

Final

Expanded Range Assessment and Phase II Site Inspection Work Plan

for

Former Vieques Naval Training Range (VNTR)

Vieques, Puerto Rico



Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic

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Prepared by

CH2MHILL

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**Expanded Range Assessment and Phase II Site
Inspection Work Plan**

**Former Vieques Naval Training Range (VNTR)
Vieques, Puerto Rico**

**Contract Task Order 047
November 2006**

**Prepared for
Department of the Navy
Atlantic Division
Naval Facilities Engineering Command**

**Under the
LANTDIV CLEAN III Program
Contract N62470-02-D-3052**

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1 Executive Summary

2 Munitions Response Program Overview

3 The Munitions Response Program (MRP) for the former Vieques Naval Training Range
4 (VNTR), Vieques, Puerto Rico, is intended to be a phased approach that will extend over
5 several years. The objectives of the MRP include the following:

- 6 • Munitions response actions will be conducted under the Comprehensive Environmental
7 Response, Compensation and Liability Act (CERCLA) National Priority List (NPL)
8 listing and will integrate the Memorandum of Agreement (MOA) between the Navy and
9 Department of Interior (DOI).
- 10 • Conduct munitions response investigations concurrently with munitions removal
11 programs to initiate cleanup during the initial phases of the program.
- 12 • Prioritize munitions response actions at sites based on risk to human health and the
13 environment and expected land use while considering the funding that is available.
- 14 • Sequence investigation and remedial actions for MRSs based on qualitative factors not
15 captured in the site prioritization scoring with input from stakeholders.
- 16 • Conduct a phased approach for response actions, which include site inspections, site
17 investigations, interim removal actions, time-critical removal actions, and permanent
18 remedial actions.
- 19 • Collect information necessary to identify areas not impacted by munitions and
20 explosives of concern (MEC).
- 21 • Assess NPL-designated “Agreed Areas” using the CERCLA process for delineating the
22 extent of the sites.
- 23 • Section the Munitions Response Areas (MRAs) into parcels and Munitions Response
24 Sites (MRSs) to provide an orderly, structured approach for the munitions response
25 actions.
- 26 • Develop response actions that are consistent with the DOI Comprehensive Conservation
27 Plan.

28 Expanded Range Assessment/Phase II Site Inspection Work Plan

29 This Work Plan for the Expanded Range Assessment and Phase II Site Inspection
30 (ERA/Phase II SI) of the former VNTR, Vieques, Puerto Rico, has been prepared to present
31 the technical approach for providing an initial assessment of several MRSs at the former
32 VNTR. These MRSs can then be prioritized relative to each other and sequenced for
33 potential future munitions response actions. The MRSs to be inspected at the former VNTR
34 are located within five MRAs: the Eastern Conservation area (ECA), the Live Impact Area

1 (LIA), the Surface Impact Area (SIA), the Eastern Maneuver Area (EMA), and the Beach
2 Area. This work plan was prepared by CH2M HILL for the Naval Facilities Engineering
3 Command (NAVFAC) Atlantic to meet current Department of Defense (DoD) guidelines for
4 the investigation of MEC.

5 The information collected for the ERA/Phase II site inspection (SI) will not be used to make
6 a final determination of the remedial action for a site. The ERA/Phase II SI will supplement
7 the information previously presented in the Preliminary Range Assessment (PRA) Report
8 (CH2M HILL, April 2003), and the ERA/Phase I SI (CH2M HILL, March 2006), and will also
9 supply information for development of an MRP strategic management plan. The objectives
10 of the ERA/Phase II SI are multifaceted and include the following:

- 11 • Conduct MEC investigations concurrently with interim removal actions.
- 12 • Supplement previous information presented in the PRA and collected during the
13 ERA/Phase I SI to provide information about the types and quantities of MEC at the
14 MRSs investigated.
- 15 • Characterize sites to confirm MRSs, and collect data necessary for assessing future
16 prioritization of munitions response actions.
- 17 • Further characterize extent of munitions at areas investigated under the ERA/Phase I SI,
18 which require additional data for prioritization.
- 19 • Identify the type(s) and location(s) of target areas that may have been used in the MRAs
20 of the former VNTR.
- 21 • Identify potential MRSs where no further munitions response actions will be considered.
22 These sites will require additional site information at a later date to make the final “no
23 further action” determination.
- 24 • Identify MRSs requiring further investigation prior to arriving at decisions on the need
25 (or lack of need) for additional munitions response actions.
- 26 • Identify high-risk MRSs that may require interim removal actions of munitions because
27 of explosives safety concerns.
- 28 • Establish time frames and funding requirements for interim removal actions and
29 disposition of munitions at high-risk MRSs.

30 The scope of work in the work plan is based on available funding. As such, the scope is not
31 intended to characterize the nature and extent of MEC at each MRS but rather to provide
32 data sufficient to prioritize sites for future munitions response actions. These future actions
33 may include: additional site inspections, site investigations, geophysical surveys, interim
34 MEC removal actions, environmental investigations, and removal actions.

35 The ERA/Phase II SI includes different activities to be performed at beach and inland
36 MRAs/MRSs selected for investigation. The tasks to be completed for the Phase II SI are
37 outlined below.

1 MRA-Beach Area

- 2 • Perform digital geophysical mapping (DGM) of 75 acres of beaches within the EMA, SIA
3 and LIA from the water line inland to the area where the vegetation density precludes
4 mapping. The information from this mapping will be utilized to complete a non-time
5 critical removal action of the beaches.

6 Roads within the Former VNTR

- 7 • Perform DGM of 220 acres of roadways including a 25-foot buffer each side of roadway.
8 The information from this mapping will be utilized to complete a non-time critical
9 removal action of the roads.

10 MRA-ECA

- 11 • Perform surface MEC evaluation of approximately 10 percent of the ECA using a
12 transect approach. This evaluation excludes areas inundated by water.

13 MRA-SIA

- 14 • Perform surface MEC evaluation of approximately 10 percent of MRSs 1 through 7.
- 15 • Perform surface MEC evaluation of 100 percent of photo identified site (PI) 1, 17, and
16 potential area of concern (PAOC) Y.
- 17 • Based on the accessibility of the northern and southern portions of MRSs 1 and 7 more
18 assessment may be conducted in these areas depending on field findings.

19 MRA-EMA

- 20 • Perform surface MEC evaluation of approximately 10 percent of MRSs 15 through 20, 25
21 through 29, 34, 35, and 40 utilizing a transect approach.
- 22 • Perform surface MEC evaluation of approximately 10 percent of range fan areas within
23 MRSs 30, 32, and 36 through 38(including PAOC BB).
- 24 • Perform surface MEC evaluation of 100 percent of PIs 2, 3, 13, 14, 15, 16, 18, and 19;
25 PAOCs Z, EE, and FF; and two Areas of Interest (AOI).
- 26 • Evaluate 6 sites identified by United States Fish and Wildlife Service (USFWS) on and
27 near EMA MRS 46.
- 28 • A 10 percent surface MEC evaluation at MRSs 2 and 4 will be conducted to determine if
29 MEC is present beyond the extent of the target areas using a transect approach.

30 In addition to the inspections completed in the MRAs identified above, a desktop slope and
31 landscape analysis for the entire former VNTR will be conducted to assess areas of difficult
32 access due to slopes or other landscape features that may limit investigations and/or
33 removal actions. The findings from slope and landscape analysis will be ground truthed
34 during surface MEC evaluations.

35 Based on the field investigation results and the explosives safety risk, the MRSs will be
36 prioritized for future munitions response actions. The ERA/Phase II SI will utilize available
37 information gathered through the combination of desktop information collection and analysis

1 and field investigations. Following consensus on an explosive hazard assessment protocol, a
2 preliminary assessment of the explosive hazard posed by any MEC will be completed for each
3 of the MRSs.

4 The site prioritization results will classify the sites into one of the following categories:

- 5 • **Sites Recommended for Site Inspection:** for those sites requiring additional data to be
6 collected based on the findings from the site investigations.
- 7 • **Sites Recommended for Time-Critical/Non Time-Critical Removal Action:** for those
8 sites that are the highest priority to initiate removal action in the early stages of the MRP.
- 9 • **Sites Recommended for Site Characterization:** for those sites where a relatively high
10 explosive hazard was identified and additional site characterization is needed to
11 delineate the nature and extent of MEC such that a remedial action cost estimate can be
12 prepared to subsequently procure a removal action
- 13 • **Sites with the Prioritization Evaluation Pending:** when there are known or suspected
14 MEC but sufficient information is not available to determine the rating
- 15 • **Site where Prioritization is No Longer Required:** MRSs that no longer require an
16 assigned priority because DoD has conducted a response, all objectives set out in the
17 response have been achieved, and no further action except for long term management
18 and recurring reviews is required
- 19 • **Sites Recommended For No Further Action:** Sites with no known or suspected hazard
20 do not require evaluation under prioritization; however, sufficient information/ data
21 will be required to support a no further action decision

Resumen Ejecutivo

Descripción del Programa de Respuesta a Municiones

El Programa de Respuesta a Municiones (MRP, por sus siglas en inglés) para el Antiguo Campo de Entrenamiento Naval (VNTR, por sus siglas en inglés), Vieques, Puerto Rico, es un acercamiento en fases que se extenderá por muchos años. Los objetivos del MRP incluyen los siguientes:

- Llevar a cabo acciones de respuesta a municiones bajo la Ley de Respuesta Ambiental, Responsabilidad y Compensación Comprensiva (CERCLA, por sus siglas en inglés), la Lista de Prioridades Nacionales (NPL, por sus siglas en inglés) e integrará el Documento del Acuerdo (MOA por sus siglas en inglés) entre la Marina y el Departamento del Interior (DOI, por sus siglas en inglés).
- Llevar a cabo investigaciones de respuesta a municiones concurrentemente con el programa de remoción de municiones para iniciar la limpieza durante las fases iniciales del programa.
- Dar prioridad a las acciones de respuesta a municiones en los sitios en base a los riesgos a la salud humana y al ambiente y el uso esperado de los terrenos al mismo tiempo que se consideran los fondos disponibles.
- Investigación secuencial y acciones de remediación para los sitios de respuesta a municiones (MRSs por sus siglas en inglés) en base a factores cualitativos no capturados en el puntaje para definir la prioridad de los sitios con información de las partes interesadas.
- Llevar a cabo un acercamiento en fases para acciones de respuesta, que incluye inspecciones al sitio, investigaciones del sitio, acciones de remoción provisionarias, acciones de remoción de tiempo crítico, y acciones de remediación permanentes.
- Colectar la información necesaria para identificar áreas que no hayan sido impactadas por municiones y explosivos de preocupación (MEC, por sus siglas en inglés).
- Evaluar las áreas NPL-designadas como “Áreas Acordadas” utilizando el proceso de CERCLA para delinear la extensión de los sitios.
- Dividir las Áreas de Respuesta a Municiones (MRAs, por sus siglas en inglés) en parcelas y MRSs para proveer un acercamiento ordenado y estructurado para las acciones de respuesta a municiones.
- Desarrollar acciones de respuesta que vayan de acuerdo con el Plan Abarcador de Conservación del DOI.

Note: This summary is presented in English and Spanish for the convenience of the reader. Every effort has been made for the translations to be as accurate as reasonably possible. However, readers should be aware that the English version of the text is the official version.

Nota: Este resumen se presenta en inglés y en español para la conveniencia del lector. Se han hecho todos los esfuerzos para que la traducción sea precisa en lo más razonablemente posible. Sin embargo, los lectores deben estar al tanto que el texto en inglés es la versión oficial.

Plan de Trabajo para la Evaluación Expandida del Campo de Tiro y la Inspección del Sitio Fase II

Se preparó este plan de trabajo para la Evaluación Expandida del Campo de Tiro y la Inspección del Sitio Fase II (ERA/Phase II SI, por sus siglas en ingles) del Antiguo VNTR, Vieques, Puerto Rico, para presentar el acercamiento técnico para proveer una evaluación inicial de varios MRSs en el Antiguo VNTR. Luego de esto, se les puede dar a los MRSs la prioridad comparándolos entre ellos y se puede definir una secuencia para futuras acciones de repuesta a municiones potenciales. Los MRSs a ser inspeccionados en el Antiguo VNTR están ubicados dentro de cinco MRAs: el Área de Conservación del Este (ECA, por sus siglas en ingles), el Área de Impacto Vivo (LIA, por sus siglas en ingles), el Área de Impacto de Superficie (SIA, por sus siglas en ingles), el Área de Maniobras del Este (EMA, por sus siglas en ingles), y el Área de la Playa. Este plan de trabajo ha sido preparado por CH2M HILL para Las Facilidades Navales del Comando de Ingeniería, División del Atlántico (NAVFAC, por sus siglas en ingles) para cumplir con las guías actuales del Departamento de la Defensa (DoD, por sus siglas en ingles) para la investigación de MEC.

La información obtenida para la inspección del sitio ERA/Phase II (SI, por sus siglas en ingles), ERA/Fase II no será utilizada para tomar una determinación final sobre la acción de remediación para un sitio. El ERA/Fase II SI suplementará la información previamente presentada en el Reporte de Evaluación Preliminar del Campo de Tiro (PRA, por sus siglas en ingles) (CH2M HILL, abril 2003), y el ERA/Fase I SI (CH2M HILL, marzo 2006), y también proveerá información para el desarrollo de un plan de MRP de manejo estratégico. Los objetivos del ERA/Fase II SI son multifacéticos e incluyen los siguientes:

- Llevar a cabo investigaciones de MEC concurrentemente con las acciones de remoción provisorias.
- Suplementar información previamente presentada en el PRA y recogida durante la ERA/Fase I SI para proveer información sobre los tipos y cantidades de MEC en los MRSs investigados.
- Caracterizar los sitios para confirmar MRSs, y recoger los datos necesarios para evaluar y dar prioridad a futuras acciones de respuestas a municiones.
- Caracterizar aun más la extensión de municiones en áreas investigadas bajo el ERA/Fase I SI, el cual requiere datos adicionales para definir las prioridades.
- Identificar el tipo(s) y ubicación(s) de áreas de tiro que pudieron haber sido usadas en el MRAs del Antiguo VNTR.
- Identificar MRSs potenciales donde no se considerarán acciones de respuesta a municiones adicionales. Estos sitios requerirán información adicional más tarde para tomar la decisión final de “ninguna acción adicional”
- Identificar MRSs que requieran investigación adicional antes de llegar a decisiones sobre la necesidad (o no necesidad) de acciones de respuesta a municiones adicionales.
- Identificar MRSs de alto riesgo que puedan requerir acciones de remoción de municiones provisorias debido a preocupaciones de seguridad de explosivos.

- Establecer requisitos de tiempo y fondos para acciones de remoción provisionarias y la disposición de municiones en MRSs de alto riesgo.

El alcance del Plan de Trabajo se basa en los fondos disponibles. Como tal, el alcance no intenta caracterizar la naturaleza y extensión de MEC en cada MRS pero provee datos suficientes para dar prioridad a los sitios para futuras acciones de respuesta a municiones. Estas acciones futuras pueden incluir: inspecciones adicionales del sitio, investigaciones del sitio, monitoreos geofísicos, acciones de remoción MEC provisionarias, investigaciones ambientales, y acciones de remoción.

La Fase II/ERA SI incluye diferentes actividades a ser realizadas los MRAs/MRSs de playas y de tierra adentro seleccionadas para investigación. Las tareas a ser completadas para la Fase II SI se describen abajo:

MRA-Área de la Playa

- Realizar mapas geofísicos digitales (DGM, por sus siglas en ingles) en 75 acres de playas dentro del EMA, SIA y LIA desde la línea del agua tierra adentro hasta área donde la densidad de la vegetación imposibilita el delineamiento. Se utilizará la información de este mapa para completar una acción de remoción de tiempo no-crítico en las playas.

Carreteras dentro del Antiguo VNTR

- Realizar DGM en 220 acres de carreteras incluyendo una barrera de 25-pies a ambos lados de la carretera. Se utilizará la información de este mapa para completar una acción de remoción de tiempo no-crítico en las carreteras.

MRA-ECA

- Realizar una evaluación de MEC en la superficie de aproximadamente 10 por ciento del ECA usando transectas. Esta evaluación excluye áreas inundadas por el agua.

MRA-SIA

- Realizar una evaluación de MEC en la superficie de aproximadamente 10 por ciento de MRSs 1 al 7.
- Realizar una evaluación de MEC en la superficie del 100 por ciento de los sitios 1 y 17 que fueron identificados con fotografías (PI por sus siglas en ingles), y en las áreas de preocupación potenciales Y (PAOC, por sus siglas en ingles).
- En base al acceso de las porciones norte y sur de los MRSs 1 y 7, se podrían llevar a cabo más evaluaciones de estas áreas dependiendo de los hallazgos en el campo.

MRA-EMA

- Realizar una evaluación MEC en la superficie de aproximadamente 10 por ciento de MRSs 15 al 20, 25 al 29, 34, 35, y 40 utilizando un acercamiento con transectas.
- Realizar una evaluación de MEC en la superficie de aproximadamente 10 por ciento de los abanicos del campo de tiro dentro de los MRSs 30, 32, y 36 al 38 (incluyendo PAOC BB).

- Realizar una evaluación de MEC en la superficie del 100 por ciento de los PIs 2, 3, 13, 14, 15, 16, 18, y 19; PAOCs Z, EE, y FF; y dos de Áreas de Interés (AOI, por sus siglas en ingles).
- Evaluar 6 sitios identificados por el Servicio de Pesca y Vida Silvestre de los Estados Unidos (USFWS, por sus siglas en ingles) en y cerca MRS 46 en el EMA.
- Se conducirá una evaluación de MEC en superficie de los MRSs 2 y 4 usando transectas para determinar la presencia de MEC más allá de la extensión de las áreas de tiro.

Además de las inspecciones completadas en los MRAs identificados arriba, se llevará a cabo una análisis de escritorio de la pendiente y el paisaje para todo el Antiguo VNTR para evaluar las áreas de acceso difícil debido a las pendientes u otras características del paisaje que puedan limitar la investigación y/o acciones de remoción. Estos hallazgos de pendientes y análisis de paisajes serán considerados confirmados durante las evaluaciones de MEC en la superficie.

Basado en los resultados de las investigaciones de campo y los riesgos de explosivos, se le dará prioridad a los MRSs en futuras acciones de respuesta de municiones. El ERA/Fase II SI utilizará información disponible recopilada a través de la combinación de información recolectada y las investigaciones y análisis de campo. Luego del consenso del protocolo de evaluación de explosivos peligrosos, se completará para cada uno de los MRSs una evaluación preliminar del peligro de explosivos que pudiera presentar cualquier MEC.

Los resultados de la prioridad del sitio clasificarán los sitios dentro de una de las siguientes categorías:

- **Sitios recomendados para inspección:** para aquellos sitios que requieren recolectar datos adicionales basados en los hallazgos de las investigaciones del sitio.
- **Sitios Recomendados para Tiempo Crítico/Acción de Remoción de Tiempo No-Crítico:** para aquellos sitios que posean la más alta prioridad para iniciar la acción de remoción en la etapa temprana del MRP.
- **Sitios recomendados para caracterización:** para aquellos sitios donde se ha identificado un peligro de explosivos relativamente alto y necesitan una caracterización adicional para delinear la naturaleza y extensión del MEC para que se pueda preparar un costo estimado para acción de remediación y subsecuentemente procurar una acción de remoción.
- **Sitios con evaluación de prioridad pendiente:** cuando se sabe o se sospecha hay MEC pero no existe suficiente información disponible para determinar el grado.
- **Sitios donde ya no es necesaria una prioridad:** MRSs que ya no necesitan se les asigne una prioridad porque el DoD ha llevado a cabo una respuesta, todos los objetivos señalados en la respuesta han sido cumplidos y no se necesita más acción excepto el manejo a largo plazo y revisión periódica.
- **Sitios recomendados para Ninguna Acción Adicional:** sitios sin ningún peligro conocido o sospechado no requieren evaluación bajo prioridad; sin embargo, se

requerirá suficiente información/datos, para apoyar la decisión de ninguna acción adicional.

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1 Acronyms and Abbreviations

2	AFWTF	Atlantic Fleet Weapons Training Facility
3	AOI	Area of Interest
4	ATG	Air-to-Ground
5	BIP	Blow-in-Place
6	CERCLA	Comprehensive Environmental Response, Compensation and
7		Liability Act
8	CLEAN	Comprehensive Long -Term Environmental Action Navy
9	CSM	Conceptual Site Model
10	DEM	Digital Elevation Model
11	DGM	Digital Geophysical Mapping
12	DoD	Department of Defense
13	DOI	Department of Interior
14	ECA	Eastern Conservation Area
15	EMA	Eastern Maneuver Area
16	ERA	Expanded Range Assessment
17	FS	Field Superintendent
18	ft	feet/foot
19	GIS	Geographic Information System
20	GP	Gun Position
21	GPO	Geophysical Prove-Out
22	GPS	Global Positioning System
23	ID	Identification
24	LAW	Light Anti-Armor/ Anti-Tank Weapon
25	LIA	Live Impact Area
26	MEC	Munitions and Explosives of Concern
27	mm	Millimeter
28	MOA	Memorandum of Agreement
29	MRA	Munitions Response Area
30	MRP	Munitions Response Program
31	MRS	Munitions Response Site
32	NAVFAC	Naval Facilities Engineering Command
33	NOSSA	Naval Ordnance Safety and Security Activity
34	NPL	National Priority List
35	OB/OD	Open Burn/Open Detonation
36	OP	Observation Post

1	PA	Preliminary Assessment
2	PAOC	Potential Area of Concern
3	PI	Photo Identified
4	PM	Project Manager
5	PRA	Preliminary Range Assessment
6	PREQB	Puerto Rico Environmental Quality Board
7	QC	Quality Control
8	RCRA	Resource Conservation and Recovery Act
9	RPM	Remediation Project Manager
10	SAM	Surface to Air Missile
11	SI	Site Inspection
12	SIA	Surface Impact Area
13	SOP	Standard Operating Procedure
14	SUXOS	Senior UXO Supervisor
15	TCRA	Time-critical Removal Action
16	USACE	U.S. Army Corps of Engineers
17	USEPA	U.S. Environmental Protection Agency
18	USFWS	U.S. Fish and Wildlife Service
19	UXO	Unexploded Ordnance
20	UXOSO	UXO Safety Officer
21	VNTR	Vieques Naval Training Range

1 SECTION 1

2 **Introduction**

3 This Work Plan for the Expanded Range Assessment and Phase II Site Inspection
4 (ERA/Phase II SI) of the former Vieques Naval Training Range (VNTR), Vieques, Puerto
5 Rico, has been prepared to present the technical approach for conducting an initial
6 assessment of munitions response sites (MRSs) so that MRSs can be prioritized relative to
7 each other and sequenced for additional munitions response actions at the former VNTR.
8 The MRSs to be inspected at the former VNTR are located within five munitions response
9 areas (MRAs), and the roads within those MRAs. The five MRAs are: the Eastern
10 Conservation Area (ECA), Live Impact Area (LIA), Surface Impact Area (SIA), Eastern
11 Maneuver Area (EMA), and the Beach Area. The LIA was assessed during the ERA Phase I
12 SI and a preliminary assessment of the types and densities of MEC within the LIA was
13 completed. Additionally, a time critical removal action (TCRA) was initiated for the LIA to
14 remove MEC from the surface. Therefore, except for road and beach areas, no additional
15 surface investigation will be conducted for the LIA. Within the MRAs identified above, the
16 road and beach areas, including those within the LIA, will be addressed by performing
17 geophysical mapping of the subsurface. This information will be utilized to complete a non-
18 time critical removal action of the roads and beaches. CH2M HILL prepared this work plan
19 for the Naval Facilities Engineering Command (NAVFAC) Atlantic to meet current
20 Department of Defense (DoD) guidelines for the investigation of munitions and explosives
21 of concern (MEC).

