILL
MEC RFI, Fort Rucker, Alabama

Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
1	VersionCode	text	15	R	Code identifying the version of the EDD.
2	LabName	text	10	R	Identification code for the laboratory performing the work. This value is used to distinguish among different facilities.
3	SDG	text	8	R	Sample delivery group designation. Always populated for all samples, including QC.
4	FieldID	text	13	R	Client sample ID as appears on COC with optional lab-assigned suffixes and/or prefixes to make it unique. If the sample identifier on the COC and the prefix/suffix is greater than 13 characters, abbreviate the value but make it unique. For laboratory QC samples (that is, MBs, lab control samples), use a unique lab sample identifier.
5	NativeID	text	13	R	Client sample ID, exactly as on the COC. No prefix or suffix allowed. Used to identify the native sample from which other samples are derived (for example, QAQCType = ”LR”, “MS”, or “SD”). For laboratory QC samples (that is, MBs, lab control samples), use a unique lab sample identifier. For lab blank spike (and blank SD) samples, use the FieldID value that was assigned to the associated MB.
6	QAQCType	text	2	R	This is the code for the sample type. Any field sample that is not used as lab QC and is not otherwise marked on the COC should have the designation of “N” (normal field sample). No suffix allowed (that is, do not add numbers as suffixes to the QAQCType values as is called for in the Environmental Resources Program Information Management System [ERPIMS] guidelines). Note that if all analyses for a given sample are diluted, then the first dilution should be designated as the normal sample. If more dilutions are required, then the next dilution should be designated as the first true dilution with a QAQCType value of “LR” and a LRType value of “DL” (see LRType, below).
7	LRType	text	3	C	This is the code for laboratory replicate sample type. Values are: blank (if QAQCType value is not “LR”), “DL” (dilution), “RE” (re-analysis), “D” (inorganic duplicate), “CF” (confirmation).

ATTACHMENT 9
Electronic Data Deliverables Format for CH2M HILL
MEC RFI, Fort Rucker, Alabama

Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
					For multiple dilutions or reanalyses of the same sample, append the replicate number after the LRType value (that is, “RE”, “RE2”, “RE3”, etc.).
8	Matrix	text	5	R	Sample matrix code. Valid values are as follows: “AIR”, “WATER”, “SOIL”, unless otherwise provided by the project data manager and marked on the COC. The use of “liquid”, “solid”, etc. for lab QC is not allowed.
9	LabSampleID	text	20	R	Laboratory sample ID. Prefix or suffix is allowed. This is where dilutions or re-extractions are noted. Ex: “D97-11111RE” is acceptable.
10	AnalysisMethod	text	20	R	Analysis method code. This is the identifier of the analytical method that was performed on the sample. Example: SW8260A. Generic names such as “USEPA” should not be used.
11	ExtractionMethod	text	20	R	Preparation method code. A value in this field is required. If the preparation is described in the method, use “METHOD”. If there is no separate preparation required, use “NONE”. Note that Total and Dissolved metal analyses are differentiated by the value in this column. Note that Total, TCLP, and SPLP analyses are now differentiated by the value in the LeachMethod column (see below).
12	SampleDate	date		C	Date of sample collection. Value is required for all samples sent to the laboratory and samples derived from those samples. Format: mm/dd/yyyy
13	SampleTime	time		C	Time of sample collection. Value is required for all samples sent to the laboratory and samples derived from those samples. 24-hour format: hh:mm
14	ReceiveDate	date		C	Date of sample receipt in the lab. Value is required for all samples sent to the laboratory and samples derived from those samples. Format: mm/dd/yyyy
15	ExtractDate	date		C	Date of sample preparation (extraction or digestion). Value is required if the ExtractionMethod field value is other than “NONE”. Format: mm/dd/yyyy
16	ExtractTime	time		C	Time of sample preparation. Value is required if the ExtractionMethod field value is other than “NONE”. 24-hour format: hh:mm
17	AnalysisDate	date		R	Date of sample analysis. Value is required for all records. Format: mm/dd/yyyy
18	AnalysisTime	time		R	Time of sample analysis. Value is required for all records. 24-hour format: hh:mm
19	PercentSolids	number		R	Percent solids within the sample. Should be zero for water samples.

ATTACHMENT 9
Electronic Data Deliverables Format for CH2M HILL
MEC RFI, Fort Rucker, Alabama

Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
20	LabLotCtlNum	text	10	C	Identifier of an autonomous group of environmental samples and associated QC samples **prepared** together. For example, its value can be a digestion or extraction batch ID. If there is no separate extraction or preparation performed, leave this field blank.
21	CAS	text	20	C	Chemical Abstract Service (CAS) number of analyte, if available.
22	ParamID	text	12	R	Parameter identifier code for the parameter listed in the Analyte field.
23	Analyte	text	60	R	Name of analyte, chemical name.
24	Result	text	10	R	Result of the analysis. Surrogate analytes will be reported in units of percent. All others will be reported in sample concentration units. If undetected, report the adjusted MDL or adjusted RL, depending on the project. (Reported as a text field to preserve significant figures.)
25	ExpectedValue	number		C	“100” for surrogates; “0” (zero) for blanks; spike level plus parent result for LCS, and MS/MSD; parent value for lab duplicate; etc.
26	Units	text	10	R	Units of measure used in the analysis. Report “PERCENT” for surrogate analytes and concentration units for all others.
27	Dilution	number		R	Total dilution reported in the analysis. Default value should be 1 (one). This value should reflect changes to sample preparation amounts as defined by the method (for example, less sample used for standard VOC analysis).
28	MDL	number		C	Minimum detection limit adjusted for preparation and dilution. Note that this value may be the method detection limit or the instrument detection limit, depending on the method and the project requirements. This value is **not** adjusted for percent moisture.
29	RL	number		C	Reporting limit adjusted for preparation and dilution. Value is **not** adjusted for percent moisture. Equivalent to PQL.
30	LabQualifier	text	6	R	Lab qualifier for the results, as reported on the hard copy. Use “=” as first (or only) qualifier value for detected results.
31	Surrogate	text	1	R	Is the chemical a surrogate? Report “Y” for yes or “N” for no.
32	Comments	text	240	O	Comment field
33	ParValUncert	text	16	C	Radiological parameter value uncertainty.

ATTACHMENT 9
Electronic Data Deliverables Format for CH2M HILL
MEC RFI, Fort Rucker, Alabama

Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
34	Recovery	number		C	Percent recovery for MS, SD, LCS, and surrogate compounds.
35	LowerControlLimit	number		C	Lower control limit value for spiked compounds, expressed in units of Percent. A value in this field is required if there is a value in the Recovery field (Field No. 34).
36	UpperControlLimit	number		C	Upper control limit value for spiked compounds, expressed in units of Percent. A value in this field is required if there is a value in the Recovery field (Field No. 34).
37	Basis	text	1	R	Weight basis for soil (or solid) sample analysis. Use “D” for dry-weight basis, “W” for wet-weight basis, or “X” if not applicable.
38	ConcQual	text	1	R	Concentration qualifier. Use “=” for detects, “J” for estimated value (value between detection limit and reporting limit), “U” for undetected result, or “E” for exceeded result.
39	MDLAdjusted	number		C	Minimum detection limit adjusted for preparation, dilution **<u>and percent moisture</u>**. See the description of the MDL field (Field No. 28) for an explanation of the contents of this field.
40	RLAdjusted	number		C	Reporting limit adjusted for preparation, dilution **<u>and percent moisture</u>**. Equivalent to PQL
41	SampleDescription	text	20	C	Full sample identifier value as it appears on the COC. In some cases, this may be the name of the sampling location instead of the sample. Required for all samples that are either collected in the field and specified on the COC, or derived from samples that are collected in the field and specified on the COC.
42	LeachMethod	text	20	R	Analytical method used for leaching the sample. This applies to TCLP, Synthetic Precipitation Leaching Procedure (SPLP), or other leaching or pre-extraction leaching procedures. Use “NONE” if the sample was not leached.
43	LeachDate	date		C	Date that the leaching method was performed (start date for multi-date leaching procedures). Value is required if the LeachMethod field value is other then “NONE”. Format: mm/dd/yyyy.
44	LeachTime	time		C	Time that the leaching procedure started. Value is required if the LeachMethod field value is other then “NONE”. 24-hour format: hh:mm.
45	LeachLot	text	20	C	Identifier of an autonomous group of environmental samples and associated QC samples **leached** at the same time. If the sample was not leached, leave this field blank.