22 This work plan presents the technical approach for conducting the ERA/Phase II SI
23 prepared for the former VNTR, Vieques, Puerto Rico. The ERA/Phase II SI will supplement
24 the information previously presented in the Preliminary Range Assessment (PRA) Report
25 (CH2M HILL, April 2003), and collected during the ERA/Phase I SI (CH2M HILL, March
26 2006). The objectives of the ERA/Phase II SI are multifaceted and include:

- 27 • Conduct MEC investigations concurrently with interim removal actions.
- 28 • Supplement previous information presented in the PRA and the ERA/Phase I SI to
29 provide information about the types and quantities of MEC at the MRSs identified.
- 30 • Further characterize the extent of munitions at areas investigated under the ERA/Phase
31 I SI, which require additional data for prioritization.
- 32 • Identify the type(s) and location(s) of target areas that may have been used in the MRAs
33 of the former VNTR.
- 34 • Identify potential MRSs where no further munitions response actions will be considered.
35 These sites will require additional site information at a later date to make the final “no
36 further action” determination.
- 37 • Identify MRSs requiring further investigation prior to arriving at decisions on the need
38 (or lack of need) for additional munitions response actions.

1 • Identify high-risk MRSs that may require interim removal actions of munitions because
2 of explosives safety concerns.

3 • Establish time frames and funding requirements for interim removal actions and
4 disposition of munitions at high risk MRSs.

5 The scope is not intended to characterize the nature and extent of MEC at each MRS, but
6 rather to provide data sufficient to prioritize and sequence sites for future munitions
7 response actions. These actions may include: additional site inspections, site investigations,
8 geophysical surveys, interim MEC removal actions, environmental investigations, and final
9 removal actions.

10 Based on the field investigation and the explosives safety risk, the MRSs will be prioritized
11 for future munitions response actions. The scope of the ERA/Phase II SI is also based on
12 DoD guidance for performing response actions on military ranges and U.S. Environmental
13 Protection Agency (USEPA) guidance for conducting Comprehensive Environmental
14 Response, Compensation, and Liability Act (CERCLA) Preliminary Assessments (PAs), as
15 well as on U.S. Army Corps of Engineers (USACE) and USEPA guidance on ordnance and
16 explosive response actions. The ERA/Phase II SI will utilize available information gathered
17 through a combination of previous archive/file searches; interviews; desktop information
18 collection and analysis; and field investigations. A preliminary assessment of the explosive
19 hazard posed by any MEC will be completed for the MRSs inspected.

20 This Work Plan was prepared by CH2M HILL under Navy Contract N62470-02-D-3052,
21 Navy Comprehensive Long-Term Environmental Action Navy (CLEAN III), Contract Task
22 Order 047.

1 SECTION 2

2 **Site Background and Physical Setting**

3 A detailed description of the background, history (including historical military operations),
4 and physical setting of the former VNTR is provided in the Draft Expanded Range
5 Assessment/ Phase I Site Inspection for the former VNTR (CH2M HILL, March, 2006). The
6 physical setting of these lands is an important consideration when developing the approach
7 for the ERA/Phase II SI and future munitions response actions. The accessibility limitations
8 due to steep terrain and dense vegetation, which contribute to accessibility, are considered in
9 the prioritization of future munitions response actions.

10 This section briefly discusses the military operations for each of the MRAs within the former
11 VNTR and summarizes the results of the ERA/ Phase I SI for each area.

12 **2.1 Former VNTR Location**

13 Vieques is located in the Caribbean Sea approximately 7 miles southeast of the eastern tip of
14 the island of Puerto Rico and 20 miles southwest of St. Thomas, U.S. Virgin Islands. Vieques
15 is the largest offshore island of the Commonwealth of Puerto Rico. It is approximately
16 20 miles long and 4.5 miles wide, and has an area of approximately 33,088 acres (51 square
17 miles). Figure 2-1 shows the regional location of Vieques with respect to the island of Puerto
18 Rico.

19 The former VNTR is situated in the eastern half of the Island of Vieques, and is bordered on
20 the west by the community of Isabel Segunda, to the north by Vieques Sound, and to the
21 south by the Caribbean Sea. The former VNTR consists of approximately 14,500 acres and is
22 divided operationally into four MRAs that (from west to east) include: the EMA, an area
23 approximately 10,900 acres; the SIA; approximately 2,500 acres; the 900-acre LIA, and the
24 200-acre ECA on the easternmost tip of Vieques. The beaches are the 5th MRA discussed in
25 this document. Figure 2-2 presents a site map of former VNTR.

26 **2.2 Munitions Response Area Description**

27 **2.2.1 Eastern Maneuver Area (MRA-EMA)**

28 The MRA-EMA, encompassing 10,900 acres, was established in 1947 and provided
29 maneuvering areas and ranges for the training of Marine amphibious units and battalion
30 landing teams in exercises that included amphibious landings, small-arms fire, artillery and
31 tank fire, shore fire control, and combat engineering tasks. T

32 An aerial photo analysis that was completed for the Draft PRA (CH2M HILL, April 2003)
33 identified eight artillery gun positions within the MRA-EMA from which Marine artillery
34 gunfire was directed toward the MRA-SIA and MRA-LIA. The locations of these gun
35 positions are shown on Figure 2-3. The artillery fired from the gun positions ranged from
36 60mm to 175mm rounds. The estimated artillery safety fans, identifying the potential impact

1 areas from these gun positions is shown on Figure 2-4. An analysis of historical aerial
2 photos identified 19 additional gun positions that were used for either mortar or artillery
3 gunfire. The locations of these gun positions are shown on Figure 2-5.

4 During 1966, six ranges were established in the EMA along the Northern Coast Road where
5 Engineers Road ends. These ranges remained operational through February 1999 when they
6 were deactivated until further notice by the Commanding Officer of Atlantic Fleet Weapons
7 Training Facility (AFWTF). The ranges were used as follows:

8 Range 1: Small Arms Range using service rifles, pistols, and machine guns

9 Range 2: Small Arms Range using pistols and shotguns

10 Range 3: 40mm Grenade projectile Range and small arms [identified in aerial photo
11 analysis as Range 4 and here forth identified as Range 4]

12 Range 4: Anti-armor/ Antipersonnel Live Fire Tracking Range using 3.5-inch rockets
13 and light anti-armor/anti-tank weapons (LAWs) [identified in aerial photo
14 analysis as Range 4B and here forth identified as Range 4B]

15 Range 5: Hand Grenade Range using various types of grenades [identified in aerial
16 photo analysis as Range 3 and here forth identified as Range 3]

17 Range 6: Demolition and small arms range

18 An aerial photograph analysis of the EMA and SIA (ERI, 2002) indicates that as many as 9
19 ranges (11 ranges now that range 4 has been subdivided into 3 discrete ranges, 4, 4A, and
20 4B) and up to 30 gun emplacements and positions may have existed historically at the EMA
21 (Figure 2-5). These ranges are currently identified as ranges 1, 2, 3, 4, 4A, 4B, 5, 6, 7, 8, and 9.
22 Additionally the aerial photograph analysis identified up to nine gun positions and eight
23 observation posts within the SIA (identified on Figure 2-5 as GP for gun position, OP for
24 observation post, or PI for photo-identified site, if the photo-identified site use could not be
25 confirmed). These SIA sites may have been used for mortar or artillery gun training.

26 Several photo identified (PI) and potential areas of concern (PAOC) sites were identified in
27 the Draft Preliminary Range Assessment (CH2M HILL, April 2003) as potentially containing
28 munitions and explosives of concern (MEC). No impacts of any potential environmental
29 releases were observed during the visual site inspection of these sites. These sites include:
30 sites PI 1, PI 2, PI 3, PI 9, PI 15, PI 16, PI 17, PAOC Y, PAOC Z, PAOC AA, PAOC BB, PAOC
31 CC, and PAOC DD. These sites will be further evaluated for munitions and munitions
32 constituents under the munitions response program (MRP).

33 During interviews, several PI Sites were identified that could potentially contain MEC.
34 However, the review of historical records or analysis of aerial photographs did not indicate
35 that these sites were MEC related. In addition, no impacts of any potential environmental
36 releases were observed during the visual site inspection of these sites. These sites include: PI
37 13, PI 14, PI 18, and PI 19, PAOC EE, PAOC FF.

38 Twelve MRSs within the MRA-EMA were investigated as part of the ERA/Phase I SI to
39 assess the types, densities, and nature of the MEC items present at the sites. The areas
40 investigated were:

- 41 • EMA MRSs 1 through 5—the rocket and grenade ranges (3, 4, 4A, 4B, and 5)

- 1 • EMA MRS 6—the artillery shortfall area adjacent to the EMA/SIA boundary
- 2 • EMA MRSs 7 through 11—photo-identified gun positions 14, 15, 17, 18, and 19,
- 3 respectively
- 4 • EMA MRS 12—photo-identified (PI) site 9

5 The results of the ERA/Phase I SI revealed that only MRSs 1, 2, and 4 had MEC present.
6 There was one MEC item located at each of these MRSs that required disposal. It is apparent
7 that maintenance of the ranges at MRSs 2 and 4 has been carried out during the history of
8 their usage. During this investigation the target areas were evaluated and in both cases the
9 items requiring disposal were found at the fringes of the target areas. Additionally, MRS 2
10 had a number of targets that appear to be free of MEC based on a visual assessment; however,
11 a thorough investigation of the targets was not conducted (e.g., disassembly and inspection of
12 internal areas).

13 EMA MRS 6 is a large area and a number of expended items were located. Two expended
14 items were located at EMA MRS 12, but appeared to have been placed at the location found.
15 A number of subsurface anomalies were detected at EMA MRS 12 during the Phase I Site
16 Inspection. It was verified that none of the items located at EMA MRSs 6 and 12 presented an
17 explosive hazard; however, there is a potential for subsurface MEC at the MRSs.

18 MRSs 3, 5, and 7 through 11 showed a low explosive hazard from the items found (small
19 arms, and expended items) and the limited accessibility to the MRSs. Based on the results of
20 the ERA/Phase I Site Inspection, the following recommendations were presented for
21 consideration:

- 22 • Due to the high explosive hazards associated with MEC at MRA-EMA MRSs 2, and 4
23 further evaluation of the areas adjacent to the target areas should be completed at these
24 MRSs.
- 25 • Due to the surface findings at MRA-EMA MRS 6 and the location of subsurface
26 anomalies, a limited subsurface evaluation is recommended.
- 27 • Due to the accessibility and subsurface detections at MRA-EMA MRS 12, a limited
28 subsurface evaluation is recommended.
- 29 • Several PI and PAOC sites were identified in the Preliminary Range Assessment
30 (CH2M HILL, April 2003) and Draft Resource Conservation and Recovery Act (RCRA)
31 Facility Investigation Report (CH2M HILL, June 2004) as potentially containing MEC.
32 These sites: PI 2, PI 3, PI 13, PI 14, PI 17, PI 18, PAOC Y, PAOC Z, PAOC EE, and PAOC
33 FF should be inspected to assess the potential explosive safety hazard of each at these
34 sites.

35 2.2.2 Surface Impact Area (MRA-SIA)

36 The 2,500 acre SIA was established in the 1950s with the construction of several Marine
37 targets. Marine artillery ranging from 76mm to 175mm was directed toward these targets
38 from artillery gun positions within the MRA-SIA and MRA-EMA. During 1969, the
39 construction of bulls-eye targets 1 and 2, used for inert bombing, established the eastern and
40 western boundaries of the MRA-SIA. At that time, a permanent observation post (OP) with a

1 helicopter pad was also constructed on Cerro Matais. In 1971, a strafing target was installed
2 adjacent to one of the targets. The aerial photo analysis identified numerous craters within
3 the eastern two-thirds of the MRA-SIA that were caused by mortar and artillery fire, naval
4 gunfire, and aerial bombing. The craters were most visible on the 1962 aerial photographs. In
5 addition, the aerial photo analysis identified several artillery gun positions and OPs within
6 the MRA-SIA that may have been used for artillery fire. The locations of artillery gun
7 positions and the artillery targets are shown on Figure 2-3. The locations of the additional
8 gun positions and observation posts identified from the analysis of the aerial photos are shown
9 on Figure 2-5.

10 SIA MRS 1 was the only MRS surveyed in the SIA during the Phase I Site Inspection. MRS 1
11 was a marine artillery target area for marine artillery gunfire from the gun positions within
12 the EMA.

13 A moderate to high screening level for exposure to explosive hazard exists at the MRA-SIA
14 MRS 1 based on the high explosive hazard associated with the surface MEC identified at the
15 MRS. However, access to the areas is limited due to very dense vegetation and rough terrain
16 (e.g., steep slopes). The subsurface was evaluated at MRS 1 using handheld magnetometers
17 and a total of 30 subsurface anomalies were located, which is only slightly more than 1
18 anomaly/acre, which is a low density.

19 Based on the results of the ERA/Phase I Site Inspection, further investigation of surface
20 MEC in the MRA-SIA was recommended to determine the extent and densities of MEC.

21 2.2.3 Live Impact Area (MRA-LIA)

22 In 1965, ATG training activity began in the MRA-LIA where several mock-ups, such as old
23 tanks and vehicles, were used as targets for aerial bombing. Since the mid-1970s, naval
24 gunfire was practiced at the MRA-LIA, where several point and area targets for ships were
25 constructed. Locations of the air-to-ground (ATG) bombing targets and the naval gunfire
26 targets in the MRA-LIA are shown on Figure 2-3. Based on the naval gunfire and ATG gunfire
27 that occurred from the 1970s through 2003, the entire 900 acres of the LIA has been impacted
28 by MEC.

29 A TCRA was initiated in the MRA-LIA in June 2005 to reduce the risk, posed to
30 unauthorized personnel entering the area, from munitions items located on the surface. The
31 initial area designated for the TCRA was 400 acres of the most westerly portion of the MRA;
32 however, following the ERA/Phase I SI it was apparent that the eastern portion of the
33 MRA-LIA and the MRA-ECA posed an equal or greater hazard and it was proposed to
34 expand the TCRA to these areas. As of February 2006, 60 acres of the MRA-LIA had been
35 cleared of surface munitions.

36 The entire portion of the MRA-LIA was evaluated during the ERA/Phase I Site Inspection
37 and evaluation concluded that the screening level of High for exposure to explosive hazard
38 due to the exposure to surface MEC. The MEC items are highly varied across the site, most
39 exhibit a high explosive hazard due to their type and sensitivity, as well as their densities
40 which were high at all areas investigated. Accessibility to the LIA is moderate to high
41 depending on the area. A subsurface evaluation could not effectively be carried out due to
42 the significant amount of surface metallic interference with the magnetometer. Beach
43 locations are readily accessible to boaters. These boaters may be able to hike from the

1 beaches to and along local roads. The roads do have security gates to prevent vehicular
2 traffic, but pedestrians can gain access.

3 Based on the high explosive hazard screening levels for the LIA, the ERA/ Phase I SI Report
4 recommended that the remainder of the LIA and ECA be surface cleared of munitions under
5 the Time Critical Removal Action.

6 **2.2.4 Eastern Conservation Area (MRA-ECA)**

7 The MRA-ECA, encompassing 200 acres on the eastern tip of Vieques, was not an
8 operational area for munitions use. However, its close proximity to the MRA-LIA, where
9 extensive naval gunfire and ATG bombing took place, identifies the MRA-ECA as a
10 potential area for MEC impacts. In addition, the open burn/open detonation (OB/OD) area
11 within the LIA generated an explosive safety arc that extended into the MRA-ECA. Based
12 on the high explosive hazard screening levels for the ECA, the ERA/ Phase I SI Report
13 recommended that the remainder of the ECA be inspected to assess the density and types of
14 MEC present, and that the MEC should be surface cleared of munitions under the TCRA.

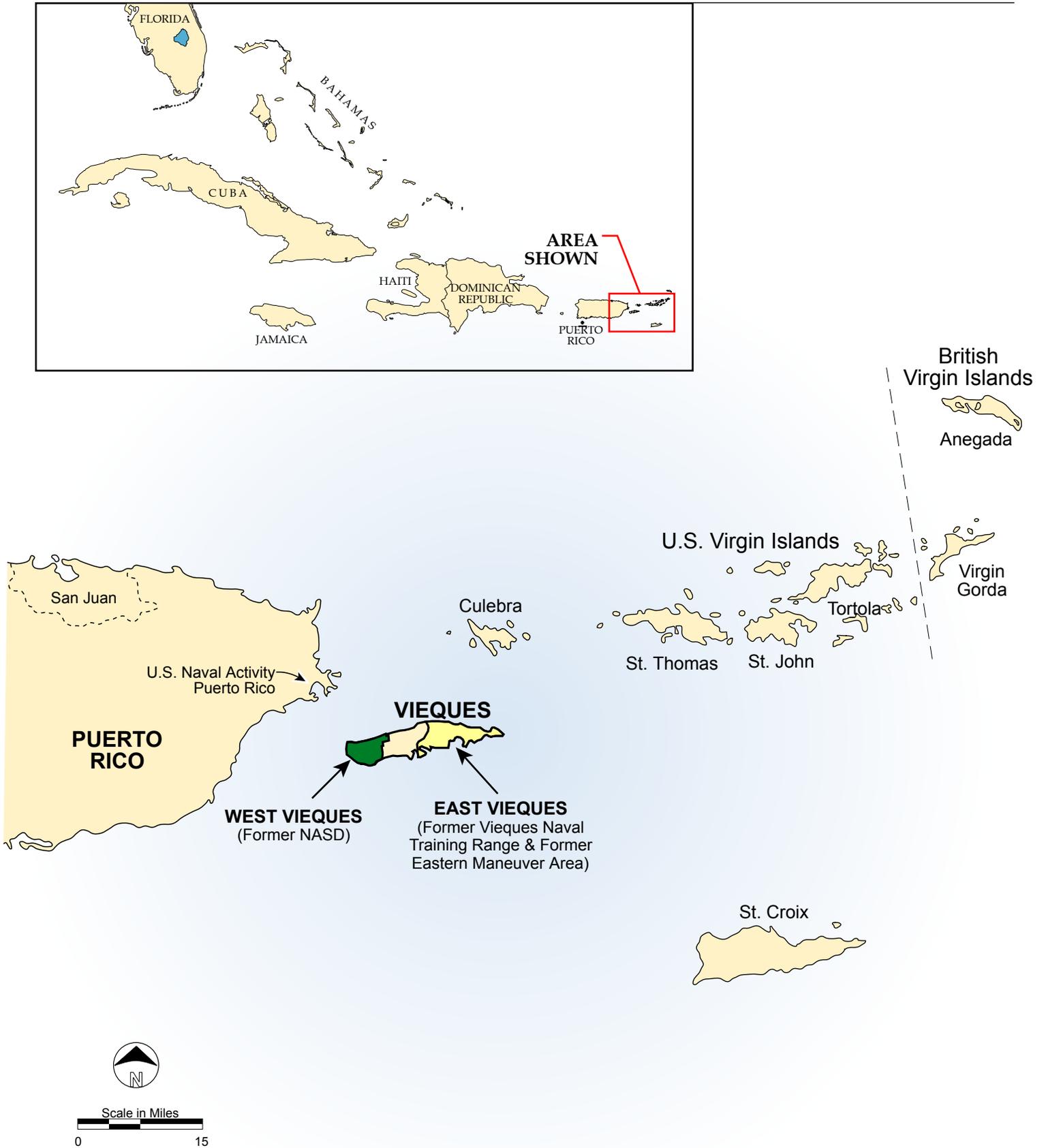
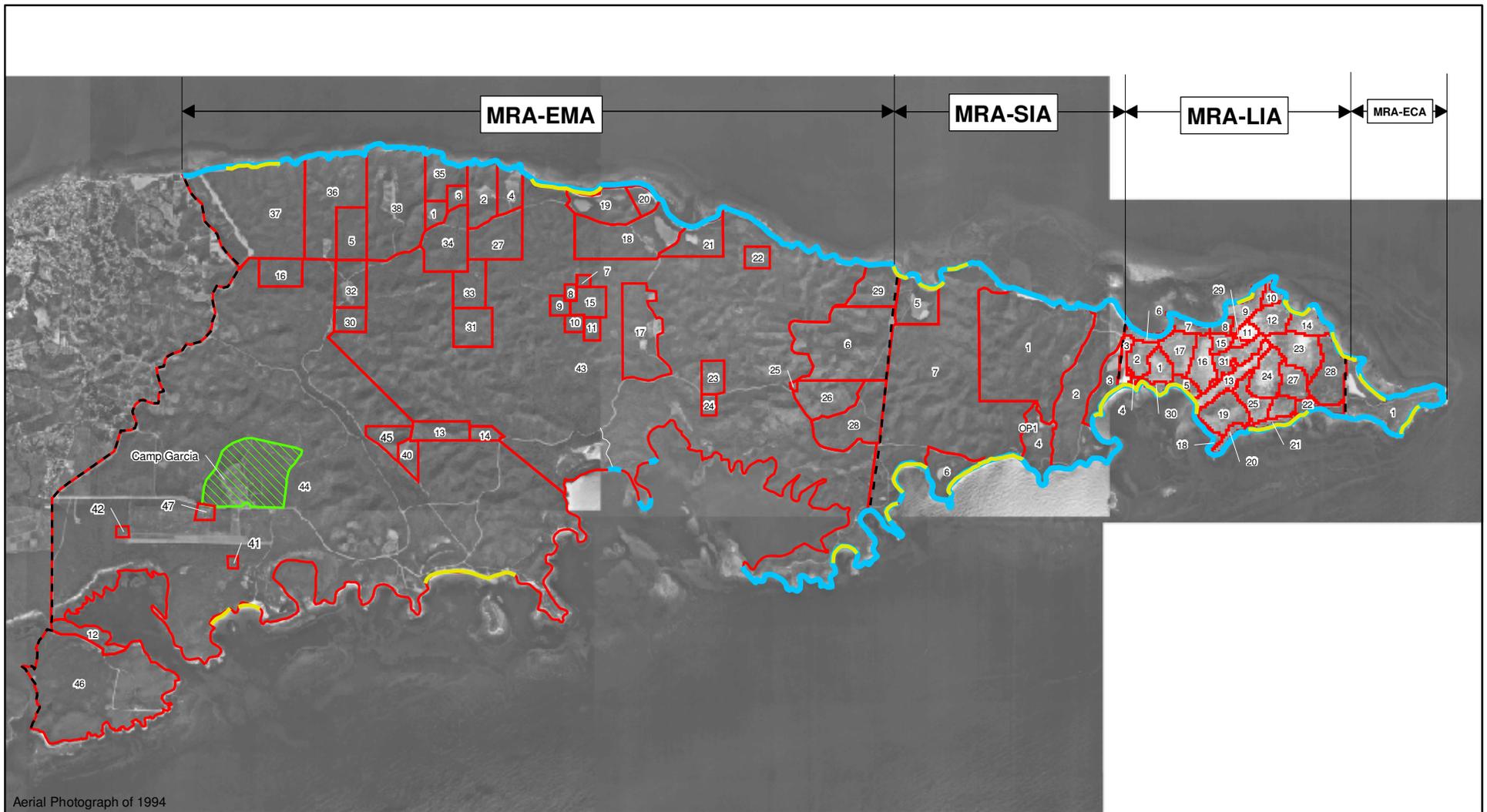