ATTACHMENT 9
Electronic Data Deliverables Format for CH2M HILL
MEC RFI, Fort Rucker, Alabama

Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
46	AnalysisLot	text	20	R	Identifier of an autonomous group of environmental samples and associated QC samples **analyzed** together. A value in this field is mandatory (that is, it should not be blank).
47	CalRefID	text	20	C	Identifier of a group of environmental and QC samples linked by a common set of calibration records. All results with the same CalRefID value will have had the same initial calibration run.

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Appendix F
Forms

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Contents

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F-1: CH2M HILL DAILY SAFETY TAILGATE MEETING LOG

Project. MEC RFI, Fort Rucker, AL Date: ____________

TOPICS DISCUSSED:

1.
2.
3.
4.
5.
6.
7.

MEETING CONDUCTED BY: SIGNATURE:

MEETING ATTENDEES	
Name/Company	Signature
1.	
2.	
3.	
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F-2: UXO PERSONNEL QUALFICATION AND VERIFICATION FORM

CANDIDATE: ____________________ POSITION/LEVEL: ____________________

CONTRACT: ____________________ Page 1 of 1

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

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F-3: SAFE BEHAVIOR OBSERVATION FORM

Safe Behavior Observation Form

☐Federal or ☐Commercial Sector (check one)

☐Construction or ☐Consulting (check one)

Project Number:

Client/Program:

Project Name:

Observer:

Date:

Position/Title of worker observed:

Background Information/ comments:

Task/Observation Observed:

- ❖ Identify and reinforce safe work practices/behaviors
- ❖ Identify and improve on at-risk practices/acts
- ❖ Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- ❖ Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- ❖ Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's Corrective Actions/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's Corrective Actions/Comments:**
Other…			

For ES Federal Sector projects please email completed forms to: CH2M HILL ES FED Safe Behavior Observation
For ES Commercial Sector projects please email completed forms to: CH2M HILL ES COM Safe Behavior Observation
For CNR ES staff please email completed forms to: cnressafe@ch2m.com

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CH2MHILL

F-4: PRE-TASK SAFETY PLAN

Project: Fort Rucker MEC RFI Location: Fort Rucker, AL Date:

Supervisor: Job Activity:

Task Personnel:
____
____
____

List Tasks:

Tools/Equipment required for Tasks, (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools, hand tools):
____
____

Potential H&S Hazards, including chemical, physical, safety, biological and environmental **(Check all that apply and review exposures as they will be encountered in the tasks above):**

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__Ergonomics
Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__Pinch points	__ plants/insects
__ Electrical	__ Cuts/abrasions	__ Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__Heights/fall> 6′	__ Overhead Electrical hazards	__ Heat stress
Noise	Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__Welding/cutting	__ Demolition

Other Potential Hazards (Describe):

F-4: PRE-TASK SAFETY PLAN

Hazard Control Measures (Check all that apply):

PPE __ Thermal/lined __ Eye __ Dermal/hand __ Hearing __ Respiratory __ Reflective vests __ Flotation device	Protective Systems __ Sloping __ Shoring __ Trench box __ Barricades __ Competent person __ Locate buried utilities __ Daily inspections	Fire Protection __ Fire extinguishers __ Fire watch __ Non-spark tools __ Grounding/bonding __ Intrinsically safe equipment	Electrical __ Lockout/tag out __ Grounded __ Panels covered __ GFCI/extension cords __ Power tools/cord inspected
Fall Protection __ Harness/lanyards __ Adequate anchorage __ Guardrail system __ Covered opening __ Fixed barricades __ Warning system	Air Monitoring __ PID/FID __ Detector tubes __ Radiation __ Personnel sampling __ LEL/O2 __ Other	Proper Equipment __ Aerial lift/ladders/scaffolds Forklift/ Heavy equipment Backup alarms __ Hand/power tools __ Crane w/current inspection __ Proper rigging Operator qualified	Welding & Cutting __ Cylinders secured/capped __ Cylinders separated/upright __ Flash-back arrestors __ No cylinders in CSE __ Flame retardant clothing __ Appropriate goggles
Confined Space Entry __ Isolation __ Air monitoring __ Trained personnel __ Permit completed __ Rescue	Medical/ER __ First-aid kit __ Eye wash X FA-CPR trained personnel X Route to hospital	Heat/Cold Stress __ Work/rest regime __ Rest area __ Liquids available __ Monitoring __ Training	Vehicle/Traffic __ Traffic control __ Barricades __ Flags __ Signs
Permits __ Hot work __ Confined space __ Lockout/tag out __ Excavation __ Demolition __ Energized work	Demolition __ Pre-demolition survey __ Structure condition __ Isolate area/utilities __ Competent person __ Hazmat present	Inspections:	Training: X Hazwaste __ Construction __ Competent person X Task-specific (THA) X Hazcom

Field Notes:

Supervisor signature:

F-5: PREPARATORY PHASE INSPECTION CHECKLIST

(Part I)

Project : ______________________________ Date: ____________________

TITLE AND NO. OF TECHNICAL SECTION: ______________________________

____

____

____

Work Plan Reference : ______________________________

A. Planned Attendants:

Name **Position** Company

1) ____________________
2) ____________________
3) ____________________
4) ____________________
5) ____________________
6) ____________________
7) ____________________
8) ____________________
9) ____________________
10) ____________________
11) ____________________

B. Submittals required to begin work:

Item Submittal No. Action Code

1) ____________________
2) ____________________
3) ____________________
4) ____________________
5) ____________________
6) ____________________
7) ____________________
8) ____________________

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

____

____

Project QC Specialist

(continued):

F-5: PREPARATORY PHASE INSPECTION CHECKLIST
(Part I)

Project : ______________________________ Date: ____________________

C. Equipment to be used in executing work:

1) ______________________________
2) ______________________________
3) ______________________________
4) ______________________________
5) ______________________________

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

____

____

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

____

____

F-5: PREPARATORY PHASE INSPECTION CHECKLIST
(Part II)

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

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

Project QC Specialist

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F-6: INITIAL PHASE INSPECTION CHECKLIST

Project.: ______________________ Date: ______________

Title and No. of SSWP Section: ______________________

Description and Location of Work Inspected: ______________________

A. Key Personnel Present:

Name	Position	Company

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

If not, explain: ______________________

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

If not, explain: ______________________

D. Workmanship is acceptable: ☐Yes ☐No

State where improvement is needed: ______________________

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

If no, corrective action taken: ______________________

____

Project Quality Control Specialist

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

Date:
Contractor:
Project: Fort Rucker MEC RFI, Fort Rucker, AL

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

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

INSPECTIONS PERFORMED & WHO PERFORMED TEST

Project QC Specialist

Date

This page intentionally left blank.

F-8: FIELD QC INSPECTION FORM

Project: Fort Rucker MEC RFI, Fort Rucker, AL

Date:

QC Inspection Team Leader:

Inspection Remarks:

1.)

2.)

3.)

4.)

5.)

6.)

Inspected by Date

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F-9: UXOQC SPOT CHECK INSPECTION FORM

Project: Fort Rucker MEC RFI, Fort Rucker, AL

Date:

QC Inspection Team Leader:

Transect ID/Number team is working in:

Y N Have all team members processed instruments through ECA before beginning work day?

Y N Has the team leader documented the daily functional test

Y N Is sweep equipment in accordance with WP requirements?

Y N Is grid cell laid out in conformance with WP requirements?

Y N Does the team execute a smooth sweep of instrument from side to side?

Y N Are team leader log entries current and legible, and include documentation of morning safety brief, tailgate safety brief, and relevant information regarding daily functions?

Y N Has the vehicle inspection form been filled out?

Y N Is recovered MEC/MPPEH/MD being managed in conformance with WP?