Figure 2-1
Regional Location Map
Former VNTR, Vieques, Puerto Rico



Aerial Photograph of 1994

Legend

- Beach MRS — Sea Turtle Nesting Areas
- 1 MRS boundary, MRS number identified
- Parcel Boundary and Designation
- MRA Boundary

Notes :

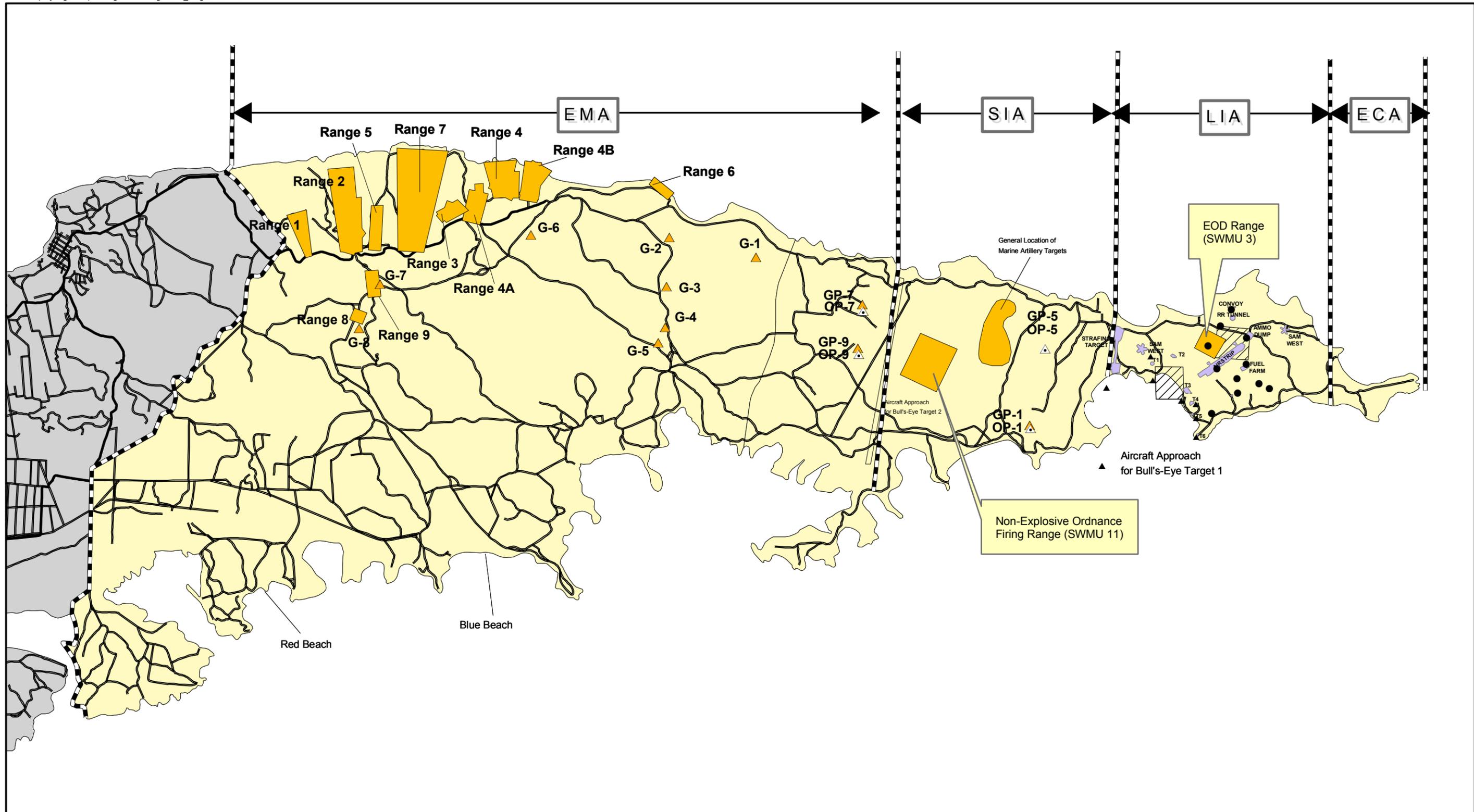
- MRS Numbers Do Not Signify Priority
- EMA-MRS 43 and SIA-MRS 7 include all terrestrial area within the range fan(s) not designated as other MRSs.
- EMA-MRS 44 includes all terrestrial area outside of range fan(s) not designated as other MRSs.



Figure 2-2
Former VNTR Site Map
Former VNTR, Vieques, Puerto Rico

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LEGEND

- | | |
|--|-------------------------------------|
| Naval Gunfire Support (NGFS) Area Target | Gun Position |
| Small Arms/Artillery Ranges | Observation Point |
| Navy Property | Air-To-Ground (ATG) Target |
| Non-Navy Property | Naval Gunfire Support (NGFS) Target |
| Property Line | |

Definitions:
 EMA - Eastern Maneuver Area
 SIA - Surface Impact Area
 LIA - Live Impact Area
 ECA - Eastern Conservation Area

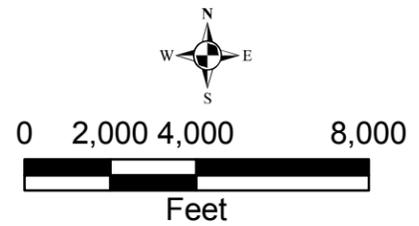
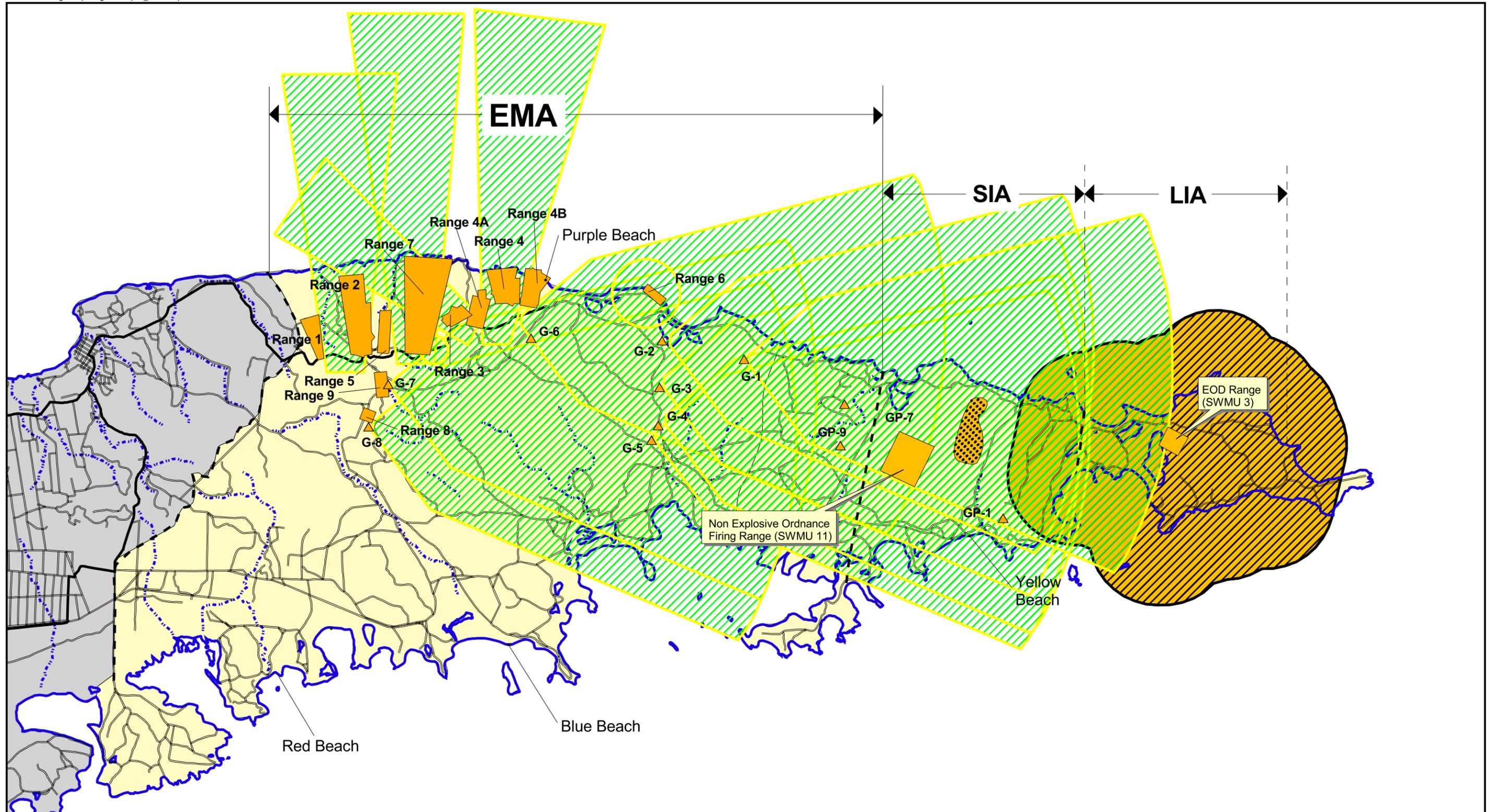


Figure 2-3
 Map of Range Related Site Features
 Former VNTR, Vieques Island, Puerto Rico



LEGEND

- Roads
- Hydrography
- Streams
- Property Line
- Non-Navy Property

Ordnance / Explosives Sites

- Gun Position
- Explosive Safety Quantity Distance Arc
- General Location of Marine Artillery Targets
- Small Arms/Artillery Ranges
- Artillery Safetyfan

AFWTF - Atlantic Fleet Weapons Training Facility
 EMA - Eastern Maneuver Area
 LIA - Live Impact Area
 SIA - Surface Impact Area



Figure 2-4
 Potential MEC Impacted Areas
 Former VNTR, Vieques, Puerto Rico

Eastern Maneuver Area (EMA)

Surface Impact Area (SIA)

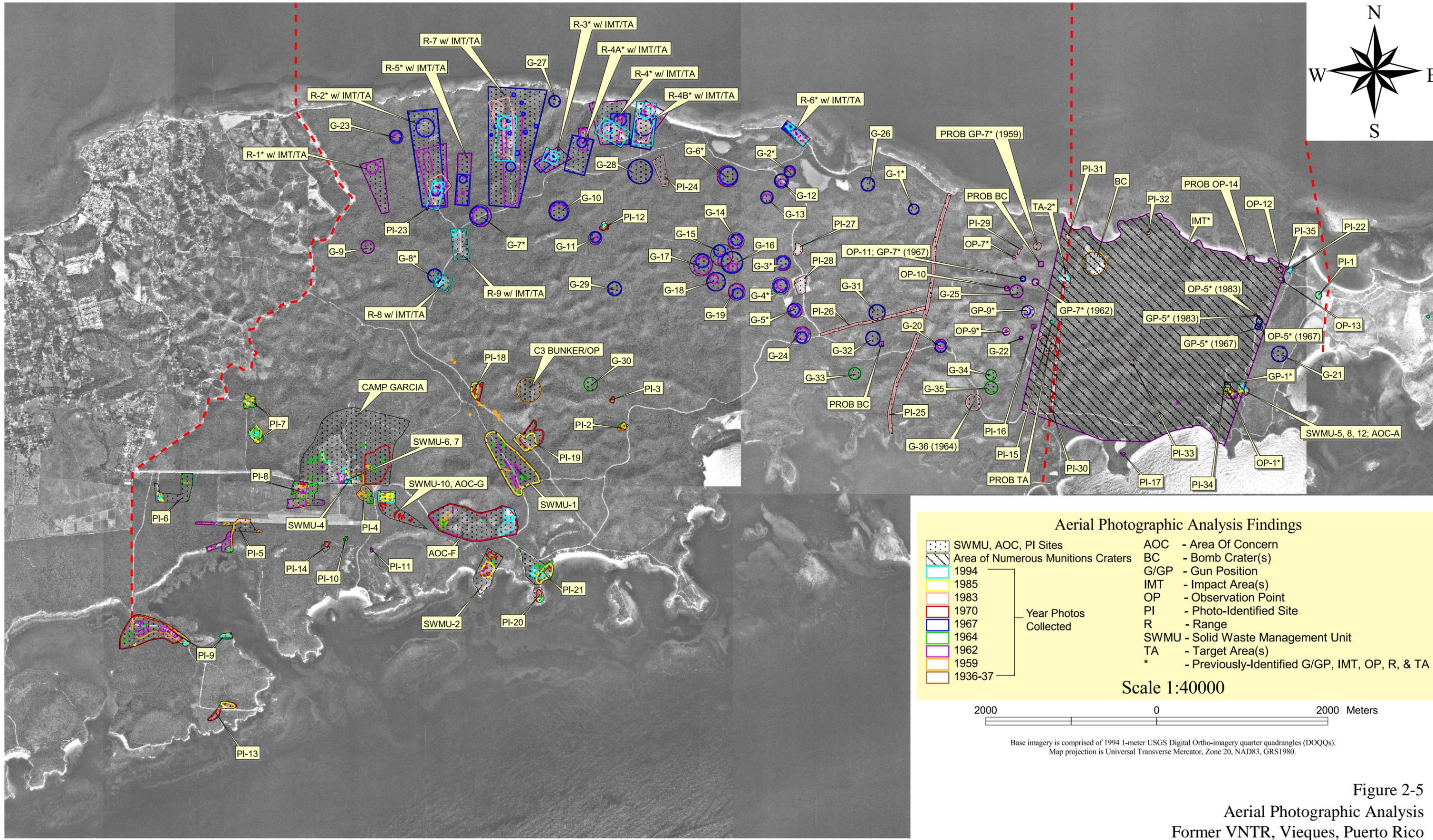


Figure 2-5
Aerial Photographic Analysis
Former VNTR, Vieques, Puerto Rico

2 Technical Approach of Phase II Site 3 Inspection

4 3.1 Rationale and Approach for Phase II Site Inspection

5 Based on the results of the ERA/Phase I SI the following MRSs will be investigated during the
6 Phase II SI:

- 7 • MRA-ECA: The entire MRA-ECA.
- 8 • MRA Beach Area: The beaches in the EMA, SIA, LIA and ECA.
- 9 • MRA-SIA: A total of 7 MRSs, and two PI sites, and one PAOC site.
- 10 • MRA-EMA: A total of 22 MRSs including eight PI sites and three PAOC sites.

11 In addition to the EMA-MRSs, PI sites, and PAOC sites noted above, two areas of interest
12 (AOIs) identified during the LIDAR survey will be investigated during the ERA/Phase II SI.
13 These AOIs are located within the boundaries of EMA-MRS 43 (Figure 3-1).

14 The general approach for completing the ERA/Phase II SI at each of the MRAs, MRSs, and
15 PI/PAOC sites is outlined in the following paragraphs. The field data collected during the
16 site inspection will be used for the priority ranking of the MRSs and determining
17 subsequent munitions response actions. This ERA/Phase II SI was developed as the second
18 phase of a multi-phase investigation approach under CERCLA. Each phase of the SI process
19 is performed to address MRSs by gathering data to facilitate the objectives described in
20 Section 1 of this work plan. Any additional data collected from subsequent investigation
21 phases can be used to re-evaluate the priority ranking of an MRS. This will allow for the
22 MRSs to be prioritized on several occasions as more data become available to determine
23 what future action should be performed and the sequence.

24 The proposed locations of the site inspections are shown in Figure 3-1. Tables documenting
25 historical munitions use at the former VNTR are presented in Appendix A of the Draft MEC
26 Master Work Plan, Revision 1. Table 3-1 lists the MRSs at the Former VNTR and historical
27 site names/uses.

28 The recommendations presented in the Final Biological Assessment for the LIA (Geo-
29 Marine, Inc., May 2006), and any subsequent recommendations within the Final Biological
30 Assessment, will be implemented for all areas to avoid impacts to threatened/ endangered
31 species. Concurrence from the US Fish and Wildlife Service (USFWS) will be obtained prior
32 to finalizing the biological assessment and mitigation measures to the areas of investigation
33 in this work plan.

34 Vegetation clearance will be conducted using hand tools as necessary to allow transect
35 evaluation. All vegetation clearance for transect evaluations will be conducted in a manner
36 that will allow unexploded ordnance (UXO) technicians to walk individual lanes through
37 vegetated areas while minimizing the amount of vegetation clearance required. Vegetation

1 will be cleared mechanically to facilitate the digital geophysical mapping (DGM) where
2 allowable based on potential MEC hazards. The Navy is currently expanding the approach
3 to minimizing impacts to threatened and endangered species during vegetation clearance
4 and other investigation and response activities developed for the LIA to the other MRAs.
5 When this approach is finalized, it will be incorporated into the work plan.

6 The DGM will be conducted utilizing equipment towed or carried by hand; therefore, no
7 impacts to wildlife or habitat are expected from the collection of geophysical data. A
8 geophysical prove-out (GPO) and test plot will be established which will require intrusive
9 operations. The area(s) for establishing the GPO and test plot will be monitored for
10 threatened/endangered species prior to any intrusive operations according to the biological
11 assessment.

12 Areas inundated with water will not be evaluated as part of this site inspection.

13 The following investigation activities will be performed during the ERA/Phase II SI:

14 **MRA-Beach Area**

15 The Beach MRA consists of the beach areas on the north side of the Former VNTR and the
16 sandy and rocky beach areas on the south side of the Former VNTR within the range fan
17 areas (Figure 2-2). The sand portions of the Beach MRA will be investigated to determine the
18 presence of subsurface magnetic anomalies (Figure 3-2). Wetlands marine boundaries are
19 not included in the Beach MRA. Through this assessment a future removal action can be
20 implemented to meet the projected future land use plan.

21 **Roads within the Former VNTR**

22 The roadways where geophysical mapping will be conducted are present throughout the
23 Former VNTR. The locations of the roadways to be mapped are shown on Figure 3-2. The
24 roadways and an additional 25-foot buffer each side of the roadways will be mapped to
25 determine where potential subsurface MEC may be present. Through this assessment a
26 future subsurface removal action can be implemented to meet the projected future land use
27 plan. The subsurface removal action along the roadways will allow the Navy's contractors
28 safe access to the MRSs throughout the former VNTR. In addition, it will also allow the Fish
29 & Wildlife Service safe access to the valuable natural resource locations throughout the
30 wildlife refuge.

31 **MRA-ECA**

32 The ECA is adjacent to the easterly boundary of the LIA, which has been impacted by past
33 military exercises and has a high density of MEC. The site inspection will be conducted to
34 provide a preliminary assessment extent of MEC for future removal action. The inspection
35 will include performing a surface MEC evaluation using a transect approach. This
36 evaluation excludes areas inundated with water.

37 **MRA-SIA**

38 An evaluation of the SIA (including MRSs and PI/PAOC sites) will be completed to
39 determine areas impacted by past military exercises. Transects totaling an area of
40 approximately 10 percent of SIA MRSs 1-7 and 100 percent coverage of PI 1, PI 17, and
41 PAOC Y will be used to evaluate surface MEC. All of the SIA lies within the projected range

1 fans and was formerly used as a bombing range. Therefore, an inspection of the SIA will
 2 help to determine the areas that will require future removal action to be compatible with
 3 future land use of the area; as well as decrease the risk to authorized and unauthorized
 4 users.

5 **MRA-EMA**

6 The MRSs and PI/PAOC sites in the EMA will be inspected to determine what further
 7 actions will be necessary at the various MRSs and PI/PAOC sites, depending on future land
 8 uses of these areas. Transects will be used to evaluate surface MEC.

9 In addition to the investigation efforts listed above, a desktop digital elevation model (DEM)
 10 analysis will be conducted for the EMA and SIA.

11 A more detailed description of field procedures is provided later in this work plan and in
 12 the Draft MEC Master Work Plan, Revision 1 (CH2M HILL, September 2005). The
 13 procedures described in the Draft MEC Master Work Plan will be implemented unless
 14 otherwise described in this work plan's Standard operating procedures (SOPs). SOPs will be
 15 provided by the UXO support subcontractor for MEC avoidance and safety.

TABLE 3-1
 Parcel, MRA, MRS, and Historical Site Use/Name Matrix
 Former VNTR, Vieques, Puerto Rico

MRA	MRS Number	Historical Site Use/Name
MRA-Beach Area*		Differentiated based on associated MRA and MRS
MRA-LIA	MRS 1	SAM West/Air-to-Ground (ATG) Target
	MRS 2	ATG Target
	MRS 3	Strafing Run/ATG Target
	MRS 4, 5, 6, 7, 8*, 9*, 10*	ATG Target
	MRS 11*	Convoy Target/ATG Target
	MRS 12*	ATG Target
	MRS 13*	Mock Runway/ATG Target
	MRS 14*, 15*, 16, 17, 18*, 19*, 20*, 21*, 22*	ATG Target
	MRS 23*	SAM East/ATG Target
	MRS 24*, 25*, 26*, 27*, 28	ATG Target
	MRS 29*	OB/OD/ATG Target
	MRS 30, 31*	ATG Target, EOD range (SWMU 3)
MRA-SIA	MRS 1*	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas, Observation Point 5, 12, 13, 14, Gun Position GP 5. Pls 22, 35.
	MRS 2	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas Gun Position 21. Pls-1, 22.
	MRS 3	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas

TABLE 3-1
Parcel, MRA, MRS, and Historical Site Use/Name Matrix
Former VNTR, Vieques, Puerto Rico

MRA	MRS Number	Historical Site Use/Name
MRA-SIA (continued)	MRS 4	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas PI-34, Observation Point 1, Gun Position GP 1. SWMUs 5, 8, 12. AOC-A
	MRS 5	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas
	MRS 6	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas PI-17
	MRS 7	Non-Explosive Ordnance Firing Range (SWMU 11) Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas, Pls-32, 33. PAOC Y.
MRA-EMA	MRS 1*	Range 3 – Hand Grenade Range
	MRS 2*	Range 4 – 40mm Rifle Grenade Range, PAOC CC
	MRS 3*	Range 4A – Rocket Range
	MRS 4*	Range 4B – Rocket Range, PAOC DD
	MRS 5*	Range 5 – Hand Grenade Range
	MRS 6*	Artillery shortfall area, Target area, Observation Points 9, 10, 11, Gun Positions 22, 25, GP 7, GP 9. Pls-15, 16.
	MRS 7*	
	MRS 8*	
	MRS 9*	PI-Gun Position 17
	MRS 10*	PI-Gun Position 18
	MRS 11*	PI-Gun Position 19
	MRS 12*	PI-9
	MRS 13	Observation point/bunker
	MRS 14	PI-3
	MRS 15	Gun Positions 14, 15, 16
	MRS 16	Gun Position 9
	MRS 17	Gun Positions 3, 4, 5, 24; PI-27 and PI-28
	MRS 18	Gun Positions 2, 6, 12 and 13
	MRS 19	Area adjacent to Range 6
	MRS 20	Range 6 - Demolition and small arms range
	MRS 21	Gun Position 26
	MRS 22	Gun Position 1
	MRS 23	Gun Position 32
	MRS 24	Gun Position 33
	MRS 25	Gun Position 20
	MRS 26	Gun Position 34
	MRS 27	Gun Position 28
	MRS 28	Gun Position 35, Artillery shortfall area. PI-30
	MRS 29	PI-29, 31. Artillery shortfall area, Gun Position GP-9, Observation Point 7. PAOC Z.