Other Comments:

Inspected by Date

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F-10: FINAL INSPECTION CHECKLIST

(PART I)

Project: Fort Rucker MEC RFI, Fort Rucker, AL Date: ____________________

Area of Inspection: ____________________

A. Definable Feature Of Work: Status of Inspection:

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

____

____

Project QC Specialist

(continued):

(PART II)

MEETING ATTENDANCE LIST
Fort Rucker MEC RFI. Fort Rucker, AL

Meeting:		Date:
Name	Organization	Phone Number

F-11: INSPECTION SCHEDULE AND TRACKING FORM

Project: Fort Rucker MEC RFI		Project Manager: Mark Sherrill					Project QC Mgr/Staff:			
Reference Number	Definable Feature of Work	Preparatory		Initial		Follow-Up		Completion		
		Date Planned	Actual Date	Date Planned	Actual Date	Planned Begin/End	Actual Dates	Planned Begin/End	Actual Dates	Status
	Planning - GIS Set-up									
	Planning – Document Management and Control									
	Planning - Data Management									
	Planning - Subcontracting									
	Planning- Technical and Operational Approaches									
	Planning - GSV Plan preparation and approval									
	Planning –Work Plan									
	Site Preparation - Mobilization									
	Site Preparation – Site Survey									

F-11: INSPECTION SCHEDULE AND TRACKING FORM

Project: Fort Rucker MEC RFI

Project Manager: Mark Sherrill

Project QC Mgr/Staff:

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

F-11: INSPECTION SCHEDULE AND TRACKING FORM

Project: Fort Rucker MEC RFI

Project Manager: Mark Sherrill

Project QC Mgr/Staff:

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

Page 3 of 3

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F-12: QUALITY ASSURANCE MONITORING FORM

Date: ___/____/______
Project: Fort Rucker MEC RFI, Fort Rucker, AL
Work Task (Milestone/Activity): ____

Survey Period: ___/____/______ through ___/____/______
Method of Surveillance: COR Review

Evaluation of Contractor's Performance: _______

Evaluation

Corrective Action Required: ☐ Yes ☐ No

Narrative Discussion of Contractor's Performance During Survey Period:

Discussion

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F-13: CORRECTIVE ACTION FORM FOR QASP

Project: Fort Rucker MEC RFI, Fort Rucker, AL

1) Work Task (Milestone/Activity): ________________________

2) Survey Period: ___/____/______ through ___/____/______

3) Description of the Failure/Deficiency that Precipitated the Corrective Action:

Description

4) Description of the Criterion that the Failure/Deficiency was Evaluated Against:

Description

5) Personnel Involved in the Identification of the Failure/Deficiency, Determination of the Appropriate Corrective Action, Approval of the Corrective Action, and Implementation of the Corrective Action:

6) Description of the Corrective Action that was Required:

Description

7) Date/Time of Implementation of the Corrective Action: ___/____/______

Description

8) Follow-Up Information to Prevent Recurrence of Failure/Deficiency (i.e., Need For Revision of Procedures or Specifications):

9) Personnel Responsible for Follow-Up Work:

10) Planned Date for Follow-Up Surveillance: ___/____/______

11) Other Notes:

Other

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F-14: CORRECTIVE ACTION REQUEST

Page 1 of 2

(2)CAR #:	(3)PRIORITY: ☐HIGH ☐NORMAL	(4)DATE PREPARED:

PART A: NOTICE OF DEFICIENCY

(5)PROJECT:	
(6)PROJECT MANAGER:	(7)QC MANAGER/STAFF:
(8)CONSTRUCTION MANAGER:	(9)MEC MANAGER:
(10)ISSUED TO (INDIVIDUAL & ORGANIZATION):	
(11)REQUIREMENT & REFERENCE:	
(12)PROBLEM DESCRIPTION & LOCATION:	
(13)CAP REQUIRED? ☐YES ☐NO	(14)RESPONSE DUE:

(15)ISSUED BY (PRINTED NAME & TITLE):		(16)MANAGEMENT CONCURRENCE:
SIGNATURE:	DATE:	

PART B: CORRECTIVE ACTION

(17)PROPOSED CORRECTIVE ACTION/ACTION TAKEN:

NOTE: SUPPORTING DOCUMENTATION MUST BE LISTED ON THE BACK OF THIS FORM AND ATTACHED.

(18)PART B COMPLETED BY (NAME & TITLE):		(19)QC CONCURRENCE:
SIGNATURE:	DATE:	

PART C: CORRECTIVE ACTION VERIFICATION

(20)CAR VERIFICATION AND CLOSE-OUT: (CHECK ONLY ONE & EXPLAIN STIPULATIONS, IF ANY)
☐APPROVED FOR CLOSURE WITHOUT STIPULATIONS
☐APPROVED FOR CLOSURE WITH FOLLOWING STIPULATIONS

COMMENTS/STIPULATIONS:

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

SIGNATURE: DATE:

CORRECTIVE ACTION REQUEST (CAR) INSTRUCTION SHEET

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

(2) QC Manager: Fill in CAR number from CAR log.

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

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

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

(6) CAR Requestor: Identify Project Manager

(7) CAR Requestor: Identify CQC System Manager.

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

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

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

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

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

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

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

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

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

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

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

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

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

(21) QC Manager: Indicate document closeout by signing and dating.

F-15: CORRECTIVE ACTION PLAN

Page 1 of 1

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

PART A: TO BE COMPLETED BY PROJECT MANAGER OR DESIGNEE

(1)PROJECT:

(2)PROJECT MANAGER:

(3)QC MANAGER:

(4)CAR NO(S) AND DATE(S) ISSUED:

(5)DEFICIENCY DESCRIPTION AND LOCATION:

(6)PLANNED ACTIONS	(7)ASSIGNED RESPONSIBILITY	(8) COMPLETION DUE DATE

(9)PROJECT MANAGER SIGNATURE:

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

(10)CAP REVIEWED BY: DATE:

(11)REVIEWER COMMENTS:

(12)CAP DISPOSITION: (CHECK ONLY ONE AND EXPLAIN STIPULATIONS, IF ANY)

- ☐ APPROVED WITHOUT STIPULATIONS
- ☐ APPROVED WITH STIPULATIONS
- ☐ APPROVAL DELAYED, FURTHER PLANNING REQUIRED

COMMENTS:

(13)QC MANAGER SIGNATURE:

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F-16: DAILY QC REPORT

Project. ______________________________ Date: ______________

LOCATION OF WORK: ______________________________

DESCRIPTION OF WORK: ______________________________

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

TEMPERATURE: MIN: _____°F MAX: _____°F

1. Work completed today by subcontractor:

____

____

____

2. Work completed today by QC inspection staff :

____

____

3. All work performed in conformance with Work Plan requirements? ______________

If not, explain: ______________________________

____

____

4. Non-conformances/deficiencies reported: ______________________________

____

5. Comments: ______________________________

____

____

____

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

____

Project QC Specialist

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F-17: NONCONFORMANCE REPORT

PROJECT: NCR No. Date:

To: Page1

ORIGINAL—Please return to CH2M HILL

Item:

Work Plan Reference :

Requirement:

Nonconformance:

Issued by: Name: Title: UXOQC Organization:

Date:

Disposition: _____ Accept _______ Reject

Details

Disposition Approvals:

UXOQCS Date	FCR Required? Yes No
Project Manager Date	Distribution:

Remarks:

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F-18: ROOT CAUSE ANALYSIS FORM

Root Cause Analysis (RCA)

Root Cause Categories (RCC): Select the RCC numbered below that applies for the root cause (RC) and/or contributing factor (CF) in the first column, then describe the specific root cause and corrective actions in each column.

1. **Lack of skill or knowledge**
2. **Lack of or inadequate operational procedures or work standards**
3. **Inadequate communication of expectations regarding procedures or work standards**
4. **Inadequate tools or equipment**
5. **Correct way takes more time and/or requires more effort**
6. **Short-cutting standard procedures is positively reinforced or tolerated**
7. **Person thinks there is no personal benefit to always doing the job according to standards**

RCC #	Root Cause(s)	Corrective Actions	RC[1]	CF[2]	Due Date	Date Completed	Date Verified

[1] RC = Root Cause; [2] CF = Contributing Factors (check which applies)

Investigation Team Members

Name	Job Title	Date

Results of Solution Verification and Validation

Reviewed By

Name	Job Title	Date

Determination of Root Cause(s)

For minor losses or near losses the information may be gathered by the supervisor or other personnel immediately following the loss. Based on the complexity of the situation, this information may be all that is necessary to enable the investigation team to analyze the loss, to determine the root cause, and to develop recommendations. More complex situations may require the investigation team to revisit the loss site or re-interview key witnesses to obtain answers to questions that may arise during the investigation process.

Photographs or videotapes of the scene and damaged equipment should be taken from all sides and from various distances. This point is especially important when the investigation team will not be able to review the loss scene.

The investigation team must use the Root Cause Analysis Flow Chart to assist in identifying the root cause(s) of a loss. Any loss may have one or more "root causes" and "contributing factors". The "root cause" is the primary or immediate cause of the incident, while a "contributing factor" is a condition or event that contributes to the incident happening, but is not the primary cause of the incident. Root causes and contributing factors that relate to the *person* involved in the loss, his or her peers, or the supervisor should be referred to as "personal factors". Causes that pertain to the *system* within which the loss or injury occurred should be referred to as "job factors".