TABLE 3-1
Parcel, MRA, MRS, and Historical Site Use/Name Matrix
Former VNTR, Vieques, Puerto Rico

MRA	MRS Number	Historical Site Use/Name
MRA-EMA (continued)	MRS 30	Part of Range 8 Gun Position 8
	MRS 31	Gun Position 29
	MRS 32	Range 9 and Gun Position 7
	MRS 33	PI-12 and Gun Position 11
	MRS 34	Gun Position 10, part of Range 4a
	MRS 35	Gun Position 27
	MRS 36	Range 2 – Small Arms Range using pistols and shotguns, PI-23, PAOC AA
	MRS 37	Range 1 – Small arms range using service rifles, pistols, and machine guns, Gun position 23
	MRS 38	Range 7 with impact areas, PAOC BB
	MRS 39	Area of Interest
	MRS 40	PIs-10, 19
	MRS 41	PI-14
	MRS 42	Area of Interest
	MRS 43	Area of Interest, PIs-24, 25, 26. C-3 Bunker/OP, Gun positions 20, 30, 31, 36. AOs 1, 2.
	MRS 44	PIs-2, 4, 5, 6, 7, 10, 11, 18, 20, 21. PAOCs U, V, W, X, FF, EE. SWMUs 1, 2, 4, 6, 7, 10. AOCs F, G Camp Garcia Gun positions 8, 9. Part of Range 8
	MRS 45	
	MRS 46	PI-13
	MRS 47	PI-8
MRA-ECA	MRS 1	Impacts due to adjacent target areas

- 1 * Shaded were evaluated during ERA/Phase I SI
2 **Bold to be evaluated during the ERA/Phase II SI.**

3 3.2 Investigation Procedures

4 A description of the work to be completed for each MRA and other areas is given in the
5 following sections.

6 All quality control (QC) will be conducted as described in the Draft MEC Master Work Plan,
7 Revision 1 (CH2M HILL, September 2005) for the surface investigation and QC procedures
8 related to the DGM is given in Appendix B. This includes the auditing of definable features
9 of work listed in Table 9-1 and the level of QC inspection in Section 9.5.2 of that document.

10 Quality control of all investigation activities will be conducted in accordance with Section 9
11 of the Draft Master MEC Work Plan, Revision 1 (CH2M HILL, September 2005). Specifically,
12 the applicable definable features of work identified in Table 9-1 will be evaluated during the
13 appropriate assessment phases (preparatory, initial, and follow-up), which are given in

1 Table 9-1. Additionally, a minimum of 10 percent of the areas (either transect or grid,
2 whichever is being used) will be re-evaluated to insure proper MEC location and
3 identification is being accomplished.

4 **3.2.1 MRA-Beach Areas**

5 The beach areas presented in Figure 2-2 have been designated as an MRA. The Phase I site
6 inspection was completed for all the beaches located within the potential MEC-impacted
7 areas of the EMA, SIA, LIA, and ECA. During the Phase I inspection, all munitions-related
8 items located at the surface were removed and items detected with the geophysical
9 equipment were located and recorded.

10 The subsurface of the sand beach areas along the north coast of the VNTR and along the
11 south coast within the range fan areas will be assessed using DGM during the ERA/Phase II
12 SI (Figure 3-2). The DGM data will be used to facilitate a future non- time critical removal
13 action, from the beaches.

14 The geophysical plan is presented in Appendix B. The following tasks will be completed for
15 the MRA-Beach Area (approximately 75 acres):

- 16 • Establish a GPO to test and determine the appropriate geophysical equipment and
17 configuration.
- 18 • Preparation of investigation area will be conducted by clearing the surface of any
19 metallic materials. A surface clearance was conducted during the ERA/Phase I SI;
20 however, it is expected that additional clearance will be required.
- 21 • If explosive or intrusive operations are required to prepare the site, an appropriate
22 survey will be conducted to avoid impacts to threatened/endangered species and
23 habitat as specified in the biological assessment.
- 24 • The geophysical investigation team will traverse the beach areas identified and will
25 perform DGM using the appropriate equipment.
- 26 • The inspection will cover the entire open beach area (sandy beach areas, rocky areas will
27 not be mapped) in the identified areas and extend to where the vegetation cover is too
28 thick to gain access without the aid of vegetation clearing.
- 29 • Processing and interpretation of geophysical data will be conducted.
- 30 • No subsurface removal will be conducted as part of this task.

31 **3.2.2 Roadways within the Former VNTR**

32 A number of roads are present throughout the Former VNTR. Digital geophysical mapping
33 of the subsurface will be conducted over approximately 220 acres of roadways including a
34 25-foot buffer each side of the roads (Figure 3-2). The DGM data will be used to facilitate
35 future munitions removal actions, where necessary.

36 The geophysical plan is presented in Appendix B. The following tasks will be carried out
37 during the subsurface geophysical data collection:

- 1 • Establish a GPO to test and determine the appropriate geophysical equipment and
2 configuration.
- 3 • Preparation of investigation area will be conducted by clearing the surface of any
4 metallic materials.
- 5 • Prior to clearing of vegetation or if explosive/intrusive operations are required to
6 prepare the site, an appropriate survey will be conducted to avoid impacts to
7 threatened/endangered species and habitat as specified in the biological assessment.
- 8 • The geophysical investigation team will traverse the road areas identified and will
9 perform DGM using the appropriate equipment.
- 10 • No subsurface removal will be conducted as part of this task.

11 3.2.3 MRA-ECA

12 In the MRA-ECA, 10 percent of the MRA (approximately 20 acres) will be inspected to
13 assess the potential types, densities, and nature of the MEC items. The ECA is located
14 adjacent to the eastern boundary of the LIA (Figure 3-1), which has been heavily impacted
15 by military operations and assessments have shown high densities of MEC. As a result, the
16 ECA has been added to the Time Critical Removal Action that is currently being conducted
17 in the LIA. Therefore, the ECA will be assessed to determine the types and densities of MEC
18 within the ECA such that the removal action for this area can be designed.

19 The objectives of the inspections at the MRA-ECA are to: 1) collect surface data to determine
20 the types and densities of MEC within ECA and 2) gather information to design the Time
21 Critical Removal Action to be completed for this area.

22 The tasks to be completed at the ECA include the following:

- 23 • A preliminary survey will be conducted by a qualified biologist to evaluate the areas for
24 presence of threatened/endangered plant species prior to any vegetation clearance
25 activities. The approach will be defined in the biological assessment.
- 26 • Vegetation clearance will be conducted using hand tools to facilitate access to the
27 transects. The approach to vegetation clearance will be one that minimizes the amount
28 of vegetation cut and will facilitate the ability of individuals to walk transects.
- 29 • Transects of approximately 5 ft in width will be chosen to gain access to a representative
30 sample area of the ECA. Figure 3-3 shows preliminary transects proposed for the ECA.
31 Sensitive vegetation/habitat, rough terrain, water, or other features may have impacts
32 on determining the location of transects, and the area inspected.
- 33 • The MEC field team will traverse the investigation area and visually inspect the area for
34 MEC with the aid of a Schonstedt GA-52CX magnetometer or other hand-held
35 instrument.
- 36 • All MEC items visually observed will be located using a global positioning system (GPS)
37 receiver, as will large subsurface anomalies.

- 1 • All the MEC items visually identified will be characterized by a UXO Technician III,
2 Senior UXO Supervisor (SUXOS) or UXO Safety Officer (UXOSO) and recorded
3 electronically or as written backup in the case of electronic instrument failure.
- 4 • Parameters to be collected for each MEC item include: item ID, item group, class,
5 category, filler type, fuzing, quantity, and date found. Photographs of representative
6 items will be taken.
- 7 • For QC purposes, evaluation of the investigated areas will be performed using the same
8 approach and equipment that the initial investigator used to verify proper identification
9 and data collection for MEC items.
- 10 • No surface or subsurface removal will be completed at this site.

11 3.2.4 MRA-SIA

12 Approximately 10 percent of MRSs 1 through 7; 100 percent of PIs 1 and 17; and 100 percent of
13 PAOC Y (Figure 3-1) within the MRA-SIA will be investigated to assess the potential types,
14 densities, and nature of the MEC items present on the surface at the sites.

15 The objectives of the inspections are to: 1) collect surface data to determine the concentration of
16 MEC within SIA target areas; and 2) gather information to determine if future inspections or
17 investigations are warranted at this site. Based on the surface MEC data, the site will be
18 prioritized for future response actions. In addition, the inspection will provide data to estimate
19 the level of effort required to perform further inspections or investigations if necessary.

20 The tasks to be completed at the MRA SIA include the following:

- 21 • A preliminary survey will be conducted by a qualified biologist to evaluate the areas for
22 presence of threatened/ endangered plant species prior to any vegetation clearance
23 activities. The specific approach will be described in the biological assessment.
- 24 • Vegetation clearance will be conducted using hand tools to facilitate access to the
25 transects. The approach to vegetation clearance will be one that minimizes the amount
26 of vegetation cut and will facilitate the ability of individuals to walk transects.
- 27 • Transects of approximately 5 ft in width will be chosen to gain access to a representative
28 sample area of the MRA. Figure 3-4 shows preliminary transects proposed for the SIA.
29 Sensitive vegetation/habitat, rough terrain, water, or other features may have impacts
30 on determining the location of transects, and the area inspected.
- 31 • The MEC field team will traverse the investigation area and visually inspect the area for
32 MEC with the aid of a Schonstedt GA-52CX magnetometer or other hand-held instrument.
- 33 • All MEC items visually observed will be located using a GPS receiver, as will large
34 subsurface anomalies.
- 35 • All the MEC items visually identified will be characterized by a UXO Technician III,
36 SUXOS or UXOSO and recorded electronically or as written backup in the case of
37 electronic instrument failure.

- 1 • Parameters to be collected for each MEC item include: item ID, item group, class,
2 category, filler type, fuzing, quantity, and date found. Photographs of representative
3 items will be taken.
- 4 • For QC purposes, evaluation of the investigated areas will be performed using the same
5 approach and equipment that the initial investigator used to verify proper identification
6 and data collection for MEC items.
- 7 • No surface or subsurface removal will be completed at the sites.

8 3.2.5 MRA-EMA

9 A surface MEC investigation of the following areas will be performed at the MRA-EMA and
10 are shown in Figure 3-1:

- 11 • 10 percent of MRSs 15 through 20, 25 through 29, 34, 35, and 40.
- 12 • 10 percent of the range fan areas within MRSs 30, 32, and 36 through 38 (including
13 PAOC BB).
- 14 • 100 percent of PIs 2, 3, 13, 14, 15, 16, 18, and 19.
- 15 • 100 percent of PAOCs Z, EE, and FF.
- 16 • 100 percent of the two AOIs.
- 17 • 6 sites identified by USFWS on and near EMA MRS 46.
- 18 • 10 percent of MRSs 2 and 4 beyond the target areas.

19 The approach and objectives for the inspection of each of the sites are given below.

20 The objectives of the inspections are to: 1) collect surface data to assess the magnitude of
21 MEC present 2) gather information to determine if future inspections or investigations are
22 warranted at this site. Based on the surface MEC data, the sites can be prioritized and
23 determine what further actions should be taken. In addition, the inspection will provide
24 sufficient data to estimate the level of effort required to perform further actions if necessary.

25 The tasks to be completed at the MRA-EMA include the following:

- 26 • A preliminary survey will be conducted by a qualified biologist to evaluate the areas for
27 presence of threatened/endangered plant species prior to any vegetation clearance
28 activities.
- 29 • Vegetation clearance will be conducted using hand tools to facilitate access to the
30 transects. The approach to vegetation clearance will be one that minimizes the amount
31 of vegetation cut and will facilitate the ability of individuals to walk transects.
- 32 • Transects of approximately 5 feet in width will be chosen to gain access to a
33 representative sample area of the EMA. Figures 3-5, 3-6, and 3-7 shows preliminary
34 transects proposed for the EMA. Sensitive vegetation/habitat, rough terrain, water, or
35 other features may have impacts on determining the location of transects, and the area
36 inspected.

- 1 • Range 6 is located within MRS 20. A site inspection of the target area and vicinity will be
2 performed cover approximately 2 acres. The exact area(s) of investigation will be
3 determined in the field after a thorough reconnaissance of the range is completed.
4 Transects or grids will be inspected to accomplish the objectives.
- 5 • The MEC field team will traverse the investigation area and visually inspect the area for
6 MEC with the aid of a Schonstedt GA-52CX magnetometer or other hand-held instrument.
- 7 • All MEC items visually observed will be located using a GPS receiver, as will large
8 subsurface anomalies.
- 9 • All the MEC items visually identified will be characterized by a UXO Technician III,
10 SUXOS or UXOSO and recorded electronically or as written backup in the case of
11 electronic instrument failure.
- 12 • Parameters to be collected for each MEC item include: item ID, item group, class,
13 category, filler type, fuzing, quantity, and date found. Photographs of representative
14 items will be taken.
- 15 • For QC purposes, evaluation of the investigated areas will be performed using the same
16 approach and equipment that the initial investigator used to verify proper identification
17 and data collection for MEC items.
- 18 • No surface or subsurface removal will be completed at the sites.

19 3.3 Desktop Digital Elevation Model (DEM)

20 A slope and landscape analysis will be completed for the entire VNTR. Light detection and
21 ranging data collected as part of the ERA/Phase I SI will be used to perform this task. This
22 will determine areas that may be technically difficult to investigate or remediate. This
23 information will be compiled and will be used when prioritizing the area for future
24 investigation. The results of this task will be presented graphically with full description of
25 the findings for areas where it is determined that access will be limited due to
26 terrain/landscape. During the surface investigation ground truthing of the findings will be
27 performed by checking the slope and other landscape features identified against the actual
28 site conditions. The results from this evaluation as it impacts the ERA/Phase II SI will be
29 presented in the report of findings from the Phase II investigation.

30 3.4 Data Management System

31 The munitions response program (MRP) Enterprise data management system will be used
32 to capture and record all field and processing notes. The MRP Enterprise is a cradle-to-grave
33 data management system designed to track and easily query all data for Munitions
34 Response projects. The system digitally captures, tracks and creates automated reports on:

- 35 • Project Information (e.g., Personnel, Teams, Instrument Serial Numbers, Grid IDs and
36 Locations)

- 1 • Field Team Leader Notes (e.g., Safety Meetings, Logbooks, Field Requests to
2 Management)
- 3 • DGM and UXO Field Team notes (e.g., Grids, Files, Personnel, Methods, Instruments,
4 MEC Items Found)
- 5 • DGM Data Processing Notes and Delivery Data (File Names, Processing Performed, QC
6 of Data, Delivery Dates)
- 7 • Grid Status (e.g., Activities Performed by Grid and by Acre, Percents and Quantities
8 Complete or Remaining)
- 9 • Demolition Tracking (All MEC Items Noted as Needing Demolition or Demilitarization
10 Tracked from Initial Discovery to Final Disposition)
- 11 • Quality Control (e.g., QC on Notes, Processing, Data, Comparison of DGM Results to
12 Intrusive Investigation Results and Field Activities)
- 13 • Photo log (project photos with notes from photographer)

14 The system operates in a multi-contractor capable environment with tools for digital data
15 capture, storage, analysis, quality control and rapid display to a web-based interface. The
16 result is a near “real-time” turnaround of project data to the management team. Field
17 operations data is captured using GPS-enabled handheld devices running a mobile
18 geographic information system (GIS)/Forms based software. The data is transferred to and
19 then validated within a centralized relational database prior to being uploaded to a Web-
20 based GIS. The Web GIS is designed with various access levels for project team members,
21 depending on their project role, and provides tools for accessing field operations status
22 maps, data visualization (e.g., locations of discovered MEC), basic and custom queries on
23 the data sets and progress reporting. The system increases project team communication,
24 provides data visualization tools for remotely based team members, provides secure data
25 tracking and quality control and rapid data access for decision-makers.

26 3.5 Lines of Communication

27 Figure 3-8 depicts the primary line of communication for the VNTR ERA/Phase II SI
28 according to the chain of command described below. The UXO support subcontractor will
29 report directly to CH2M HILL field personnel. The UXO support subcontractor’s SUXOS
30 will report directly to the CH2M HILL Safety/QC supervisor. The geophysical surveying
31 subcontractor’s site geophysicist will report directly to the CH2M HILL geophysicist. The
32 CH2M HILL geophysicist will coordinate with the geophysics subcontractor and will report
33 directly to the Project Manager (PM). The PM will coordinate with CH2M HILL MRP
34 Manager and Project Geophysicist for senior technical advice. The PM will report directly to
35 Chris Penny, NAVFAC Atlantic Remediation Project Manager (RPM). Any proposed
36 revisions to the scope of work will be discussed between the PM and the NAVFAC RPM
37 and approved by the NAVFAC RPM prior to revising the scope of work. Communications
38 will be maintained with USFWS as shown in Figure 3-8. All communications with USFWS
39 will be made by the NAVFAC Atlantic project manager unless NAVFAC directs the
40 contractor to communicate directly with USFWS. The day-to-day operations related to the

1 ERA/Phase II SI will be communicated to USFWS by NAVFAC. USFWS will maintain
2 communications with NAVFAC Atlantic and the field operations staff to ensure that the
3 field crew members are aware of USFWS management operations.

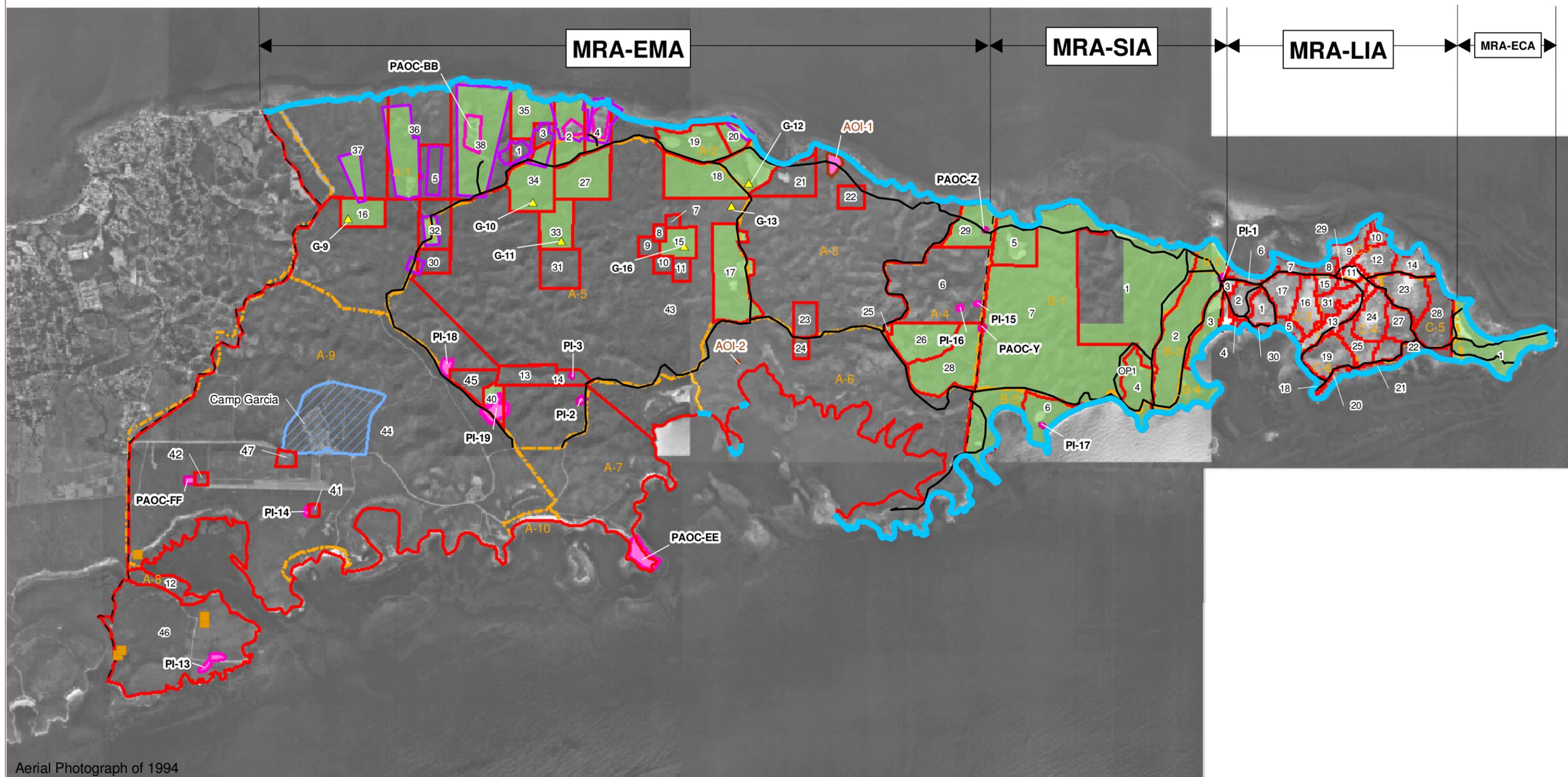
4 The NAVFAC RPM works individually with the CH2M HILL MEC Manager and QC
5 Supervisor and will report significant findings, if necessary, directly to the Naval Ordnance
6 Safety and Security Activity (NOSSA), USEPA, Puerto Rico Environmental Quality Board
7 (PREQB), and USFWS/Department of the Interior (DOI).

8 **3.5.1 Blow-in-Place Decision Matrix**

9 No MEC disposal is anticipated for the activities being conducted as part of the
10 ERA/Phase II SI; however, in the case that disposal becomes necessary (e.g., to facilitate the
11 DGM) the chain of command that pertains to the process of disposal of MEC by the blow-in-
12 place (BIP) methods is illustrated in Figure 3-9.