Personal Factors

- Lack of skill of knowledge
- Correct way takes more time and/or requires more effort
- Short-cutting standard procedures is positively reinforced or tolerated
- Person thinks that there is no personal benefit to always doing the job according to standards

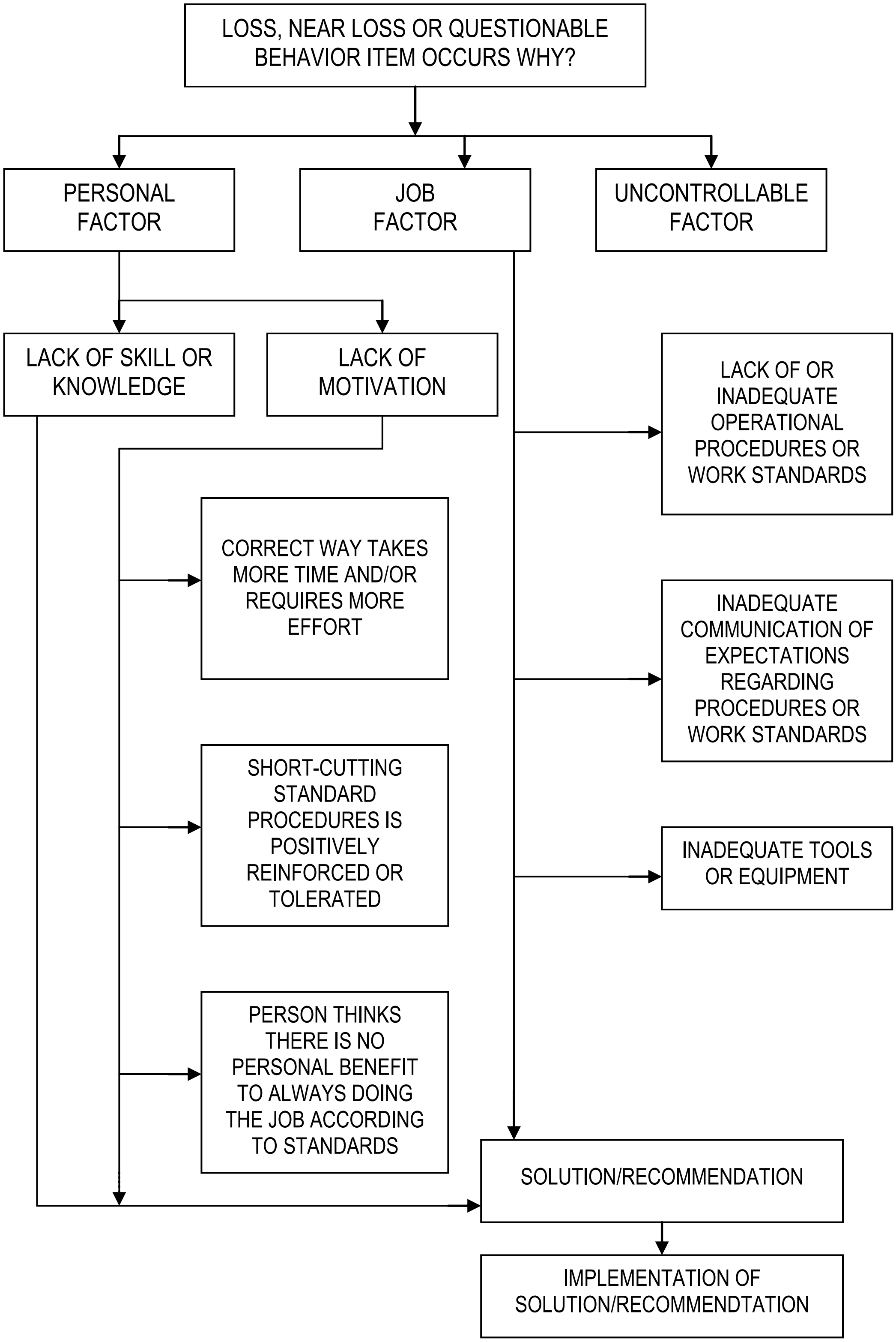
Job Factors

- Lack of or inadequate operational procedures or work standards.
- Inadequate communication of expectations regarding procedures or standards
- Inadequate tools or equipment

The root cause(s) could be any one or a combination of these seven possibilities or some other "uncontrollable factor". In the vast majority of losses, the root cause is very much related to one or more of these seven factors. Uncontrollable factors should be used rarely and only after a thorough review eliminates "all" seven other factors.

Root Cause Analysis
Flow Chart

CH2M HILL, INC.



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F-19: EQUIPMENT/IVS CERTIFICATION DOCUMENT/CHECKLIST

Section 1 - Team Information

TEAM:

LOCATION:

DATE:

TEAM MEMBERS

NAME	Company	Position

Section 2 - Equipment Serial Numbers

EQUIPMENT ITEM	Serial #	Equipment Item	Serial #

Section 3 – Checklist

ITEM	Ref.	Inspection Point	Yes	No	N/A	Comments
1	GSV PLAN	EQUIPMENT CHECK PERFORMED IN ECA?	☐	☐	☐	
2	GSV PLAN	DATA COLLECTED IAW WP?	☐	☐	☐	
3	GSV PLAN	WAS PAPERWORK COMPLETED PROPERLY?	☐	☐	☐	
4	GSV PLAN	OBTAIN COPY OF LOGBOOK ENTRIES FROM GEO AND UXO TEAMS.	☐	☐	☐	
5	GSV PLAN	DID TEAM EXPERIENCE ANY PROBLEMS WHILE COMPLETING IVS C?	☐	☐	☐	

Section 4 - Punch list Items

ITEM #	DESCRIPTION

Conducted by: ________________________________

Project QC Specialist: ___________

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F-20: MEC INFORMATION FORM

DATE/TIME: ______________________ TRACKING NUMBER (S): ______________________
LOCATION: Fort Rucker, AL

1. MEC REMOVED FROM SITE ☐ YES ☒ NO

2. WHO REMOVED THE ITEM(S)?
Name: N/A Organization: N/A

3. IF MEC WERE REMOVED, WHERE WERE MEC TAKEN? ☐ DAYBOX ☐ MAGAZINE

4. MEC DESTROYED ONSITE? ☐ YES ☐ NO

5. WHO DESTROYED MEC?
Name: ______________________ Organization: ______________________
Time of Detonation: ______________________ MEC Down Time: ______________________

6. **MEC ENCOUNTERED**:

Tracking No.	Transect ID	Team	MEC Type	Qty

7. GOVT. REPRESENTATIVE NOTIFIED AT (TIME): ______________________ REP: ______________________

8. PROJECT TEAM PERSONNEL NOTIFIED AT (TIME): ______________________ REP: ______________________

9. FORT RUCKER NOTIFIED AT (TIME): ______________________ REP: ______________________

10. COMMENTS (Significant events or findings): ______________________

MEC Representative (Signature)

MEC Representative (Print Name)

CHECKED BY __________	APPROVED BY ________

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Appendix G
Contractor Personnel Qualifications Certification Letters

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MARK SHERRILL, PG

Project Manager

Education

BA, Geology and Geography, University of Georgia

Registration

Professional Geologist: AL (1998, No. 885); GA (1989, No. 689)

Distinguishing Qualifications

Over 25 years total experience and 18 years experience at Fort Rucker

Outstanding record of success in helping Fort Rucker achieve NFAs

Trust and credibility with ADEM

Mr. Sherrill is a Professional Geologist with more than 25 years of experience in project management, environmental and hydrogeologic investigations and remediation; regulatory compliance, permitting, and training; and environmental site assessments. **For 18 years, Mr. Sherrill has been providing technical support to Mr. Jim Swift (Fort Rucker IRP Manager) in solving environmental issues at Fort Rucker.** He has managed task orders involving all the SWMUs and AOCs listed in Fort Rucker's HWMMA permit, starting with the initial RFI conducted at Fort Rucker in 1991. He has guided Fort Rucker sites through the RCRA process by conducting RFI, CMS, MNA/LTM, RD, and completing corrective actions. Mr. Sherrill has an outstanding record of success in helping Fort Rucker achieve NFA for sites listed in Fort Rucker's HWMMA permit, with more than 90 percent of sites achieving NFA since 1991. During his 18 years supporting Fort Rucker, Mr. Sherrill has worked closely with ADEM representative, Mr. Mark Harrison, along with Mr. Jim Swift in forming a successful partnership in overseeing the stewardship of the IRP at Fort Rucker.