13 **3.6 Investigation Procedures**

14 All investigation procedures not described in this work plan will be conducted as described
15 in the Draft MEC Master Work Plan, Revision 1 (CH2M HILL, September 2005).



Aerial Photograph of 1994

Legend

- MRS Boundary
- Parcel Boundary and Designation
- MRA Boundary
- PAOC, PI Sites, 100% Investigation
- Areas of Interest (AOI), 100% Investigation
- Firing Range Fan
- Roads
- Beach MRA
- Known or Suspected Debris or Pit
- ▲ Gun Positions

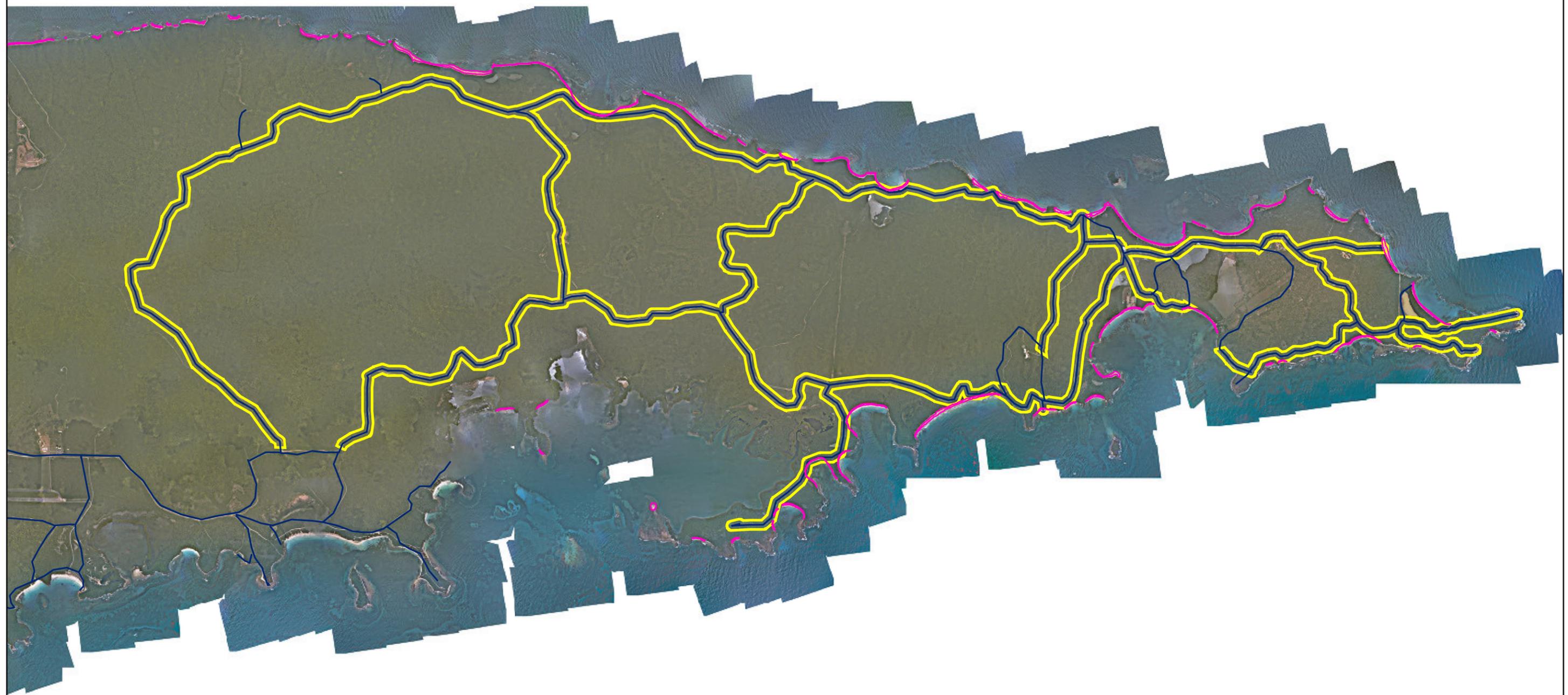
Notes :

- MRS Numbers Do Not Signify Priority
- EMA-MRS 43 and SIA-MRS 7 include all terrestrial area within the range fan(s) not designated as other MRSs.
- EMA-MRS 44 includes all terrestrial area outside of range fan(s) not designated as other MRSs.



Figure 3-1
ERA Phase II Site Investigation Areas
Former VNTR, Vieques, Puerto Rico

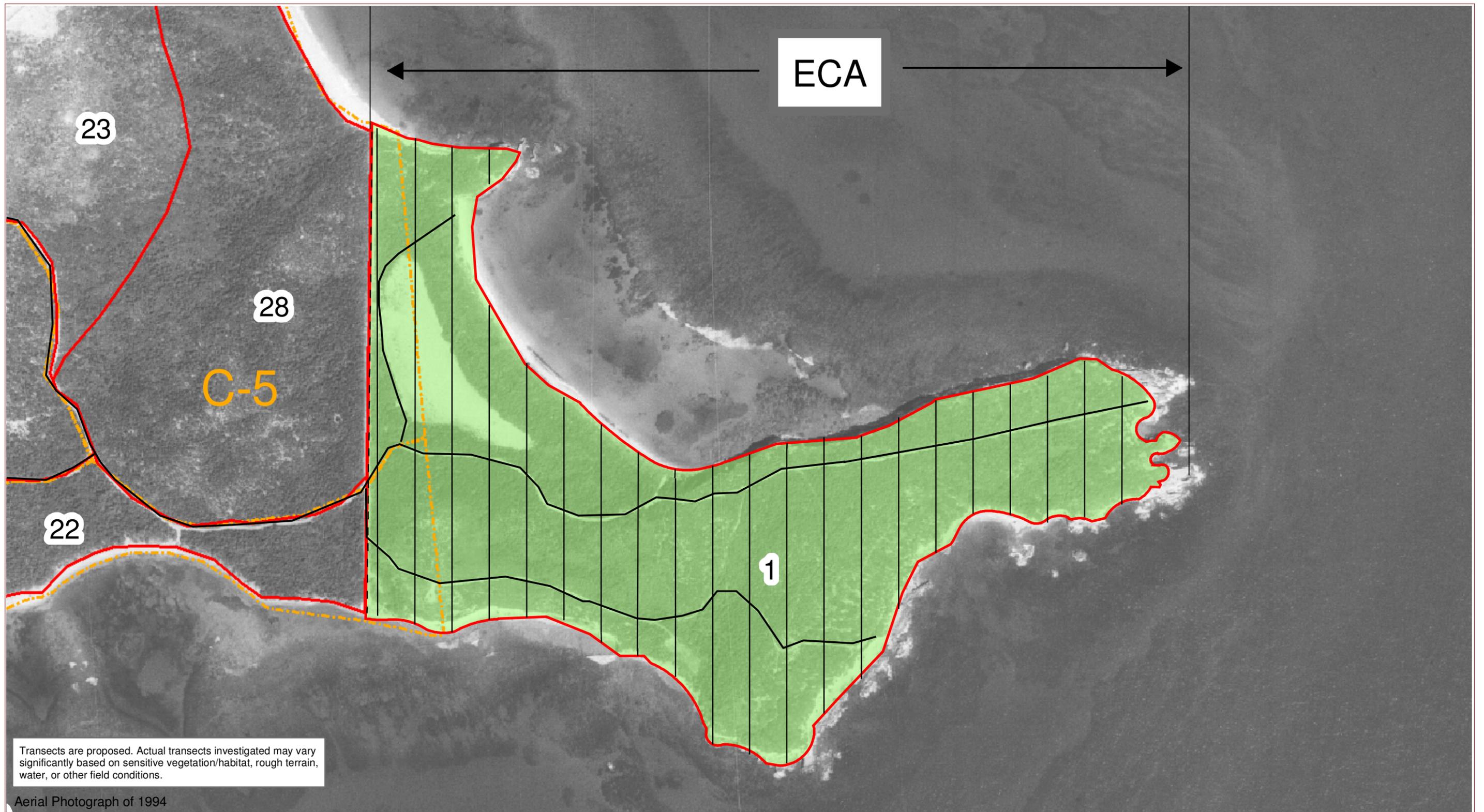




- Legend**
- ▭ Sandy Beaches within the MRA Beach Area to be digital geophysically mapped
 - ▭ Roads
 - 50m Road Buffer



Figure 3-2
Digital Geophysical Mapping Areas along
Roads with 50m Buffers and Sandy Beach Areas
Former VNTR, Vieques, Puerto Rico



Transects are proposed. Actual transects investigated may vary significantly based on sensitive vegetation/habitat, rough terrain, water, or other field conditions.

Aerial Photograph of 1994

Legend

- 1 MRS Boundary
- Parcel Boundary and Designation
- 10% Investigation Area
- Roads

Potential Investigation Transects
(Lines are graphical representation of 1.5 m width transect)

Notes :
- MRS Numbers Do Not Signify Priority

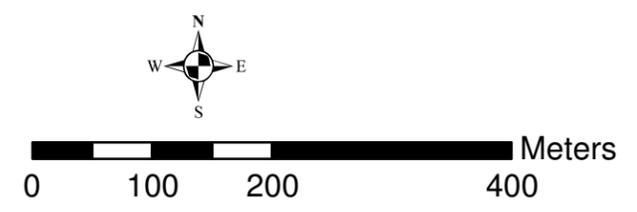
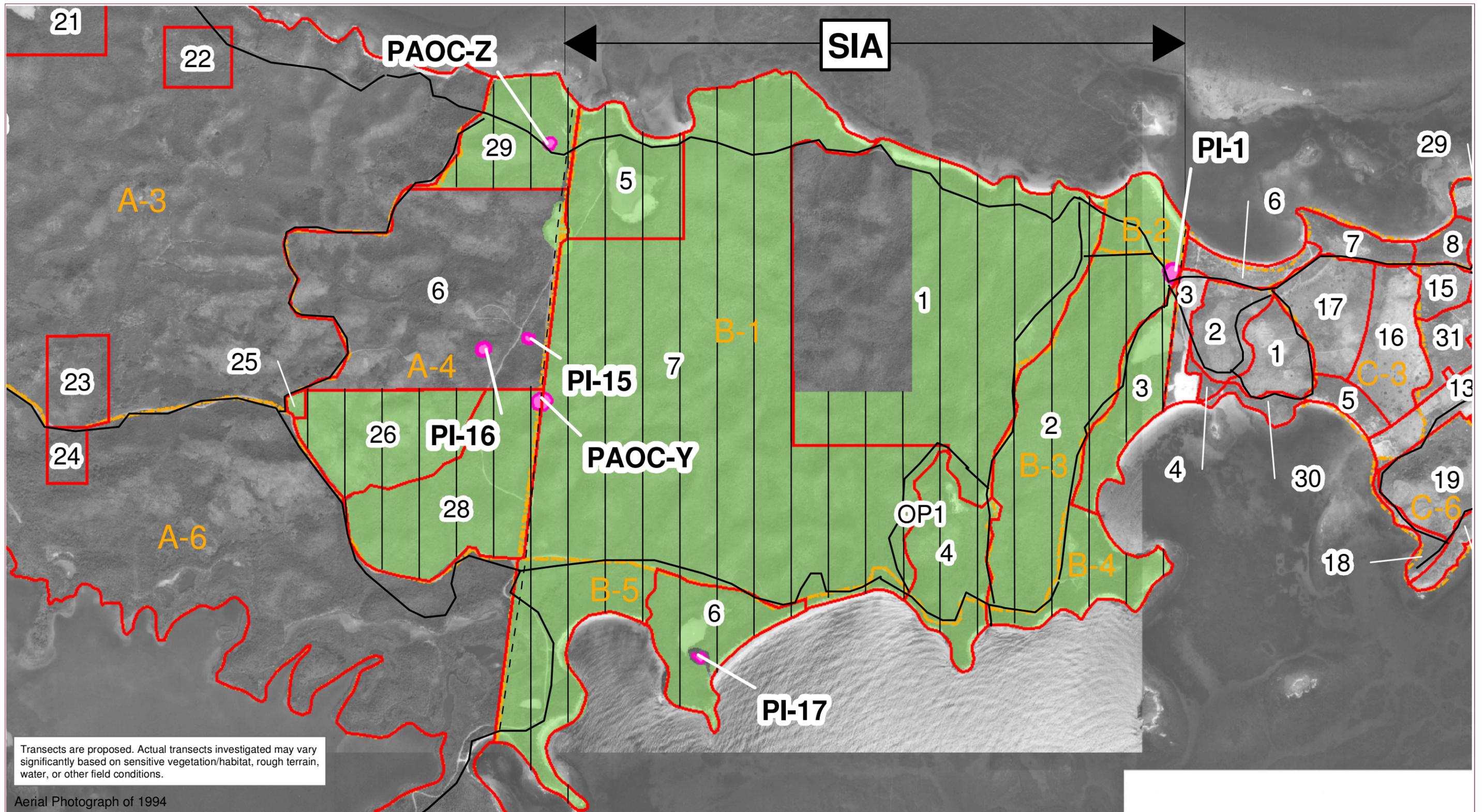


Figure 3-3
Preliminary Locations of 10 Percent Inspection
Transects in the ECA
Former VNTR, Vieques, Puerto Rico



Legend

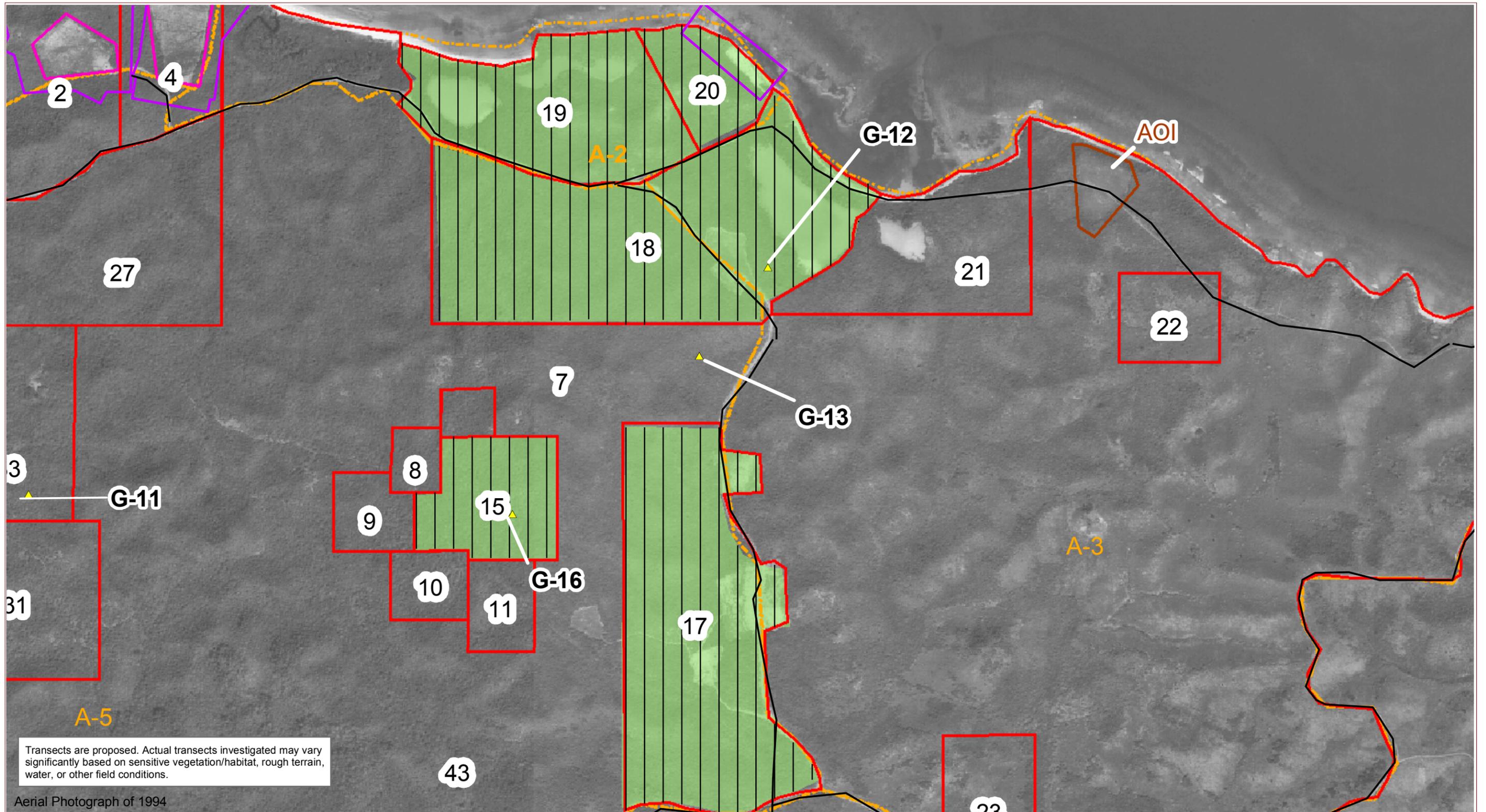
- 1 MRS Boundary
- Parcel Boundary and Designation
- 10% Investigation Area
- PAOC, PI Sites, 100% Investigation

- Roads
- Potential Investigation Transects (Lines are graphical representation of 1.5 m width transect)

Notes :
 - MRS Numbers Do Not Signify Priority



Figure 3-4
 Preliminary Locations of 10 Percent Inspection Transects
 in the SIA and EMA-MRSs 26, 28, 29
 Former VNTR, Vieques, Puerto Rico

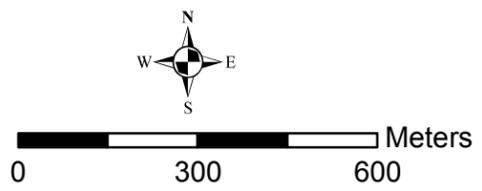


Transects are proposed. Actual transects investigated may vary significantly based on sensitive vegetation/habitat, rough terrain, water, or other field conditions.

Aerial Photograph of 1994

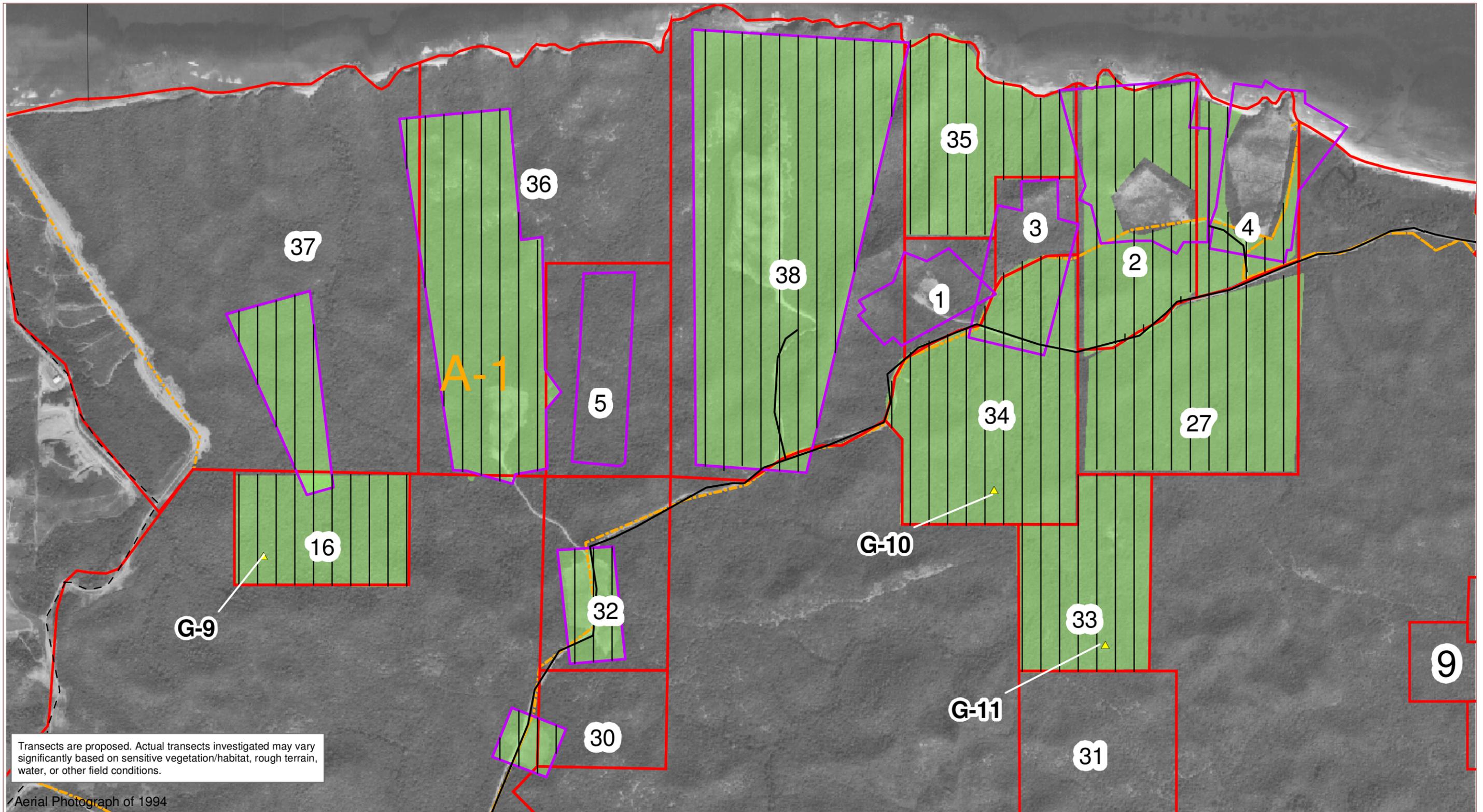
Legend

- 1 MRS Boundary
- Parcel Boundary and Designation
- 10% Investigation Area
- Areas of Interest (AOI), 100% Investigation
- ▲ Gun Positions
- Firing Range Fan
- Roads
- Potential Investigation Transects (Lines are graphical representation of 1.5 m width transect)



Notes :
- MRS Numbers Do Not Signify Priority

Figure 3-5
Preliminary Locations of 10 Percent Inspection
Transects Middle EMA
Former VNTR, Vieques, Puerto Rico



Transects are proposed. Actual transects investigated may vary significantly based on sensitive vegetation/habitat, rough terrain, water, or other field conditions.