In addition to having a thorough understanding of Alabama's state regulations, Mr. Sherrill is knowledgeable of other relevant federal and local laws, regulations, and guidance. Having conducted hundreds of environmental investigations and remediation efforts, Mr. Sherrill is well versed in risk management and solution identification, implementation, and management. He has managed large, complex projects under several different contract types and has developed a solid understanding of firm-fixed price, indefinite delivery/indefinite quantity, and other contract types.

Representative Projects

Project Manager, HTRW ID/IQ Contract, USACE, Mobile, AL. Directed all phases of project management and implementation for a number of projects under the HTRW contract. Coordinated with and directed subcontracted work. Specific delivery orders include the following:

- Provided program support to **Fort Rucker Environmental Office** from 2005 to 2009. Program support included technical oversight of performance-based contractor conducting construction and field activities in remediation and closure of RCRA SWMUs and AOCs listed in Fort Rucker's HWMMA permit. Specifically, aided Fort Rucker by providing (1) oversight during construction of 28-acre RCRA landfill cover at SWMU 2d, oversight during investigation of ash at SWMU 8, and long-term groundwater monitoring at SWMUs 2d, 4, 10, 14, and 15; (2) technical analysis and review of corrective measures implementation work plans and reports; (3) technical input during quarterly progress meetings, and (4) support during preparation of 5-year review of SWMUs and AOCs undergoing corrective action.
- Performed RFI to investigate source and nature and extent of approximately 60-acre PCE groundwater plume at AOC-S. Investigation included drilling of DPT borings and installation of temporary groundwater monitoring wells. Groundwater samples were collected and analyzed in the field for total chlorinated hydrocarbons to delineate the horizontal and vertical extent of PCE. Based on the DPT work, the plume was determined to be migrating off-post. Prepared and presented data and recommendations to the Army and ADEM and helped negotiate the number and location of permanent groundwater monitoring wells.
- Performed abandonment of groundwater monitoring wells at the Fort Rucker Open Detonation Unit. Work involved coordination with the Fort Rucker Range Control, obtaining clearance to enter the OD Unit, MEC avoidance activities, marking of access route to each monitoring well for the drilling subcontractor, and abandonment of monitoring wells following ADEM guidance.

Project Manager, HTRW ID/IQ Contract, USACE, Savannah, GA, and Mobile, AL. Responsible for regular client communication, work management, plan approval, and regulatory compliance. Prepared MNA/LTM reports for SWMUs 4, 10, 14, and 15, and performed groundwater investigation at closed sanitary landfill (SWMU 2d) to evaluate nature and extent of TCE and benzene in groundwater.

Project Manager, Confidential Client, Woodbine, GA. Performed Focused Field Investigation at four SWMUs and 6 past industrial use areas to confirm volume of material remaining in place, confirm waste characteristics of material remaining in place; provide preliminary cost for removal of material remaining in place, and provide a basis to make decisions about future property use(s). Due to the potential for MEC to be present in the investigation areas, all site investigations were performed with the augmentation of MR personnel to observe if ordnance exists at the ground surface, mark ordnance, mark access routes, and provide subsurface MEC avoidance during test pit activities and groundwater monitoring well installation.

KEVIN LOMBARDO

MMRP Sites Team Lead/Military Munitions Specialist

Mr. Lombardo is a former military Master EOD Technician with more than 23 years of experience in EOD, MR, CWM, and demilitarization projects. Mr. Lombardo's program experience includes Title I &Title II response actions for manufacturing processing units, depots, proving grounds, training ranges, unsafe buildings, and infrastructure on active and Formerly Used Defense Sites (FUDS). He has served as the Technical Manager for numerous MR and MEC removal actions and remediation projects, where he has been responsible for overseeing and managing all MEC and CWM activities. In addition to having an unparalleled understanding of MEC, MR, and CWM, Mr. Lombardo has a broad knowledge of applicable federal, state, and local laws, regulations, and guidance.

Representative Projects

Technical Manager, Former Pinecastle Jeep Range, Orlando Landfill, Orlando FL. Removal action of 310 acres of former air to ground, direct fire, and ground to air training ranges for the use of 20mm and 37mmTarget Practice and High Explosive Projectiles, 76mm Armor Piercing and High Explosive, and 2.25-inch air to ground rockets and 5-inch High Velocity Aerial Rockets. Performed the design, planning, management, and reporting of Land Survey, DGM Surveys, re-acquiring of 10,000 target anomalies, and explosive destruction of projectiles and rockets.

Technical Manager, Hard Case Bomb Recycling Project U.S. Air Force Utah Test and Training Range, Wildcat Facility Detachment, Hill AFB, UT. Munitions demilitarization and recycling of 2,500 hard case bombs and 700 tons of Bomb Dummy Unit (BDU) type 33 to include MPPEH inspection, certification, and verification for witness destruction by smelting. This $1 million project was completed ahead of schedule and below budget. MEC Operations Manager for design and implementation of technical approach.

MEC Operations Manager, Site Investigations and Removal Actions, U.S. Naval Surface Weapons Station, Dahlgren, VA. MEC Removal Actions, Former DRMO Yard, two ½-acre sites and two ½-acre Open Burning Grounds, and two RCWM investigations of a Former CWM Laboratory Facility supporting soil borings. Responsibilities included preparing ESS and ESP, and coordinating with U.S. Army TEU for CWM support. All projects less than $1 million and on schedule. MEC Operations Manager for design and implementation of technical approach. Site 14 is a RCWM site, in design of CSS for removal of GB agents.

MEC Operations Manager, Site Investigation, U.S. Naval Station Indian Head, MD. Prepare ESS for Intrusive Investigation Site 11 Caffee Road Thermal Treatment Unit and Former Burning Grounds. Provide MEC Construction Support. Project was completed under $300,000 on schedule. MEC Operations Manager for design and implementation of technical approach.

Education

BS, Organizational Management, Regent University

Registration

Certified Construction Safety Manager: Virginia, 2004

Certified Blaster: Maryland, Pennsylvania, Hawaii (2007)

Certified Emergency Medical Technician: Virginia (2006)

Certified Safety Planner (National) 2004

Certified Safety Trainer (National) 2004

Distinguishing Qualifications

Extensive experience in EOD, MR, CWM, and demilitarization projects. Specialized studies/training includes:

- Graduate US Army Chemical & Biological Warfare School Redstone AL, 1984
- Graduate USNAVEOD School Phase I & II Indian Head MD, 1985
- Graduate USNAVEOD School Phase III Nuclear, Indian Head MD, 1985
- Graduate International Society of Explosives Engineers, Explosive Safety, 1996
- Graduate United Nations Demining and Mine Action, New York, NY 1998
- Graduate IABT&I Advanced Improvised Explosive Devices, Region II, 2003
- Instructor USACE Military Munitions Response Programs EWS Vicksburg, MS 2003
- Instructor USEPA Management of Closed, Transferred & Transferring Ranges, VA, 2003
- Achieved DDESB acceptance for multiple Explosive Safety Submissions (ESS), Explosive Site Plans (ESP) and MR Work Plans
- Qualified Air, Ground, and Naval Range Control Officer (1998)
- BATF Responsible Person (current)

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GEORGE DEMETROPOLIS

Senior Client Service Manager

Dr. DeMetropolis has more than 30 years of experience in the Unexploded OrdnanceExplosive Ordnance Disposal (UXO/EOD) industries. His responsibilities have included program and project management; training and quality assurance of work performance; scheduling; budgeting; tracking materials and resources; coordinating subcontractor work; and complying with health, safety, environmental analysis, and site protection rules and regulations.

Education

Ph. D., Business Administration (Management), Northcentral University
M.B.A., Business Administration, Pepperdine University
B.S., Political Science/French, U.S. Naval Academy

Registration

ASQ Certified Quality Auditor (CQA) (1999, No. 21793)

Distinguishing Qualifications

Master EOD Technician

Planning, Administration, Execution, and Control of UXO Operations and Safety Programs

Field Administration of UXO Clearance/Demolition Range Operations and Safety Programs

EOD/UXO Experience, and Military Experience

Representative Projects

Senior Client Service Manager/Western Region Munitions Response Market Segment Leader; West Region Environmental Services; CH2M HILL. Represents the Munitions Response group's services to assigned clients including consulting and operations. Responsible for increasing business volume to CH2M HILL through development of client relationships in the assigned area and efficient project delivery. Provides client-specific input into the strategic business development and annual business plans. Grows CH2M HILL 's business consistent with those plans. Wins major projects and sells across business groups. Positions CH2M HILL to obtain high value projects and programs from the client. Successfully executes all assigned projects. Responsible for client satisfaction.