Aerial Photograph of 1994

Legend

- 1 MRS Boundary
 - Parcel Boundary and Designation
 - 10% Investigation Area
 - ▲ Gun Positions
 - Firing Range Fan
 - Roads
 - Potential Investigation Transects (Lines are graphical representation of 1.5 m width transect)
- Notes :
- MRS Numbers Do Not Signify Priority

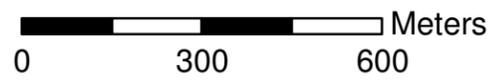
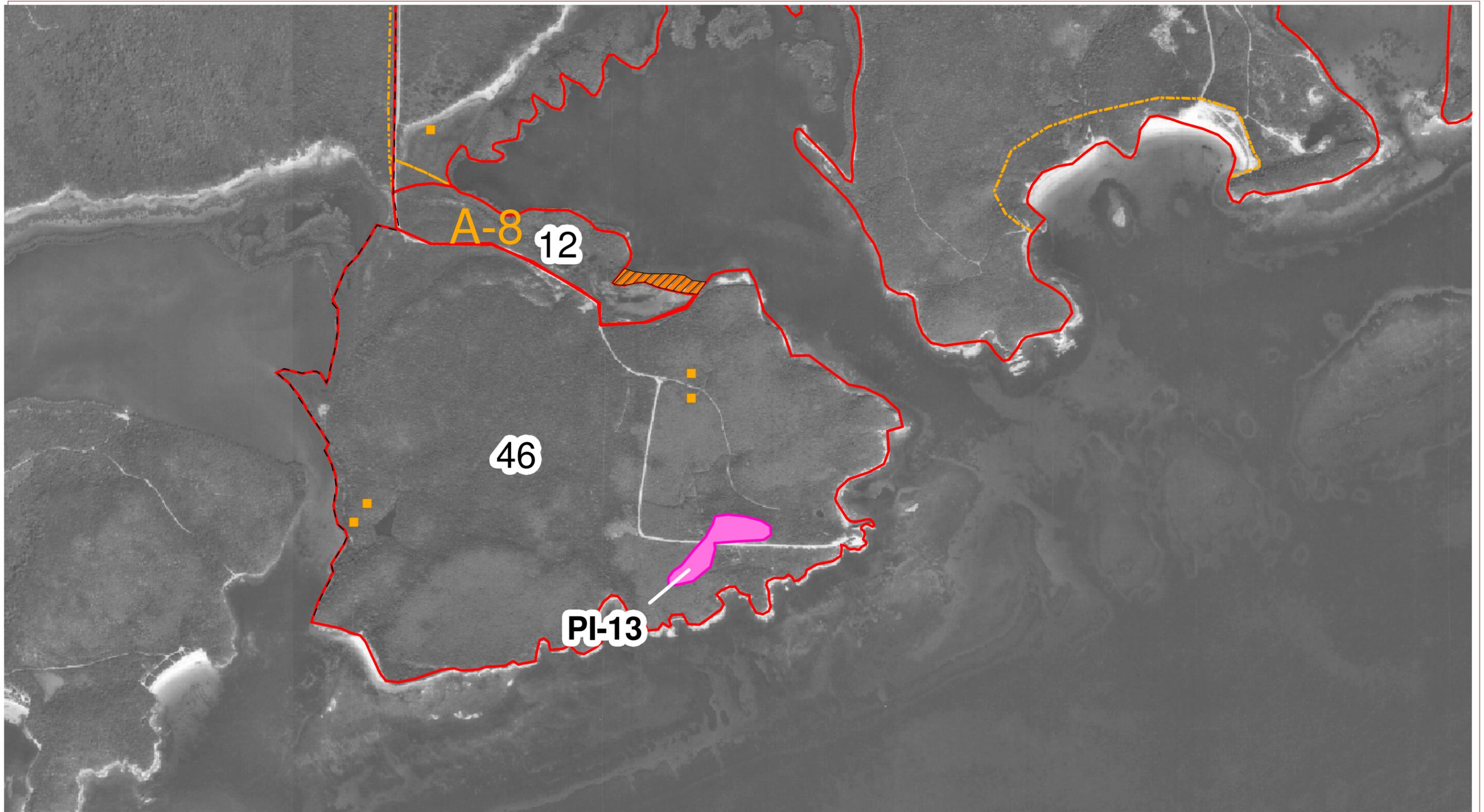


Figure 3-6
Preliminary Locations of 10 Percent Inspection
Transects Western EMA
Former VNTR, Vieques, Puerto Rico

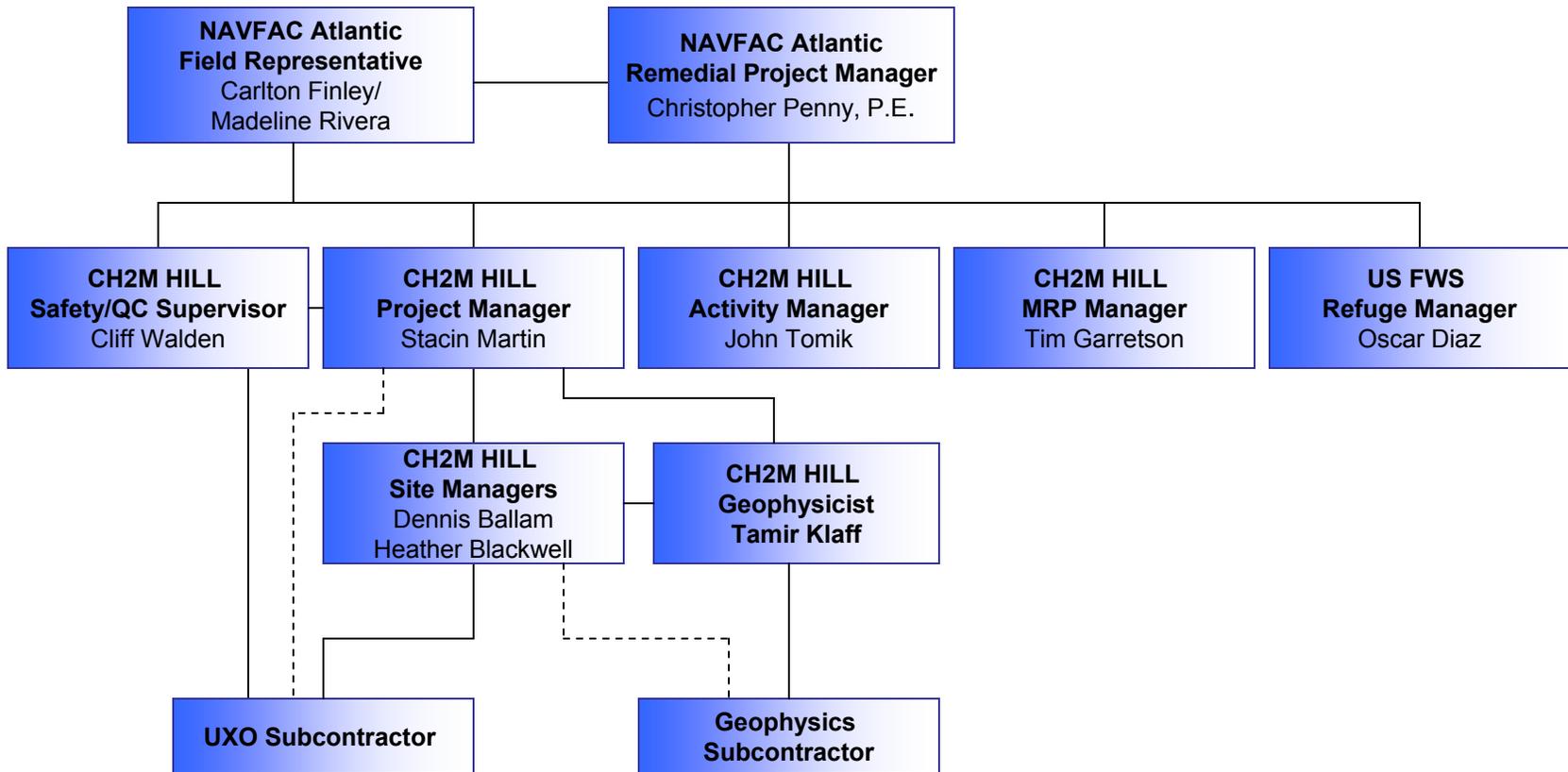


Legend

- MRS Boundary
 - Parcel Boundary and Designation
 - MRA Boundary
 - Revised MRS Small Arms Range
 - PAOC, PI Sites, 100% Investigation
 - Roads
 - Known or Suspected Debris or Pit
 - Debris Areas
- Notes :
 - MRS Numbers Do Not Signify Priority



Figure 3-7
 Locations of known and suspected debris to be Investigated in EMA MRS 44 and EMA MRS 46 Former VNTR, Vieques, Puerto Rico



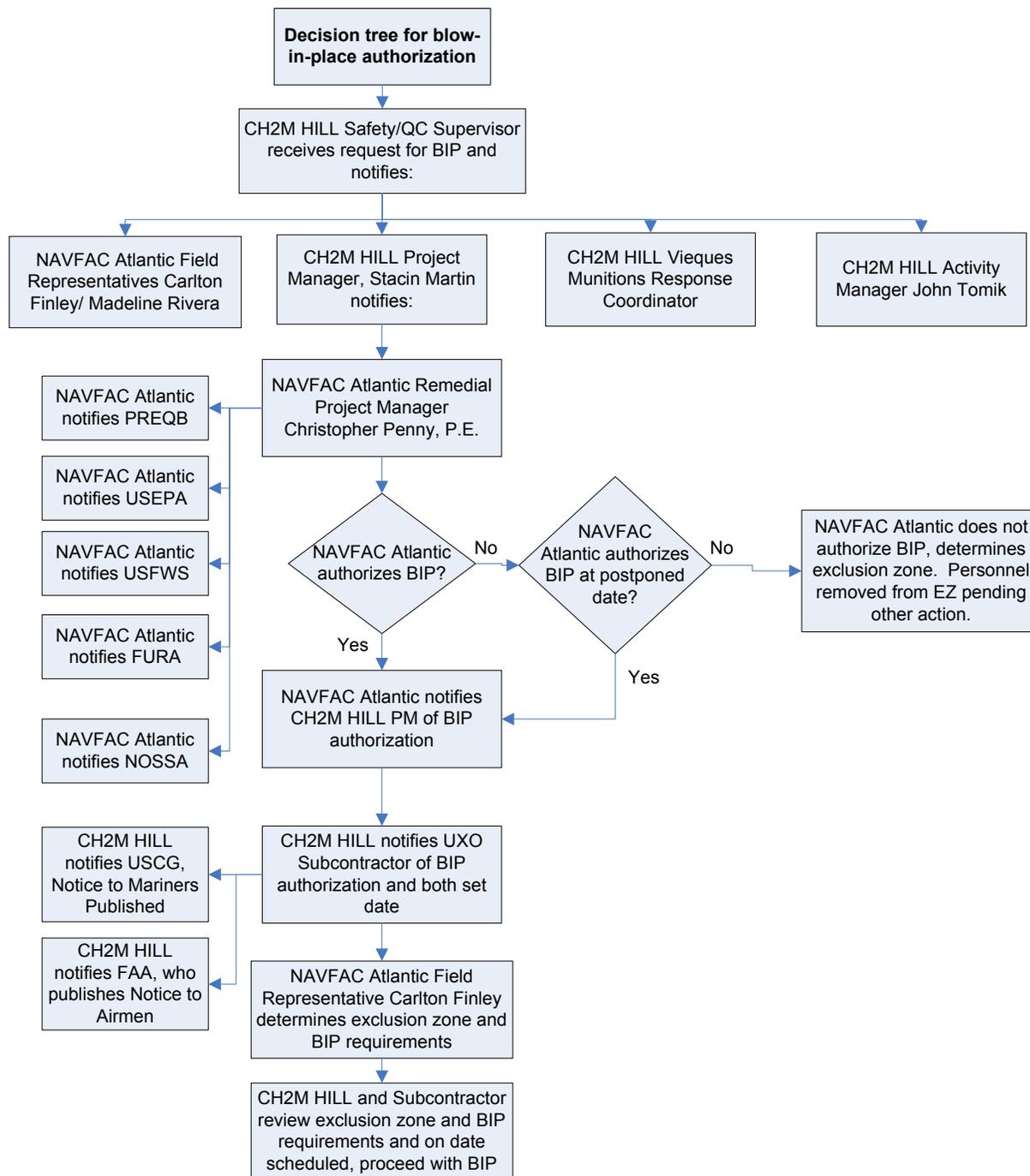
Solid line-Direct communication

Dashed line-Indirect communication

FIGURE 3-8

Project Field Communication Plan
Former VNTR, Vieques, Puerto Rico

Figure 3-9 Blow-in-Place (BIP)
 Decision Tree,
 Former VNTR, Vieques, Puerto Rico



1 SECTION 4

2 **Explosives Safety Plan**

3 The Draft MEC Master Work Plan, (CH2M HILL, September 2005) describes the site-specific
4 approaches for storing and transporting explosives in the former VNTR. Other related
5 documents regarding explosives safety include: Draft-Final Explosives Safety Submission,
6 Expanded Range Assessment/Phase I Site Inspection, Former VNTR, Vieques, Puerto Rico,
7 Revision 1, June 2005 (CH2M HILL, June 2005) and the Explosives Operations Site
8 Approval, Former VNTR, Vieques, Puerto Rico, October 2004 (CH2M HILL, October 2004).

9 As discussed in Section 3, the need for disposal of MEC as part of the ERA/Phase II SI is not
10 anticipated. In the case that acquisition of explosives materials to dispose of MEC becomes
11 necessary, the UXO support contractor will procure and store as necessary the materials to
12 conduct disposal. All deliveries will be made directly to the Former VNTR and explosive
13 materials will be stored according to the approved siting plan at the permanent magazines
14 located east of OP-1.

1 SECTION 5

2 **Expanded Range Assessment/Site**
3 **Inspection Report**

4 **5.1 Conceptual Site Model**

5 The preliminary MEC conceptual site model (CSM) completed as part of the PRA and ERA/
6 Phase I SI will be updated based on site inspections. The initial CSM for the former VNTR is
7 presented as Figure 5-1, and describes the known sources, pathways, and receptors of
8 potential MEC hazards within the study areas.

9 **5.2 Expanded Range Assessment/Phase II Site Inspection Report**

10 A draft ERA/Phase II SI Report will be submitted to the USEPA, PREQB, and USFWS for
11 review and comment. Based on the review comments on the Draft ERA/Phase II SI Report,
12 a Final ERA/Phase II SI Report will be prepared. The report will include the results of the
13 site inspection findings, and will include tables and figures to supplement the text.

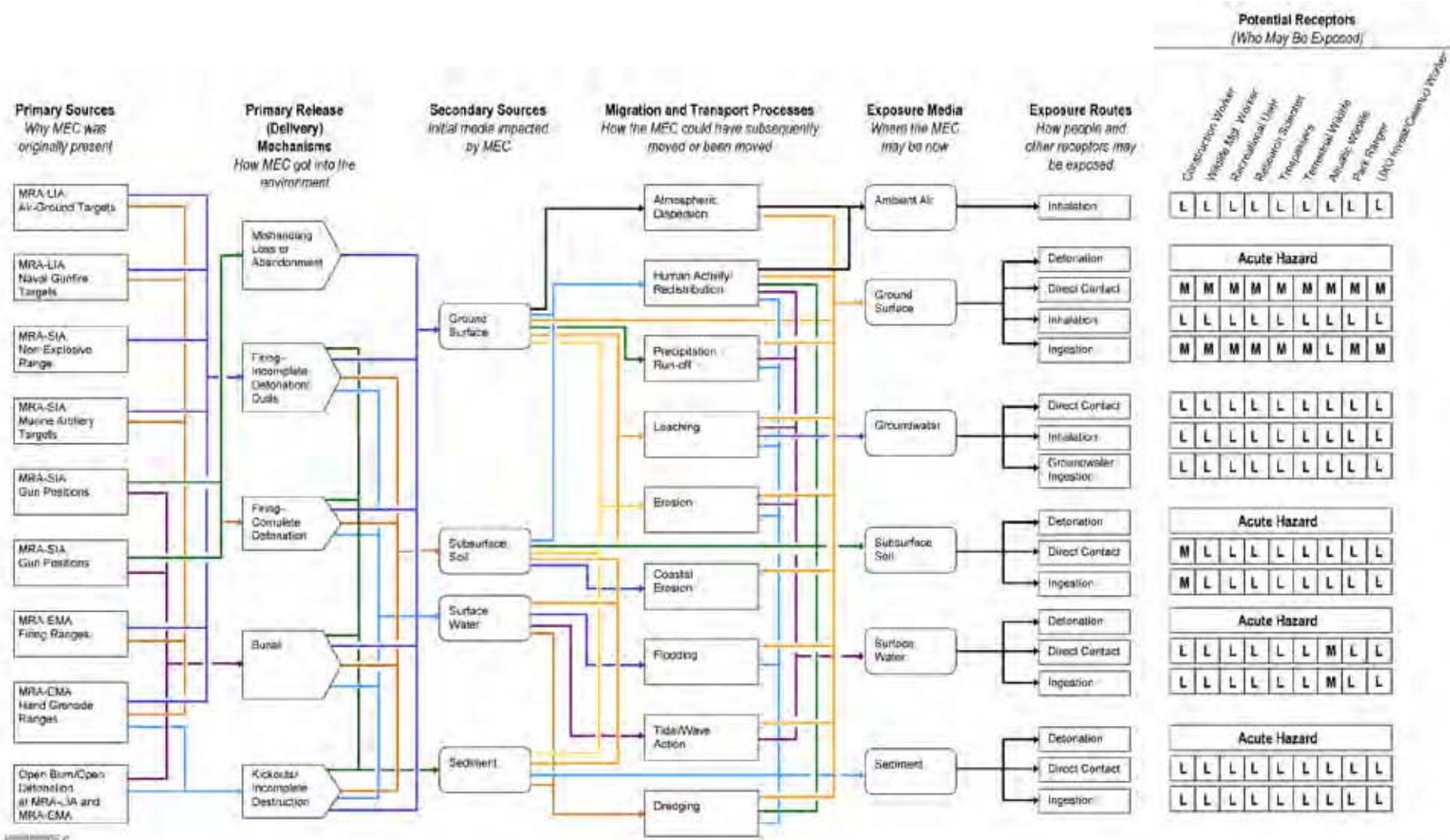


FIGURE 5-1
Graphical Conceptual Site Model for MEC Impacts
Former VNTR, Vieques, Puerto Rico

1 SECTION 6

2 Project Schedule

3 It is anticipated that the site inspection activities will begin December 2006 and will be
4 completed April 2007. The schedule may be modified based on determination that
5 additional site information is needed at the MRSs or other factors (e.g., weather) limit
6 performance. The schedule is based on the following assumptions:

- 7 • A 60-day review period for the USEPA, PREQB, and USFWS to review and comment on
8 documents prepared by the U.S. Navy.
- 9 • A 30-day period for the U.S. Navy to respond to comments generated by USEPA and
10 PREQB and incorporate these responses into a revised work plan.

1 SECTION 7

2 **References**

- 3 Adak Risk Subcommittee, 1999. *Draft Final Level 1 Ordnance and Explosives Hazard Severity*
4 *Screening Methodology for Adak Island, Alaska*. December.
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Final

**CH2M HILL Site Safety and Health Plan
Former Vieques Naval Training Range (VNTR)**

Contract Task Order 0047

November 2006

Prepared for

**Department of the Navy
Naval Facilities Engineering Command
Atlantic Division**

Under the

**LANTDIV CLEAN III Program
Contract No. N62470-02-D-3052**

Prepared by



Virginia Beach, Virginia

CH2M HILL Site Safety and Health Plan

This site-specific Safety and Health Plan supplements the Safety and Health Plan provided in Section 6 of the *Draft MEC Master Work Plan, Revision 1 (CH2M HILL, January 2006)*, and is intended for convenient reference by field personnel during implementation of MEC activities at VNTR. The Navy Occupational Safety and Health Manual, OPNAVINST 5100.23E, will be referenced as necessary during implementation of field activities.

This Site Safety and Health Plan will be kept onsite during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the SOPs in the CH2M HILL Health and Safety Program, Program and Training Manual, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Site Safety Coordinator (SSC) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment A-1. CH2M HILL's SOP HSEQ-610 for Explosives Usage and Munitions Response is included in Attachment A-2 of this plan.

A.1 Project Information and Description

Project No: 187211

Client: U.S. Navy

Project/Site Name: Expanded Range Assessment Vieques Naval Training Range

Site Address: Vieques Island, Puerto Rico

CH2M HILL Project Manager: Stacin Martin

CH2M HILL Office: Virginia Beach

Date Health and Safety Plan Prepared: 24 March 2006

Date(s) of Site Work: July to December 2006.

Site Access: All investigation sites are located in the Former Vieques Naval Training Range, in the eastern portion of Vieques Island, Puerto Rico. All Sites are accessed through the secure gates for the MEC restricted area of the Former VNTR.

Site Size: 14,500 Acres

A.1.1 Site Topography

The topography of Vieques is characterized by gentle to steep rolling hills and valleys throughout the island, with the eastern side of the island exhibiting a more rugged terrain. Figure 2-5 illustrates the topography of the VNTR. The LIA is relatively flat with elevations ranging from 0 to approximately 50 feet above sea level. Cerro Matias, located within the SIA as OP-1 (Figure 2-3) is the highest point on VNTR, at approximately 420 ft above MSL. The average elevation across Vieques is approximately 246 ft MSL. The coastal area is relatively narrow, however, the southern coast exhibits wider expanses of beach.

A.1.2 Prevailing Weather

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

A.1.3 Site Description and History

Vieques is the largest offshore island of Puerto Rico, with a surface area of approximately 51 square miles. It is located approximately 7 miles east-southeast of the eastern end of the main island of Puerto Rico. The Navy owned portions of Vieques from 1941 until 2003. Although the Island of Culebra was the focal point for naval gunfire in the 1960s and early 1970s, AFWTF began developing facilities on the eastern end of Vieques in 1964 when it established a gunnery range in the LIA. In 1965, the Navy established a LIA, also known as the air impact area, and began construction activities at Observation Post (OP) 1 on Cerro Matias.

By the 1970s, the LIA maintained several targets for aerial bombing including old tanks and vehicles which were used as mock-ups, two bulls-eye targets and a strafing target. In addition, several point and area targets for ships to practice naval gunfire support were established in the LIA. The locations of these targets are shown on Figure 2-3.

The Environmental Impact Statement (EIS) for Vieques (Tippetts, et al., 1979) provides a detailed discussion on the development of training facilities in the VNTR leading up to 1979. The AFWTF provided logistics support, scheduling assistance, and facilities for NGFS and ATG ordnance delivery training for Atlantic Fleet ships, NATO ships, air wings, and smaller air units from other allied nations and the Puerto Rican National Guard. The Fleet Marine Force, Atlantic (FMFLANT), conducted training for Marine amphibious units, battalion landing teams, and combat engineering units in the EMA. Occasionally, naval units of allied nations having a presence in the Caribbean and the Puerto Rican National Guard also utilized the EMA.

Adjacent to and west of the SIA, the 10,673-acre EMA provided maneuvering space and ranges for the training of marine amphibious units and battalion landing teams in exercises of amphibious landings, small arms fire, artillery and tank fire, shore fire control, and combat engineering tasks. The EMA was first established in 1947. It is demarcated by the western property line east to the western front friendly fire line where the SIA begins. Figure 1-3 presents a map showing the location of the primary target areas, the artillery gun positions and the ranges that were established by the 1970s.

Portions of the training areas within the VNTR were in continuous use from World War II, when the Navy acquired title to the land, until 2003. The Atlantic Fleet's ships, aircraft and marine forces carried out training in all aspects of NGFS, ATG ordnance delivery, air-to-surface mine delivery, amphibious landings, small arms fire, artillery and tank fire, and combat engineering. As part of normal operations, unexploded ordnance was cleared periodically from the LIA and destroyed. The Navy also operated a waste munitions open burn and open detonation (OB/OD) facility under an EPA permit within the LIA.

A.2 Tasks to be Performed Under this Plan

A.2.1 Description of Tasks

Refer to project documents (i.e., Work Plan) for detailed task information. A risk analysis (Section A.3) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin.

A.2.1.1 Hazwoper-Regulated Tasks

- Site Layout
- Surface and subsurface geophysical surveys
 - Magnetic
 - Electromagnetic
- Vegetation removal using hand tools

A.2.1.2 Non-Hazwoper-Regulated Tasks

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

A.3 Activity Hazard Analysis for MEC Operations

Table A-1 shows hazards analysis, and Table A-2 shows inspection requirements. The “principal steps” and “equipment to be used” identified with an (*) are not anticipated to be conducted or used, but have been evaluated in the case they become necessary.

TABLE A-1
Hazards Analysis

Principal Steps	Potential Hazards	Recommended Controls
Transportation of explosive materials*	Accidental detonation of explosives	<p>Explosives will be transported in accordance with the 49, CFR, Parts 100-199.</p> <p>Explosives will be transported in closed vehicles whenever possible.</p> <p>When using an open vehicle, explosives will be covered with a flame resistant tarpaulin.</p> <p>Motor vehicles will be shut off when loading/unloading explosives.</p> <p>Beds of vehicles will have either a nonconductive bed liner, dunnage, or sand bags to protect the explosives from contact with the metal bed and fittings.</p> <p>Initiating explosives, such as blasting caps, will remain separated at all times from bulk explosives.</p>

TABLE A-1
Hazards Analysis

Principal Steps	Potential Hazards	Recommended Controls
Transportation of explosive materials*	Unqualified Drivers	<p>Each vehicle used for the transport of MEC will be outfitted with a fire extinguisher and first aid kit.</p> <p>Do not fuel trucks when loaded with MEC.</p> <p>Drivers will be licensed in accordance with federal, state, and local regulations.</p>
	Vehicle operations	<p>Drivers will observe all posted speed limits while operating a motor vehicle on a public roadway.</p> <p>Vehicles transporting explosives offroad will not exceed 15 miles per hour (mph).</p> <p>Chock wheels when loading or unloading MEC-related materials.</p>
Storage of explosive materials*	Accidental detonation of explosives	<p>Materials will be stored in accordance with federal, state and local regulations.</p> <p>Refer to the SOP for the Storage of Explosive Materials.</p>
Surveying and establishing boundaries and grids	Accidental detonation of explosives	<p>Personnel involved will attend a site-specific MEC recognition class prior to the commencement of any site activities.</p> <p>UXO technicians will escort non-UXO-qualified personnel at all times.</p> <p>Mark and avoid MEC. Only UXO technicians will handle MEC waste.</p> <p>Check location with magnetometer prior to driving stakes.</p>
	Wildlife, slips, trips, falls, insects, poisonous plants, use of hand tools	Refer to the Activity Hazard Analysis section of this SSHP.
Clearing and grubbing	Accidental detonation of explosives	<p>Personnel involved will attend a site-specific MEC recognition class prior to the commencement of any site activities.</p> <p>Be alert and mark all MEC located.</p> <p>Only clear and grub to within 4 inches of the ground surface.</p> <p>UXO trained personnel will escort non-UXO-qualified personnel at all times.</p> <p>Surface sweeps will be conducted with magnetometers or other suitable geophysical instrumentation to identify potential MEC.</p>
Transportation of MEC waste*	Accidental detonation of explosives	No personnel allowed in cargo compartment of vehicle transporting MEC.

TABLE A-1
Hazards Analysis

Principal Steps	Potential Hazards	Recommended Controls
	Accidental detonation of explosives	No MEC allowed in passenger compartment of vehicle. Block, brace, secure MEC. No smoking in vehicles used for transport of MEC waste.
	Vehicle operations	Placard vehicle in accordance with U.S. Department of Transportation (DOT) regulations. Vehicles transporting explosives offroad will not exceed 15 mph. Drivers will observe all posted speed limits while operating a motor vehicle on a public roadway.
MEC disposal operations*	Accidental detonation of explosives	Observe procedures outlined in EODB 60A-1-1-31.
MPPEH demilitarization*	Accidental detonation of explosives	Only UXO technicians will perform explosive demilitarization of MPPEH.
	Shredder Operations	Stay clear of moving mechanical parts. Ensure that only inspected scrap is fed into shredder.
Inspection/certification of MD*	Accidental detonation of explosives	Only UXO technicians will inspect MPPEH. Personnel in the immediate vicinity of MPPEH inspections will be kept to the minimum necessary for safe operations but no less than two UXO technicians. Observe requirements of DoD 4160.21-M-1.
Anomaly reacquisition	Accidental detonation	Only UXO technicians will excavate or handle MEC. Personnel in the immediate vicinity of MEC operations will be kept to the minimum necessary for safe operations, but no less than two UXO technicians. Do not subject MEC to heat, shock, or friction. Only hand excavation permitted when within 1 ft of MEC. Magnetometers will be used frequently to pinpoint the location of MEC.
	Non-UXO technician personnel ^{1,2}	Establish exclusion zone (EZ); post warning signs, maintain site control. Stop all MEC operations when non-UXO-technician personnel are within the EZ ^{1,2} .

TABLE A-1
Hazards Analysis

Principal Steps	Potential Hazards	Recommended Controls
Clearing and Grubbing of vegetation	Cutting tools, chain saws, weed cutters	Eye, hand, foot, and hearing protection, (Level D). Face shield and chaps will be worn by chain saw operations. Personnel using chain saws, cutting tools, and weed cutters must provide safe distance between workers and be cautious of tools.

Only the UXO subcontractor will transport MEC material and explosives.

1) By US Army Corps of Engineers regulations, sweep personnel are not permitted within the EZ while “MEC operations” (intrusive and explosive operations such as demolition) are being performed; UXOT Is can only be in the EZ, under the same circumstances, if under the supervision of UXOT IIs or IIIs.

2) Non-UXO Technician personnel can be designated as Essential Personnel to observe MEC operations if they have a letter authorizing them from the appropriate federal agency, a risk analysis has been performed, and they have been briefed on safety and are escorted by UXOT II or higher. No more than two authorized visitors, can enter the EZ at one time.

TABLE A-2
Inspection Requirements

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

A.4 Hazard Controls

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

A.4.1 Munitions Response (Munitions Response Standards of Practice, SOP HSE&Q-610)

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

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

- Only qualified UXO Technicians will locate, identify, handle, remove, transport, store, or dispose of MEC items.
- The preferred and safest method for disposal of MEC is to destroy it in its original position by demolition (BIP) whenever circumstances permit. By this method, both the ordnance and the hazard it poses are eliminated in one operation.
- Munitions that have been determined to be “safe to move” by an authorized UXO Technician(s) can be transported to an approved holding area or disposal site.
- One person acting alone will never conduct operations involving contact with MEC.
- MEC must not be moved or disturbed in any way unless it has been determined to be safe to do so by qualified UXO technician(s). Operations in the vicinity of MEC should only be conducted after a complete work plan, including emergency procedures, has been established, reviewed and approved.
- Electronic equipment capable of emitting electromagnetic radiation (such as radios or cellular phones) shall not be activated in the vicinity of known or suspected electrically initiated ordnance.
- Munitions having no color-coding, incomplete color-coding, or improper color-coding are not uncommon, so color coding should not be relied on as a positive identification of ordnance.
- Inhalation of, and skin contact with, smoke, fumes, and vapors of explosives and related hazardous materials shall be avoided.
- MEC that has been exposed to fire or detonation must be considered extremely hazardous. Chemical and physical changes may have occurred to the contents, which render it more sensitive than when in its original state.
- When encountered, attempts should be made to positively identify MEC items. The item shall be carefully examined for markings and other identifying features such as shape, size, and external fittings. The item should not be moved prior to inspection.

- Ordnance shall be approached from the side because munitions may contain an ejection hazard, shaped charge explosive jet hazard, rocket motor, or fuzing sensitive to movement.
- Unnecessary personnel must not remain in the vicinity of MEC.
- Ordnance items must be considered armed and dangerous.
- Fired ammunition or ordnance should not be considered safe.
- Souvenirs shall not be collected.

A.4.2 Competent Person

UXO subcontractors are responsible for providing a competent person to oversee MEC operations. A competent person may be a SUXOS, UXOSO, UXO QC Specialist, or a UXO Technician III. Occupational Safety and Health Administration (OSHA) regulations describe a competent person as one who is capable of identifying existing and predictable hazards in the work surroundings and has the authorization to take prompt corrective measures to eliminate them.

The competent person must meet the following minimum qualification requirements:

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

A.4.2.1 (Reference CH2M HILL SOP HSE&Q-307, Excavations)

- Do not enter the excavations unless completely necessary, and only after the competent person has completed the daily inspection and has authorized entry.
- Follow all excavation entry requirements established by the competent person.
- Do not enter excavations where protective systems are damaged or unstable.
- Do not enter excavations where objects or structures above the work location may become unstable and fall into the excavation.
- Do not enter excavations that potentially contain a hazardous atmosphere until the air has been tested and found to be safe.
- Do not enter excavations with accumulated water unless precautions have been taken to prevent excavation cave-in.
- Use the Health and Safety Self-Assessment Checklist found in Attachment A-5 of this Site-Specific Work Plan to evaluate excavations prior to entry.

- Prior to excavation crews entering any of the sites, conduct a reconnaissance and MEC avoidance activities to provide clear access routes to each site, according to the following procedures:
 - Identify and clearly mark the boundaries of a clear approach path for the sampling crews, vehicles, and equipment to enter the site. This path will be, at a minimum, twice the width of the widest vehicle. No one will be allowed outside any marked boundary.
 - If MEC is encountered on the ground surface, clearly mark the area where it is found, report it to the proper authorities, and divert the approach path around it.
 - Conduct an access survey using the appropriate geophysical instrument over the approach path for avoidance of MEC that may be in the subsurface. If a magnetic anomaly is encountered, assume it is MEC and divert the approach path around the anomaly. Only UXO technicians will operate the appropriate geophysical instrument and identify MEC.
- After preparing the site, employ the following approaches to excavation:
 - Remember that hand excavation is the most reliable method for uncovering MEC.
 - Consider earth-moving machinery (EMM) to excavate overburden from suspect MEC. EMM will not be used to excavate within 12 inches of suspected MEC.
 - Use a step-down or offset access method for hand or EMM excavation methods.

A.4.3 General Hazards

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

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

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

A.4.3.1 General Hazards and Housekeeping

- Site work must be performed during daylight hours whenever possible. Work conducted at night requires enough illumination intensity to read a newspaper without difficulty.
- Hearing protection must be worn in areas where shouting is necessary to hear someone within 3 ft.

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

A.4.3.2 Hazard Communication SOP HSE&Q-107

In addition to complying with the above SOP 107 requirements, the SSC or UXOSO is to perform the following:

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

A.4.3.3 Shipping and Transportation of Chemical Products

Chemicals are not expected to be needed as part of the field efforts. If chemicals are determined to be necessary, these chemicals might be defined as hazardous materials by DOT. All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via

Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the RHSM or Regional Environmental Coordinator (REC) for additional information.

A.4.3.4 Lifting HSE&Q SOP 112

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

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

A.4.3.5 Slips, Trips, and Falls

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

A.4.3.6 Fire Prevention and Control HSE&Q SOP 308

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

A.4.3.7 Electrical HSE&Q SOP 206

- All temporary wiring, including extension cords, must have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must be:
 - Equipped with third-wire grounding
 - Covered, elevated, or protected from damage when passing through work areas
 - Protected from pinching if routed through doorways

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

A.4.3.8 Ladders (HSE&Q SOP 214, Stairways and Ladders)

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

A.4.3.9 Heat Stress (HSE&Q SOP 211, Heat and Cold Stress)

A.4.3.10 Preventing and Treating Heat Stress

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every

20 minutes, for a total of 1 to 2 gallons per day. Take regular breaks in a cool, shaded area. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.

- Acclimate by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. The devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Provide adequate shelter or shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Monitor buddy for signs of heat stress. Persons who experience signs of heat rash or heat cramps should see medical attention.
- Cool down immediately if heat syncope (sudden fainting), heat exhaustion (hot, pale, clammy/moist skin), or heat stroke (red, hot, dry skin; loss of consciousness) is experienced and consume cool water or sports drink. Persons who experience heat syncope or heat exhaustion should also seek medical attention as soon as possible. Persons who experience heat stroke must get immediate medical attention.

A.4.3.10.1 Monitoring Heat Stress

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

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

A.4.3.11 Procedures for Locating Buried Utilities

Local Utility Mark-Out Service

Name: Caleb Romero, NSSR, Puerto Rico

Phone: (787) 865-4152, Ext. 423

- No excavation or subsurface intrusion is being conducted as part of this investigation; however, in the case it becomes necessary the steps below will be conducted.

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

A.4.3.12 Working Near Water

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

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

A.4.3.13 Working on Water

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

A.4.3.14 IDW Drum Sampling (HSE&Q SOP 408, Waste Management: Analysis and Characterization)

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

- Minimize transportation of drums.
- Sample only labeled drums or drums known to contain IDW.
- Use caution when sampling bulging or swollen drums. Relieve pressure slowly.
- If drums contain, or potentially contain, flammable materials, use non-sparking tools to open.
- Do not use picks, chisels, and firearms to open drums.
- Reseal bung holes or plugs whenever possible.
- Avoid mixing incompatible drum contents.
- Sample drums without leaning over the drum opening.
- Transfer the content of drums using a method that minimizes contact with material.
- PPE and air monitoring requirements specified in Sections A.6 and A.7 must address IDW drum sampling.
- Spill containment procedures specified in Section A.9 must be appropriate for the material to be handled.

A.4.3.15 Confined Space Entry (HSE&Q SOP 203, Confined Space Entry)

No confined space entry will be permitted without the written authorization from the RHSP. Confined space entry requires additional health and safety procedures, training, and a permit. If conditions change such that confined-space entry is necessary, the RHSM must be contacted to develop the required entry permit.

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

A.4.3.16 Working Around Material Handling Equipment (HSE&Q SOP 306, Earthmoving Equipment)

- Never approach operating equipment from the rear. Always make positive contact with the operator, and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment; remain outside of the swing and turning radius.
- Maintain distance from pinch points of operating equipment.

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

A.4.3.17 Biological Hazards and Controls

A.4.3.17.1 Snakes

No poisonous snakes are indigenous to Puerto Rico.

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

A.4.3.17.2 Poison Ivy and Poison Sumac

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

A.4.3.17.3 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 length. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray only outside of clothing with permethrin or permethrin and spray skin only with DEET. Check yourself frequently for ticks.

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

A.4.3.17.4 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the UXOSO and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

A.4.3.17.5 Bloodborne Pathogens

Exposure to blood-borne pathogens may occur when rendering first aid or cardio-pulmonary resuscitation (CPR), or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and PPE are required as specified in CH2M HILL SOP HSE&Q -202, Blood-borne Pathogens. Hepatitis B vaccination must be offered where exposure is a possibility.

A.4.3.17.6 Other Anticipated Biological Hazards

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

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

Toxic native plants include manchineel, castor bean, *Comocladia*, *Tragia volubilis*, *Malpighia fucata*, *Cordia rupicola*, *Pictetia aculeate* and *Croton*. Manchineel (*Hippomane mancinella*) is an evergreen tree found in coastal forest or thickets and can be more toxic than poison ivy or poison sumac. Its sap produces lesions similar to chemical burns. Castor bean (*Ricinus communis*) also has sap that can cause skin lesions and is found in previously disturbed coastal areas. *Comocladia* is a small shrub found in limestone soils such as the eastern part of the LIA, it has toxic sap and can cause allergic reactions. Another invasive shrub is *Croton discolor*. This small shrub rapidly invades cleared or disturbed areas and can cause respiratory allergies.

Several plants on Vieques are known to be skin irritating (Attachment A-8). They include:

- *Comocladia dodonaea*—Commonly known as Christmas-bush, this is a fairly small shrub that has waxy looking leaves that have a small spine at the end of each of them. The leaves can vary in color from green to yellow to red. The sap and residue on the leaves contain a chemical similar to those found in poison ivy but in a higher concentration.
- *Croton discolor* – This plant is a fairly large bush (up to 7 ft. tall) that looks like it is drying out and doesn't have long to live. There are two species on the island, but both look very similar and have very



Comocladia dodonaea



Croton discolor

hairy leaves. The leaves have a tendency to stick to your clothing because of the hairs of the leaves.

- *Tragia volubilis*–This plant is commonly known as Pica-Pica, as well as Cowitch. It is a vine that, if cut or disturbed, will release hairs that can cause skin irritations.



Tragia volubilis

- *Malpighia fucata* – Commonly known as palo bronco, this evergreen shrub (or small tree) is identified by its opposite, blunt-pointed leaves. Upper leaf surfaces are green and lower surfaces are a paler green with many yellowish, needle-like hairs. Flowers have white/pink petals.



Malpighia fucata

- *Cordia rupicola* – This is a small shrub with red fruit. Previously

thought to be endemic to Puerto Rico and known only from one area, it has recently been reported from the island of Anegada's wooded hills among low dense brush.

- *Pictetia aculeate* – Commonly known as tachuelo, gumbo limbo, or turpentine tree, this tree has a reddish, peeling bark and produces an intensely aromatic resin not unlike the pine tree resins that are used to produce true turpentine.



Cordia rupicola

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

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



Pictetia aculeate

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

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

Mongoose, rats, and mice have been documented to (potentially) carry rabies. There is some evidence that mongooses can be infected with the rabies virus in an attenuated form, allowing them to carry and spread the virus for a considerable time before succumbing to the disease. Any observed unusual behavior by mongooses and other mammals must be reported. Signs of rabies can be characterized in two forms. Animals with furious rabies

exhibit agitation and viciousness, followed by paralysis and death. Animals with dumb rabies exhibit lethargy and paralytic symptoms, followed by death. Behavioral indicators for both include fearlessness and change in nocturnal/diurnal rhythms.

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

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

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

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

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

drinking only treated water serve as general precautions. CDC recommends hepatitis A vaccine as a precaution.

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

A.4.3.18 Radiological Hazards and Controls

The Navy acknowledged inadvertently firing 263 rounds of depleted uranium (DU) ammunition in 1999. An intensive range sweep was initiated at that time and many of the DU rounds were recovered. The 25mm PGU-20 projectiles contain a small DU core about the size of a .50 caliber bullet. DU oxidizes rapidly when exposed to air. Oxidized DU is a greenish-yellow, powdery substance.

If a suspected DU projectile is encountered during MEC operations work will stop. UXO personnel will scan the suspected item with a radiation detection instrument. If the item is benign work will continue. If the item is radioactive the FS will refer to the contractors Health and Safety Program, Program and Training Manual, and Health and Safety Program Radiation Protection Manual for SOPs in contaminated areas.

If DU is suspected notify the SUXOS, UXOSO and MRP Site Manager immediately, and contact the **Radiological Affairs Support Office (RASO)**. **The contact information is: Steven W. Doremus, Ph.D. Director, Environmental Radiation Programs NAVSEADET RASO, (757) 887-7745, DSN 953-7745, fax (757) 887-3235.**

The following equipment and personal protective equipment (as per U.S. Army, Industrial Operations Command, Pamphlet 700-48) will be available on-site in the case that UXO personnel are directed to remove and secure the DU to maintain the work schedule: coveralls, leather gloves, nitrile gloves, protective goggles, eye wash, hand cleanser, plastic bags (4 mil), metal container (30 gal, 55 gal, or ammunition box, swabs, tape to seal bags, marking pens, labels, and Radiac meter AN VDR2 6665-01-222-1425 (or similar). Direct surface or swab measurements with the Radiac meter can be performed if directed by support center.

A.4.3.19 Chemical Warfare Materials

CWM is not expected at these work sites. If, at any time during the fieldwork, suspected CWM is encountered, the UXO team must stop all work activities immediately. Field sampling teams must withdraw from the site along the cleared approach paths, away from the area where the suspected CWM is found. The UXO team will immediately report the chemical event to the FS, who will in turn notify the NAVFAC RPM.

The NAVFAC RPM in coordination with the DoI will request assistance through the US Army's 52d Ordnance Group at Fort Gillem, GA (404) 469-3333.

A team of at least two UXO-qualified personnel will secure the suspected CWM site and standby in an upwind location until relieved by a government representative. The initial

exclusion zone for chemical weapons is 450 meters in all directions per US Army FM 9-15, Explosive Ordnance Disposal Service and Unit Operations.

A.4.3.20 Contaminants of Concern

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

TABLE A-3
Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section A.6.	Inhalation: Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections A.6 and A.7, respectively.	Other: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).
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A.5 Project Organization and Personnel

A.5.1 CH2M HILL Employee Medical Surveillance and Training (HSE& SOP 113, Medical Monitoring)

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated SSC have completed a Hazard Communication and Safety Awareness, a 10 hour Construction Safety Awareness class, the 40 hour hazardous Waste Worker training, Initial Safety coordinator training, Safety coordinator - Construction training, Safety Coordinator - Hazardous Waste training, Dangerous Goods Shipping, the Waste Management Course, Bloodborne Pathogens training, Fire Extinguisher, CPR & 1st Aid and have documented requisite field experience. . Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least two (2) FA-CPR designated employees must be present during all tasks performed in exclusion or decontamination zones. The employees listed in Table A-4 are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

The subcontractors listed above are covered by this plan and must be provided a copy of it. This plan does not, however, address hazards associated with the tasks and equipment in which the subcontractor has expertise (e.g., MEC clearance). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established Health and Safety Plan(s). The CH2M HILL UXOSO or SSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s). HSE&Q SOP 215, Contracts, Subcontracts and HSE&Q Management Practices will be followed.

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

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

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Sheet included in Attachment A-1.
- Ask subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action; the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify the subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and RHSM as appropriate.
- Document all oral health and safety related communications in the project field logbook, daily reports, or other records.

A.5.2.1.1.4 Contractors

This plan does not address contractors who are contracted directly to LANTDIV. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and must never assume such responsibility through our actions (e.g., advising on safety and health issues). In addition to this plan, CH2M HILL staff should review contractor safety plans so staff remain aware of appropriate precautions that apply

to CH2M HILL. Except in unusual situations when conducted by the RHSM, CH2M HILL must never comment on or approve contractor safety procedures.