Commanding Officer of EOD Mobile Unit One and Marine Defense Sector Hawaii Mine Countermeasures Commander; Hawaii. Responsible for quality control and safety of all explosive operations; equipping, deploying, employing, planning, administering, executing and controlling UXO Operations and Safety Programs for 11 EOD mobile detachments; one mine countermeasures diving area search detachment; and one marine mammal system detachment through training and readiness inspections. Responsible for a budget of over $1 million.

Officer-in-Charge, Naval School EOD Detachment; Eglin Air Force Base; Florida. A jointly staffed (Army, Navy, Air Force, Marine Corps) School providing specialized EOD training in the best methods and procedures for the recovery, evaluation, render safe and disposal of surface and underwater, conventional and nuclear, explosive ordnance employed by the U.S. and other nations. Responsible for providing UXO training program oversight. Also managed the school consisting of a staff of 100 personnel and over 300 students. Managed a budget of over $2 million.

Commanding Officer of EOD Training and Evaluation Unit One; Hawaii. Fleet training unit providing specialized training to all Pacific Fleet EOD units, detachments and other selected commands. He was responsible for a budget of over $750 million.

Readiness/Training Officer of EOD Group One; Hawaii. Administered the level of readiness of six operational commands and fifteen detachments providing EOD services to the Fleet and shore activities in an area extending from the Indian Ocean to the Mississippi River. Responsible for the planning and administering of UXO and Safety Programs through quality control and safety inspections of the readiness levels of these organizations.

Executive Officer of EOD Training and Evaluation Unit One; Hawaii. Responsible for the routine operation of this Fleet training unit providing specialized training to all Pacific Fleet EOD units.

Operations Officer and Officer-in-Charge of Shore, Mobile, Mine Countermeasures, and Shipboard Detachments while assigned to EOD Mobile Unit One; Hawaii. Provided EOD, general diving and UXO Clearance/Demolition Range Operations throughout the U.S. Pacific Fleet.

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MICHAEL GOLDMAN , CIH, CSP, CHMM, CPEA

Health and Safety Manager

Education

BS, Biology, Florida State University

Registrations

Certified Industrial Hygienist (CIH);

Certified Safety Professional (CSP);

Certified Hazardous Material Manager (CHMM);

Certified Professional Environmental Auditor (CPEA)

Distinguishing Qualifications

Extensive experience designing and managing H&S protection programs. Specialized training includes the following:

- 40-Hour Hazardous Waste and 8-Hour Refresher
  Drug Free Workplace Program
- Dangerous Goods Shipping
- Fire Extinguishers
- Bloodborne Pathogens
- CPR 2 Year
- Medical Services First Aid 2 Year
- Asbestos Awareness
- Safety Coordinator Construction
- Ladders
- Fall Protection
- Excavation Safety Training
- Safety Coordinator/Hazardous Waste
- Noise
- HS&E Auditor Training
- Lockout/Tagout
- Confined Space Entry
- 30-Hour Construction Safety
- Hazard Communication
  8-Hour Hazardous Waste Supervision
- 10-Hour Construction Safety Awareness

Mr. Goldman has more than 30 years of experience in project and program health and safety (H&S) management. As a Regional H&S Program Manager, Mr. Goldman works closely with members of the Regional Management Team and Functional Management Teams to facilitate effective value-added implementation of Health, Safety, and Environment (HS&E) on environmental remediation and construction projects. His experience includes H&S program development for air monitoring techniques, respiratory protection, and personal protective equipment (PPE) programs for work conducted in toxic atmospheres. He also has extensive experience developing, implementing, and maintaining project-specific H&S plans. To ensure H&SE compliance, Mr. Goldman conducts project audits, provides oversight to field personnel, reviews H&S qualifications of subcontractors, and regularly updates H&S plans. Mr. Goldman has provided H&S management for a number of large federal contracts, including a Navy CLEAN contract in which the CH2M HILL team has delivered more than 350,000 labor hours with no lost-time incidents. Through more than 30 years of experience, Mr. Goldman has acquired an in-depth knowledge of H&S-related laws, regulations, and guidance.

Representative Projects

H&S Manager, National Guard Bureau Environmental Contract, Andrews AFB, MD. Program involves CERCLARCRA, BRAC, and ERP services. Implements and oversees CH2M HILL's Health and Safety Program at all locations on this contract. Directs health and safety staff that writes program plans and develops/reviews TO-specific Health and Safety Plans. Responsible for the implementation of the Behavior-Based Loss Prevention System that manages CH2M HILL and subcontractor safety in the field. Performs HS&E audits on active projects. To date, this contact has included 50 TOs, worth $50 million.

Health & Safety Manager, Environmental Restoration Safety & Health Program, U.S. Department of Energy (DOE). Provided technical support in development and implementation of the Environmental Restoration Safety & Health Program and the Defense Nuclear Facilities Safety Board (DNFSB) Conduct of Operations Program. Reviewed site-specific safety and health plans for accuracy and technical applicability, and conducted audits of hazardous waste site and construction site activities for compliance with OSHA, EPA, and DOT standards, and DOE orders. Developed and presented OSHA, DOT, and DOE required training programs to DOE personnel.

Regional H&S Manager, Various Recovery Projects, Atlanta, Georgia. Oversaw the H&S aspects of the company-wide response to hurricanes Katrina, Rita, and Wilma. Developed the corporate H&S strategy for mobilizing field personnel, including training, vaccinations, PPE selection, and plan development. Advised the Corporate Response Operations Center on H&S issues of procurement, planning, and delivery of work. Projects/clients included FEMA, USACE Memphis, USACE Vicksburg, Keesler AFB, AFCESA, Hurlburt Field, and NAS Pensacola, as well as commercial clients.

TAMIR KLAFF, RG, PG

Munitions Response Geophysicist

Education

MS, Engineering Geology/Hydrogeology;
BA, Geology

Registration

Registered Geophysicist: CA (2001, No. GP 1036);
Professional Geologist: GA (1998, No. 001482)

Distinguishing Qualifications

13 years field experience in geophysics specifically related to UXO clearance

Mr. Klaff is a Registered Geophysicist and Professional Geologist with more than 16 years of experience designing, implementing, and managing MR projects. He has performed MEC geophysical operations, including DGM, on over 75 MR sites. Mr. Klaff served as the Project Munitions Response Geophysicist for an MEC investigation project in California, where he helped CH2M HILL obtain the first unrestricted land use closure approval from the DTSC for a FUDS with MEC. Most recently, Mr. Klaff has served as CH2M HILL's MEC Technical Lead on all geophysical projects. He has served as Project Manager for investigation and remediation of UXO, CWM, and hazardous waste projects for RCRA and CERCLA programs, and is the primary author for numerous publications on UXO detection on munitions response programs. Mr. Klaff has extensive experience in both the management and technical application of multiple types of investigations, allowing him to understand and merge these often disparate aspects of a project.

Representative Projects

Program Munitions Response Geophysicist, Former Vieques Naval Training Range, Puerto Rico. Responsible for developing and reviewing work plans, designing and implementing the DGM field program, and performing QC of DGM subcontractor operations and data. Designed field data collection and quality control software for geophysical and UXO intrusive operations.

Program Munitions Response Geophysicist, Camp Lejeune, North Carolina. Responsible for developing and reviewing work plans, designing and implementing the DGM field program, and performing QC of DGM subcontractor operations and data for multiple MR sites over hundreds of acres slated for residential and military construction/reuse.

Program Munitions Response Geophysicist, Fixed Price Remediation with Insurance for Military Munitions Response (MMR) Removal/Remedial Action Services Contract. Developed proposals, project documents (e.g. work plans, Explosives Safety Submissions [ESS], ESP, reports), and provided design and oversight of DGM field programs and QC of DGM subcontractor operations and data.

Project MR and Quality Control Geophysicist for Multiple MR/CWM Investigations (Various Army, Navy and Air Force Contracts); National and International Sites. Responsible for design and implementation of geophysical operations over thousands of acres of UXO areas at over 75 different UXO/CWA sites, oversight of DGM subcontractors, and quality control review of data. Investigations vary from ground-based digital geophysical mapping (time-domain electromagnetics, magnetometry, frequency domain electromagnetics, ground penetrating radar) to airborne helicopter magnetometer and underwater EM surveys.

Project Manager and Quality Control Geophysicist, UXO Investigations and Geophysical Surveys, Nicolet River Channel and Landroche Channel, Nicolet, Quebec. Responsible for project management, technical approach development, quality control oversight, and reporting for all aspects of investigation. Investigation included of underwater DGM of approximately 53 ha in the Nicolet River and Lac St. Pierre.

Project Manager and Quality Control Geophysicist, UXO Wide Area Assessment at the Former Goose Lake Range and Commonage Areas, Vernon, British Columbia, Canada. Responsible for project management, technical approach development, quality control oversight and reporting for all aspects of investigation. Investigation encompassed wide area assessment of site, including airborne Orthophotography/LiDAR (Light Detection and Ranging) (11,000 ha), and Helicopter Magnetics survey (1,820 ha, and ground-based digital geophysical mapping (7 ha).

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CHARLES (CHRIS) ROSE

Senior UXO Supervisor/Site Manager

Mr. Rose is a SUXOS with more than 21 years of experience.

Representative Projects

Senior UXO Supervisor/UXO Safety Officer/UXO Quality Control Specialist – Aug 2008 to Present. 12 years of experience in Civilian Munitions Response and 10 years of experience in U. S. Army Explosive Ordnance Disposal.

Senior UXO Supervisor, OB/OB Closure Project, Camp Navajo, Bellemont, AZ – March 09 to Present. Supervised the surface clearance of over 360 acres and the soil sieving of over 15,000 yards of MEC contaminated soil. Managed multiple subcontractors and as many as 40 site personnel.

UXO Quality Control Officer/UXO Safety Officer, Munitions Response for Leeward North Migrant Camp Munitions Response Area, Guantanamo Bay, Cuba, 11/08 – 02/09. Performed duties as UXO Quality Control and Safety Officer on a project that included brush removal, geophysical data collection, UXO Surface and Sub-surface clearance of over 400 acres and the disposal of MEC. Performed oversight of multiple subcontractors and as many as 100 site personnel.

Education

Bachelor of Science, Athens State College, Athens, AL

Registration

Arkansas Department of Labor, Safety Division: Blaster #121;
State of Oklahoma Mining Commission: Certified Blaster #R1591;
State of Tennessee: Registered Blaster #00029952

Distinguishing Qualifications

Senior UXO Supervisor for UXO Surface Clearance and Soil Sieving Projects; Camp Navajo, Bellemont, AZ

Radiation Worker Level II certification, Senior UXO Supervisor for Radiation and UXO cleanup operation Tonopah Test range (TTR), Nevada

UXO Quality Control Officer for Chemical Warfare Material removal operation; The Former Dunn Field, Memphis Depot, Memphis, TN

Certification in Construction Quality Management for Contractors (CQMC)

Site Supervisor/Senior UXO Supervisor, Former NAS Cecil Field, Jacksonville, FL, 08/08 - 10/08. Supervised multiple sub-contractors and 20 site personnel on a MEC Sub-surface Removal/MEC Construction Support project. Project was awarded the CH2M HILL Target Zero Quarterly Safety Award.

Experience Prior to CH2M HILL

UXO Quality Control Officer/UXO Safety Officer, Former Southwest Proving Ground, Hope, AR, Zapata Engineering, 02/08 - 07/08. UXO Quality Control and Safety Officer on an EE/CA that included brush removed, geophysics, sub-surface investigation and MEC disposal on over 2000 acres.

UXO Safety Officer, Ft. Belvoir Engineer Proving Ground, Springfield, VA , Zapata Engineering, 12/06 – 09/07. Performed duties as UXO Safety Officer on a UXO clearance project that included brush removal, geophysics, sub-surface removal and MEC disposal of over 1000 training landmines.

Site Supervisor/Senior UXO Supervisor, Tonopah Test Range, NV Zapata Engineering, 05/06 – 11/06. Supervised the UXO surface sweep and robot geophysical data collection on more than 1100 acres and the removal of 150 pounds of depleted uranium.

Site Supervisor/Senior UXO Supervisor, Oahu and Maui, HI, Zapata Engineering, 2003 – 2006. Supervised numerous EE/CAs on the Islands of Oahu and Maui.

UXO Quality Control Officer, The Former Dunn Field, Memphis Depot, Memphis, TN, UXB INT, 03/00 – 01/01. Performed UXO QC duties on a Chemical Warfare Material removal operation which removed over 20 vented WWII era German Mustard Bombs.

Explosive Ordnance Disposal Technician, US Army, 1986 – 1996. Duties included EOD Section Sergeant supervising 3 EOD Teams during Operation Provide Comfort in Northern Iraq and EOD Instructor for the Basic and Advanced Non-Commissioned Officers courses and the Phase III EOD Course, Redstone Arsenal, AL.

CLIFFORD (CLIFF) WALDEN

UXO Quality Control/UXO Safety Officer

Education

US Army Chemical Weapons School, Redstone Arsenal, AL, December 1974

US Navy School Explosive Ordnance Disposal (EOD) (Basic), Indianhead, MD, April 1975

US Navy School EOD Nuclear Phase, Indianhead, MD, June 1975

US Navy School EOD Advanced Training, May 1979, September 1980, April 1988, May 1992

US Air Force Dynamics of International Terrorism, August 1988

US Navy School EOD, Advanced Access and Disablement (AA&D), April 1990

Distinguishing Qualifications

Has performed as Technical Manager, Senior UXO Supervisor (SUXOS), UXO Team Leader (UXOTIII), UXO Technician (UXOTII), UXO Safety Officer (UXOSO), and UXO Quality Control Specialist (UXOQCS) at Base Realignment and Closure (BRAC) sites, Formally Used Defense Sites (FUDS), EPA Superfund Sites and Active Military impact/demolition ranges throughout the Continental United States.

40 Hour Hazardous Waste Operations & Emergency Response (HAZWOPER) Course; Current 8 Hour HAZWOPER Supervisor Course; Current first aid, cardiopulmonary resuscitation, automatic external defibrillator training

Mr. Walden has more than 35 years of EOD experience, which includes over 10 years of conventional munitions response and 5 years of chemical warfare material response experience.

Representative Projects

Military Facilities, Munitions Response, Navy Clean Program-Unexploded Ordnance Quality Assurance; Vieques Naval Training Range and Naval Ammunition Support Detachment; US Navy; Vieques Island, Puerto Rico; November 2005 to present. Performs quality assurance (QA) inspections, revises site explosive plan, and revises site explosive safety submission (ESS). Assists with air monitor and radio maintenance. Provides munitions and explosives of concern (MEC) escort and contractor support services over approximately 14,600 acres.

Unexploded Ordnance Quality Assurance; Remedial Investigation/Feasibility Study of the Thermal Treatment Unit and Surrounding Areas; US Navy; Naval Weapons Station Yorktown, Virginia; November 2005 to 2006. Assisted writing the explosive safety submission (ESS). Provided munitions and explosives of concern (MEC) escort and contractor support services.

Experience Prior to CH2M HILL

August 2001 to October 2005, Zapata Engineering, Inc., worked on munitions response projects nationwide as Technical Manager, Site Manager, Senior Unexploded Ordnance Supervisor (SUXOS), Unexploded Ordnance Safety Officer (UXOSO), or Unexploded Ordnance Quality Control Specialist (UXOQCS). Sites worked included Former Camp Croft Army Training Facility, Spartanburg, SC; former Opana Point Bombing Range and Makawao Gunnery Range, Island of Maui, Hi; Former Camp Wellfleet, Wellfleet, MA; Lake Bryant, FL; Schofield Barracks, HI; and Former Nansemond Ordnance Depot, VA.

June 2001 to August 2001, USA Environmental, Inc., worked as a UXO Technician II (UXOTII) at Conway, SC and Ft Stewart, GA.

July 2001, TekStar, LLC (TSI), worked as a UXOTII on a munitions response project at Ft McClellan, AL.

June 2001, Explosive Ordnance Technologies Incorporated (EOTI), UXOTIII, team leader on a munitions response project at Tooele Army Depot, UT.

August 2000 to May 2001, UXB International, UXOTII, UXOTIII, UXOQCS, and UXOSO (promoted as positions became available) on a munitions response project at Dunn Depot, Memphis, TN.

August 1996 to July 2000, owned and operated Awesome Pools, a swimming pool maintenance and cleaning company in Ft Walton Beach, FL.

Explosive Ordnance Disposal Technician, NCOIC, and Chief, USAF, 1975 – 1996. Duties included team supervision and resource management at EOD Deployment & Equipment Flight 96th Civil Engineering Group, Eglin AFB, FL; EOD Flight, 35th Civil Engineer Squadron, Misawa Air Base, Japan; EOD Flight Operations and Range Operations, 58th EMS, Luke AFB, AZ; EOD Flight Training and Administration at the 7008th EOD Flight RAF Lakenheath, UK.; Moody AFB, GA; and George AFB, CA.

Appendix H
Technical Project Planning Work Sheets

FTRU-001-R-01, Anti-Tank/Rocket Grenade Range
FTRU-003-R-01, Infiltration/Grenade Range
FTRU-004-R-01, .22 Caliber Target Butt

Fort Rucker, Alabama

TPP Team	**EM 200-1-2, Paragraph 1.1.1**
	Decision Makers
Customer	U.S. Army Environmental Center (USAEC); U.S. Army Corps of Engineers, Mobile District (USACE)
Project Manager	Mark Sherrill (CH2M HILL)
Regulators	Alabama Department of Environmental Management (ADEM)
Primary Stakeholders	Fort Rucker, USAEC, USACE, ADEM, EPA

Data Types	**Data Users**	**Data Gatherer**
Demographics/Land Use	Risk, Responsibility, and Compliance Perspectives	CH2M HILL (Senior Scientist, Risk Specialist)
Site Conditions	Remedy Perspective	CH2M HILL (Geologist, Senior Scientist)
Munitions and Explosives of Concern (MEC)	Risk and Remedy Perspectives	CH2M HILL (UXO Technician III or higher, Risk Specialist, Senior Scientist)
Munitions Constituents (MC)	Risk and Remedy Perspectives	CH2M HILL (Chemist, Risk Specialist, Senior Scientist)
Endangered Species	Risk and Compliance Perspectives	CH2M HILL (Staff Scientist, Risk Specialist)

CUSTOMER'S GOALS EM 200-1-2, Paragraph 1.1.2

Munitions Response Site (MRS)	**Contaminant Issues**	**Future Land Use**	**Site-specific Closeout Goal (if applicable)**
Anti-Tank/Rocket Grenade Range	MEC, MC	Recreational (golf course); undeveloped	LUCs
Infiltration/Grenade Range	MEC, MC	Recreational (golf course and equestrian center); undeveloped	LUCs
.22 Caliber Target Butt	MC	Recreational (fitness trail); undeveloped,	LUCs

Site Closeout Statement

To manage the potential munitions and explosives of concern (MEC) and munitions constituents (MC) risk through a combination of removal, administrative controls, and public education; thereby rendering the site as safe as reasonably possible to humans and the environment and conducive to the anticipated future land use.

Customer's Schedule Requirements

RFI for each MRS by October 30, 2010

Customer's Site Budget

RFI and Reporting Payment Upon Completion of Milestones

IDENTIFY SITE APPROACH		
EXISTING SITE INFORMATION & DATA EM 200-1-2, Paragraph 1.1.3 and 1.2.1		
Attachment(s) to Phase I TPP Memorandum	**Located at Repository**	**Preliminary Conceptual Site Model**
Historical Records Review	Yes	Yes
SI Report	Yes	Yes
POTENTIAL POINTS OF COMPLIANCE EM 200-1-2, Paragraph 1.2.1.3		
Determination of absence or presence of MEC/MC		
If MEC is detected, identification and demilitarization/removal.		
If MC is detected above soil screening levels as identified in "Site Constraints and Dependencies" below to determine if further MC evaluation is warranted.		
Avoidance of sensitive conditions: threatened or endangered species, archaeological sites		
MEDIA OF POTENTIAL CONCERN EM 200-1-2, Paragraph 1.2.1.4		
Qualitative review of MEC presence.		
Quantitative screening of MC in surface soil		
Comparison criteria		
SITE OBJECTIVES EM 200-1-2, Paragraph 1.2.2		
Collection of sufficient MEC and MC data to determine if concentrations are high enough to warrant further study or action.		
Eliminate from further consideration those releases that pose no significant threat to public health or the environment.		
REGULATOR AND STAKEHOLDER PERSPECTIVES EM 200-1-2, Paragraph 1.2.3		
Regulators	**Community Interests**	**Others**
PROBABLE REMEDIES EM 200-1-2, Paragraph 1.2.4		
Land Use Controls following RFI characterization		
EXECUTABLE STAGES TO SITE CLOSEOUT EM 200-1-2, Paragraph 1.2.5		
RCRA Facility Investigation (RFI)		
Corrective Measures Study (CMS)		
Statement of Basis		
Corrective Measures Implementation Plan		
Certification of Remedy Completion		
Recurring Review		
Time Critical Removal Action (as required)		

IDENTIFY CURRENT PROJECT

SITE CONSTRAINTS AND DEPENDENCIES EM 200-1-2, Paragraph 1.3.1

Administrative Constraints and Dependencies

Funding
Biological Assessment (optional)
Cultural resources survey (optional)

Technical Constraints and Dependencies

Property owner site activities (e.g., exclusion zones, site access)
Habitat for federally listed species (TBD)
Topography/Vegetation
Close proximity to golf course and equestrian center

Legal and Regulatory Constraints and Dependencies

Consistent with CERCLA and NCP

Stakeholder, and regulatory involvement and review of key documents

CURRENT EXECUTABLE STAGE EM 200-1-2, Paragraph 1.3.3

RCRA Facility Investigation

See attached worksheets developed by Corps of Engineers, Los Angeles District (CESPL), and ITSI/Parsons

Basic (For Current Projects)	**Optimum** (For Future Projects)	**Excessive** (Objectives that do not lead to site closeout)
RFI	Removal Action	

PROJECT OBJECTIVE WORKSHEET

Sites: FTRU-001-R-01, Anti-Tank/Rocket Grenade Range
FTRU-003-R-01, Infiltration/Grenade Range
FTRU-004-R-01, .22 Caliber Target Butt

Project: Fort Rucker, Alabama

Site Objective					Data Needs	Data Collection Methods	Project Objective Classification
Number	Executable Stage		Description	Source			
	Current	Future					
1	Yes		Delineate MEC and MC within the Anti-Tank/Rocket Grenade Range,Infiltration/Grenade Range, and .22 Caliber Target Butt	HRR, SI	UXO	Historical Review, Geophysical, GPS, Site screening	Basic
2	Yes		Determine presence/absence of MEC, and presence/absence of MC before/after detonation	RFI	Nature and extent of MEC/MPPEH and MC	RI	Optimum
3		Yes	LUC Implementation	Fort Rucker, ADEM	Site conditions, Land use, regulatory compliance	RFI Report	Basic

SITE INFORMATION WORKSHEET

Sites: FTRU-001-R-01, Anti-Tank/Rocket Grenade Range
FTRU-003-R-01, Infiltration/Grenade Range
FTRU-004-R-01, .22 Caliber Target Butt
Project: Fort Rucker, Alabama

Number	Site Information Needed	Potential Source(s) of Site Information	User of Site Information	Suggested Means to Obtain Information	Deadline for Obtaining Information
1	Historical use of land	HRR, SI	CH2M HILL	Fort Rucker	Already obtained
2	Previous site investigations	HRR, SI	CH2M HILL	Fort Rucker	Already obtained
3	Cultural resources	HRR, SI	CH2M HILL	Fort Rucker	TBD
4	Biological assessment	HRR, SI, Fort Rucker Environmental Office	CH2M HILL	Fort Rucker	TBD
5	Soil Background Metal Concentrations		CH2M HILL	Fort Rucker	TBD
6					

DATA QUALITY OBJECTIVES WORKSHEET

Site: FTRU-001-R-01, Anti-Tank/Rocket Grenade Range
FTRU-003-R-01, Infiltration/Grenade Range
FTRU-004-R-01, .22 Caliber Target Butt
Project: Fort Rucker, Alabama

DQO Statement Number: 1

Intended Data Use: (Which project objective (s) will be satisfied?)	Prepare and obtain stakeholder concurrence on a Decision Document (the RCRA Statement of Basis)
Data need requirements: (What data do you need to collect?) see para 3-3.	The type, distribution, and density of MEC/MPPEH and any MC within the MRSs.
Are data: basic, optimal, or excessive need? (see para 3-4)	Data needs are basic and optimal.
How much data is enough?	Any presence or evidence of munitions and explosives of concern or munitions debris, either in soil on the surface or subsurface. Any presence of MC in surface soil above screening levels.
How will these data be collected?	Geophysical mapping of transects, and intrusive investigation of selected anomalies (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range). Munitions Constituents analysis (MC) by screening using XRF and the collection of soil samples for small arms metals (.22 Caliber Target Butt) and the collection of soil samples for metals and explosives (Anti-Tank/Rocket Grenade Range and Infiltration/Grenade Range). MC samples will be analyzed as follows: Explosives by Method SW8330 and ,metals by Method SW6010B.
Was Data Quality Objective attained?	TBD
Where are supporting data maintained?	Fort Rucker, CH2M HILL