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

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

A.6 Personal Protective Equipment (PPE) (HSE&Q SOP 117, Personal Protective Equipment)

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

TABLE A-5
Personal Protective Equipment

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

Reasons for Upgrading or Downgrading Level of Protection

Upgrade ^f	Downgrade
<ul style="list-style-type: none"> Request from individual performing tasks Change in work tasks that will increase contact or potential contact with hazardous materials Occurrence or likely occurrence of gas or vapor emission Known or suspected presence of dermal hazards Instrument action levels (Section A.7) exceeded 	<ul style="list-style-type: none"> New information indicating that situation is less hazardous than originally thought Change in site conditions that decreases the hazard Change in work task that will reduce contact with hazardous materials

^a Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

^b No facial hair that would interfere with respirator fit is permitted.

^c Hardhat and splash-shield areas are to be determined by the UXOSO. UXO technicians are required to wear hard hats except when investigating suspect MEC.

^d Ear protection should be worn when conversations cannot be held at distances of 3 ft or less without shouting.

^e Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is >85 percent, or if organic vapor measurements are > midpoint of Level C range (refer to Section A.7)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the RHSM.

^f Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the RHSM, and/or the UXOSO or SSC..

^g Steel-toed boots are not required during surface geophysical mapping.

A.7 Air Monitoring/Sampling

A.7.1 Air Monitoring Specifications

Table A-6 shows relevant air monitoring specifications.

TABLE A-6
Air Monitoring Specifications

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

^a Action levels apply to sustained breathing-zone measurements (2 minute duration) above background.

^b The exact frequency of monitoring depends on field conditions and is to be determined by the UXOSO SSC; generally, every 5 to 15 minutes is acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., “Breathing Zone/MW-3”, “at surface/SB-2”, etc.).

A.7.2 Calibration Specifications

Table A-7 shows calibration specifications.

TABLE A-7
Calibration Specifications

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

A.7.3 Air Sampling

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

Contact the HSM immediately if these contaminants are encountered.

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

A.8 Decontamination

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

A.8.1 Decontamination Specifications

Table A-8 shows the general decontamination specifications.

TABLE A-8
Decontamination Specifications

Personnel	Sample Equipment	Heavy Equipment
<ul style="list-style-type: none"> • Boot wash/rinse • Glove wash/rinse • Outer-glove removal • Body-suit removal • Inner-glove removal • Respirator removal • Hand wash/rinse • Face wash/rinse • Shower immediately • Dispose of PPE in municipal trash, or contain for disposal • Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal 	<ul style="list-style-type: none"> • Wash/rinse equipment • Solvent-rinse equipment • Contain solvent waste for offsite disposal 	<ul style="list-style-type: none"> • Power wash • Steam clean • Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

A.8.2 Diagram of Personnel Decontamination Line

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

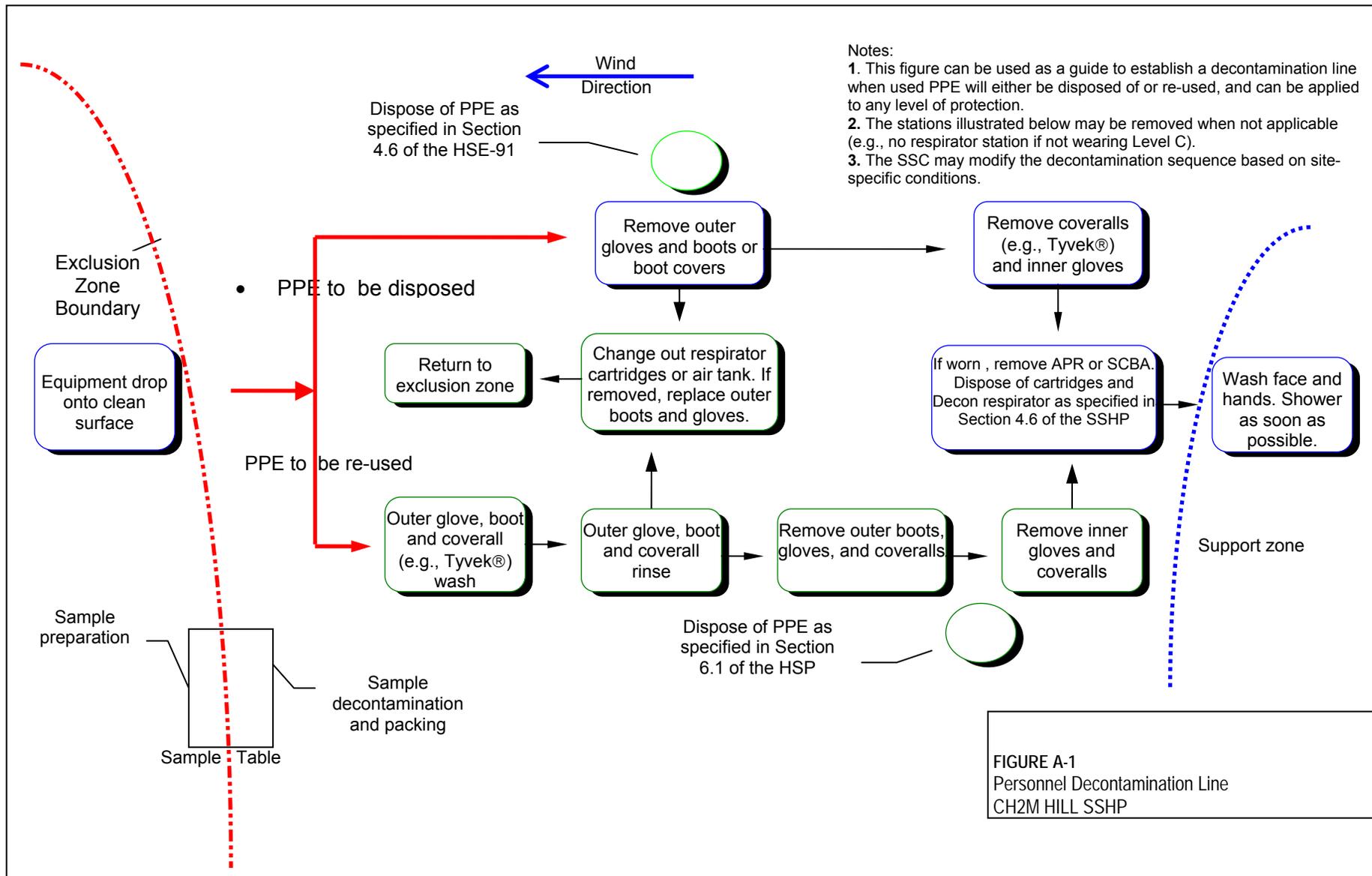
Figure A-1 illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the UXOSO or SSC to accommodate task-specific requirements.

A.9 Spill Prevention and Containment Procedures

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

A.9.1 Spill Prevention

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



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

A.9.2 Spill Containment and Control

- Spill control materials will be maintained in the support zone and at fuel storage and dispensing locations. Incidental spills will be contained with sorbent and disposed of properly. Spilled materials must be immediately contained and controlled. Spill response procedures include taking the following actions:
- Immediately warn any nearby personnel and notify the work supervisor.
- Assess the spill area to ensure that it is safe to approach. Activate site evacuation signal if the spill presents an emergency.
- Ensure that any nearby ignition sources are immediately eliminated.
- If it can be done safely, stop the source of the spill.
- Establish site control for the spill area.
- Use proper PPE in responding to the spill.
- Contain and control spilled material through the use of sorbent booms, pads, or other materials.

A.9.3 Spill Clean-up and Removal

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

A.10 Site Control Plan in accordance with HSE&Q SOP 510, Site Control

A.10.1 Site Control Procedures

- The UXOSO or SSC will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for onsite safety briefing include a general discussion of this section, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, and emergencies.
- The UXOSO or SSC records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL SOP HSE&Q-116, OSHA Postings.

- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
 - Line-of-sight and hand signals
 - Air horn or megaphone
 - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the “buddy system.”
- Initial air monitoring is conducted by the UXOSO or SSC in appropriate level of protection.
- The UXOSO or SCC is to conduct periodic inspections of work practices to determine the effectiveness of this plan: refer to Sections A.2 and A.3. Deficiencies are to be noted, reported to the RHSM, and corrected.

A.10.2 Hazwoper Compliance Plan

Certain parts of the site work are covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated Hazwoper tasks (Section A.2.1.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in Section A.2.1.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed onsite, or while non-Hazwoper-trained staff are working near Hazwoper activities. Other data (e.g., soil) also must document that no potential exists for exposure. The HSM must approve the interpretation of these data. *Draft MEC Master Work Plan, Revision 1 (CH2M HILL, September 2005)* subsections 6.4.20 and 6.7 address contaminant data and air sampling requirements, respectively.
- When non-Hazwoper-trained personnel are at risk of exposure, the SSC must post the exclusion zone and inform non-Hazwoper-trained personnel of the following:
 - Nature of the existing contamination and its locations
 - Limitations of their access
 - Emergency action plan for the site
- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that a potential for exposure to health and safety hazards no longer exists.

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

A.11 Emergency Response Plan (HSE&Q SOP-106, Emergency Planning)

A.11.1 Pre-Emergency Planning

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

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

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

A.11.2 Emergency Equipment and Supplies

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

TABLE A-9
Sample Supply List and Locations

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

A.11.3 Incident Response

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

- Shut down CH2M HILL operations and evacuate the immediate work area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.
- **No attempts will be made to extinguish fires located within the impact areas.**
- The UXOSO cognizant of the fire's location will assess the affect on egress routes, immediately notify all other contractors and subcontractors and make recommendations to their respective UXOSO's as to the safest route to follow, or in the case that no safe route exists, an alternate plan of evacuation.

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

A.11.4 Emergency Medical Treatment

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

- Notify appropriate emergency response authorities listed in Section A.11.8 (e.g., 911).
- Prevent further injury.
- Initiate first aid and CPR where feasible.

- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section A.11.7.

A.11.5 Evacuation

- Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the UXOSO or SSC before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The UXOSO or SSC and a “buddy” will remain onsite after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The UXOSO or SSC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The UXOSO or SSC will write up the incident as soon as possible after it occurs and submit a report to the Director of Health and Safety.
- If the need of rapid evacuation in case of severe trauma exists, the currently approved helicopter evacuation plan will be followed. This plan includes primary contact communications via satellite phone (maintained and tested weekly by the three (3) primary contractor UXOSO’s) and secondary communications through 2-way radios with Aeromed (primary) helicopter evacuation agency. Cell phones may be used as a supplementary method if all other communications fail.
- Evacuation Signals

Table A-10 provides examples of possible evacuation signals:

TABLE A-10
Evacuation Signals

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

A.12 Incident Notification and Reporting/Injury Management

- In the event of an emergency, immediately call **911**.
 - Severe Bleeding
 - Loss of consciousness
 - Chest Pain
 - Broken bones
- All other injuries or illness' (even those that are minor and may only require First Aid) which occur at work, while on business travel or commute must be reported to your supervisor and the Vieques MRP PM immediately.
- After informing their supervisor and the PM, the injured employee calls CH2M HILL's contracted Occupational Nurse.

24-hour CH2M HILL Emergency Nurse Assistance 800/756-1130

- The Occupational Injury Nurse listens to the injured employee to understand the injury/illness.
- Employee is provided guidance on appropriate treatment options (triage).
- If instructed to visit a medical facility by the Occupational Nurse, the Supervisor is responsible for instructing the injured employee to take a copy of the **CH2M HILL Initial Medical Treatment Form (Attachment # 14)** with them to the physician, clinic or hospital.
- Appropriate treatment details are handled by the Occupational Injury Nurse, and Workers Compensation Groups.
- Nurse communicates and troubleshoots with and for employee through full recovery.
- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.
- For CH2M HILL subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to NAVFAC as required in contract.

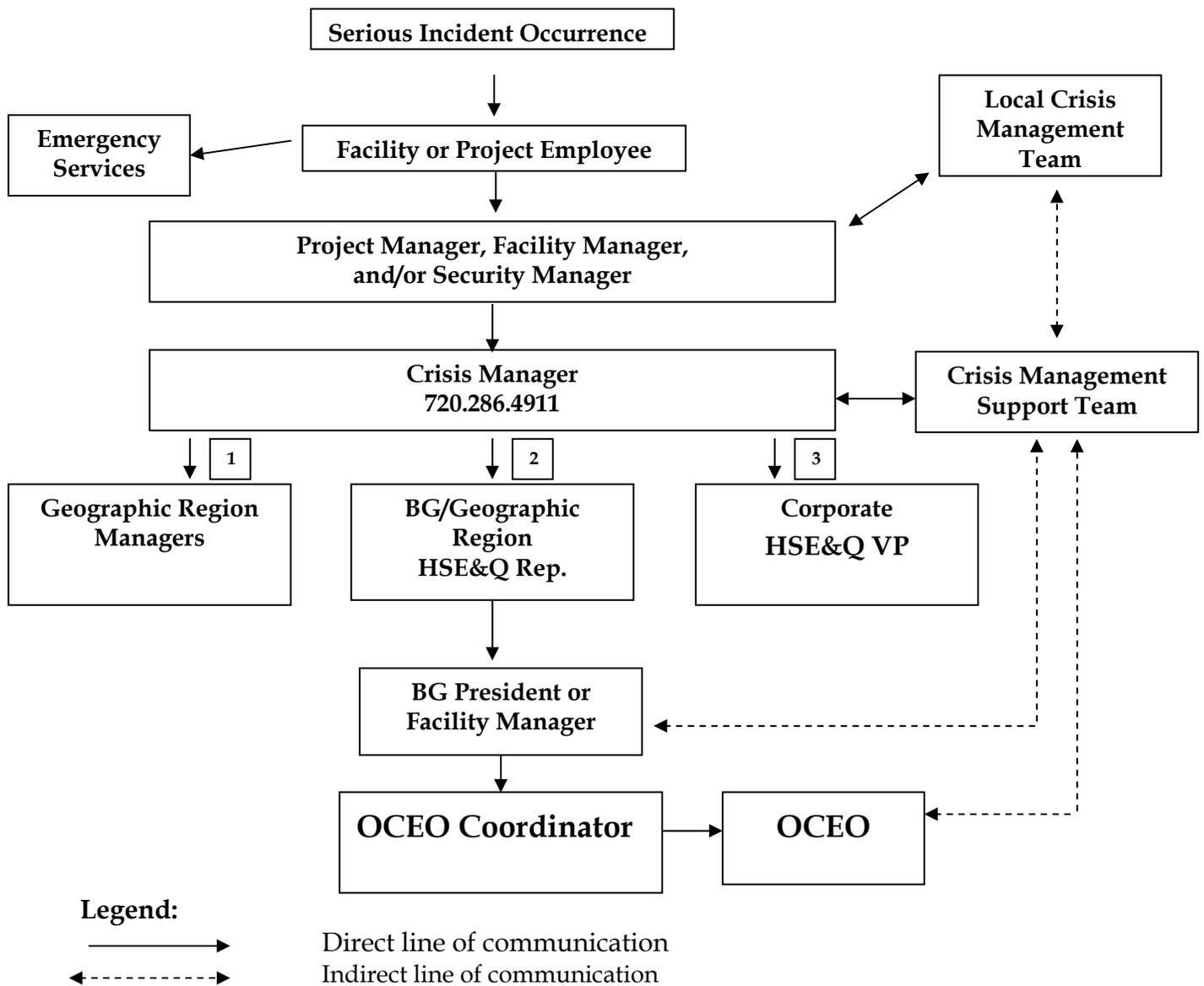
HSE&Q-111 Incident Notification and Reporting, is incorporated in this plan as Attachment A-12. HSE&Q-601 Serious Incident Reporting Process, is incorporated in this plan as Attachment A-13. HSE&Q-124 Injury Management/Return-to-Work, is incorporated as Attachment A-14.

A.13 Serious Incident Reporting

Serious Incidents must be reported in accordance with CH2M HILL Standard of Practice HSE-601, *Serious Incident Reporting Process* (Attachment A-13 to this plan), immediately. Serious incidents are those that involve any of the following:

- 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 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

A.14 Serious Incident Notification Chart



A.14.1 Emergency Contacts (complete during project start-up)**24-hour CH2M HILL Occupational Nurse: (800) 756-1130**

Medical Emergency – 911 <i>911 Operators on Vieques DO speak English</i>	CH2M HILL Medical Consultant Health Resources Dr. Jerry H. Berke, M.D., M.P.H. 600 West Cummings Park, Suite 3400 Woburn, MA 01801-6350 1-781-938-4653 After hours: 1-800-350-4511 (After hours calls will be returned within 20 minutes)
Local Ambulance #: - 911 Hospital (Non-Emergency)#: (787) 741-2151	
Fire/Spill Emergency – 911 Local Fire Dept (Non-Emergency)#: (787) 741-2111	Injury Management Administrator/Occupational Medical Consultant: 1-800-756-1130
Security & Police – 911 FWS Law Enforcement #: (787) 457-0082 (Billy Wolfrum) Local Police (Non-Emergency)#: (787) 741-2020	Chief Health, Safety, Environment & Quality Officer and Senior VP: Keith Christopher Phone: (703) 471-1441
Utilities Emergency Water: N/A Gas: N/A Electric: N/A	Regional Health and Safety Manager (RHSM) Name: Michael Goldman Phone: (770) 604-9182 (office) ext 396; Cell: (770) 331-3127, Home: (404) 872-6081, Pager: (888) 856-9114
Emergency Response Coordinators (ERCs)/Site Safety Coordinators (SSCs) Name: Cliff Walden: Cell (334) 462-3946 Dennis Ballam: Cell (757) 270-0812	Regional Human Resources Department Name: Rosemary Duvall: 561/515-6698
Project Manager Name: Stacin Martin Phone: (757) 967-8710, Cell: (571) 215-4198, Office: (757) 671-8311 Ext. 435	Corporate Human Resources Department Name: John Monark/COR Phone: (303) 771-0900
Federal Express Dangerous Goods Shipping Phone: (800) 238-5355 CH2M HILL Emergency Number for Shipping Dangerous Goods Phone: (800) 255-3924	Worker's Compensation and Auto Claims Zurich Insurance Company: (800) 382-2150 Report fatalities and report vehicular accidents involving pedestrians, motorcycles, or more than two cars.
Federal Agency/Contact Name: DoI/Mr. Oscar Diaz State Agency/Contact Name: Yarissa Martinez Local Agency/Contact Name:	Phone: (787) 741-2138 Phone: (787) 365-8573 Phone:
Contact the Project Manager. Generally, the PM will contact relevant government agencies.	
Facility Alarms: N/A	Evacuation Assembly Area(s):
Facility/Site Evacuation Route(s):	
Hospital Name: Centro de Salud Familiar Susana Centeno Address: Carr. 997 Kilometer 1 Ht. 0 Bo. Destino Vieques Puerto Rico	Hospital Phone #: (787) 741-2151

Directions to Hospital

Exit the VNTR via the main road passing Camp Garcia on the right. At the intersection of Hwy 997 turn right. Head north on Hwy 997 for approximately 2 miles. The hospital is on the right.

If you reach the intersection of Hwy 997 and Hwy 200 you have driven too far north.

Important Notes on Medical Emergencies

1. Always call for an ambulance, but keep in mind access to the range is limited by gates and terrain. It may be necessary for the field team to transport the patient to the hospital, or possibly send someone to meet the ambulance and guide them to the site of the emergency.
 2. The hospital is open 24hrs, however the ability to treat traumatic injuries is limited. Serious cases are flown to San Juan's Centro Medico Hospital via AEROMED helicopter. The entire AEROMED process (evaluation, notification, and transport) will take at least 1 hour.
-

A.15 Behavior Based Loss Prevention System

A Behavior Based Loss Prevention System (BBLPS) has been implemented on this project. 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 four basic Loss Prevention tools that will be used to implement the BBLPS on this project include:

- Job Hazard Analysis (JHA)
- Pre-Task Safety Plans (PTSP)
- Safe Work Observations (SWO)
- Loss and Near Loss Investigations (NLI)

The MRP Site Manager serves as the Safety Coordinator (SC) and is responsible for implementing the BBLPS on the project site. When a separate individual is assigned as the SC, the SC is delegated authority from the MRP Site Manager to implement the BBLPS on the project site, but the MRP Site Manager remains accountable for its implementation. The MRP Site Manager/Safety Coordinator shall only oversee the subcontractor's implementation of their AHAs and PTSPs processes on the project.

A.15.1 Job Hazard Analysis

An Job Hazard Analysis (JHA) 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 prior, during and after the performance of work to further identify the hazards posed and control measures required.

Job Hazard Analysis will be prepared before beginning each project activity posing H&S hazards to project personnel using the JHA form provided in Attachment A-9. The JHA shall identify the work tasks required to perform each activity, along with potential H&S hazards and recommended control measures for each work 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 JHA shall be prepared for all field activities performed by CH2MHILL and subcontractor during the course of the project by the MRP Site Manager/SSC. Hazard

Controls (Section B-4) of the HSP, the Hazard Analysis Table (Table B-1), and applicable CH2M HILL Standards of Practice (SOPs) should be used as a basis for preparing these JHAs.

CH2M Hill subcontractors will be required to provide JHA's specific to their scope of work on the project for acceptance by CH2M Hill. Each subcontractor shall submit JHAs for their field activities, as defined in their work plan/scope of work, along with their project-specific HSP. Additions or changes in CH2M HILL or subcontractor field activities, equipment, tools or material to perform work or additional/different hazard encountered that require additional/different hazard control measures requires either a new JHA to be prepared or an existing JHA to be revised.

A.15.2 Pre-Task Safety Plans

Daily safety meetings are held with all project personnel in attendance to review the hazards posed and required H&S procedures/JHAs, that apply for each day's project activities. The PTSPs serve the same purpose as these general assembly safety meetings, but the PTSPs are held 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, provided in Attachment A-10, with input from the work crew, during their 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 H&S procedures, as identified in the JHA. The use of PTSPs, better promotes worker participation in the hazard recognition and control process, while reinforcing the task-specific hazard and required H&S procedures with the crew each day. The use of PTSPs is a common safety practice in the construction industry.

A.15.3 Safe Work Observations

Safe Work Loss-Prevention Observations (SWOs) shall be conducted by MRP Site Managers/SCs for specific work tasks or operations comparing the actual work process against established safe work procedures identified in the project-specific HSP and AHAs. SWOs 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. MRP Site Managers/SCs shall perform at least one SWO each week for a tasks/operations addressed in the project-specific HSP or JHA. The MRP Site Managers/SCs shall complete the SWO form in Attachment A-11 for the task/operation being observed.

A.15.4 Loss/Near Loss Investigations

Loss/Near Loss Investigations shall be performed for the all CH2M HILL and subcontractor incidents involving:

- Person injuries/illnesses and near miss injuries
- Equipment/property damage
- Spills, leaks, regulatory violations
- Motor vehicle accidents

The cause of loss and near loss incidents are similar, so by identifying and correcting the causes of near loss causes, future loss incidents may be prevented. The following is the Loss/Near Loss Investigation Process:

- Gather all relevant facts, focusing on fact-finding, not faultfinding, while answering the who, what, when, where and how questions.
- Draw conclusions, pitting 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.
- Filed follow-up on implemented corrective active action to confirm solution is appropriate.

MRP Site Managers/SSCs shall 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 shall be performed using the following incident investigation forms provided in Attachment A-12:

- Incident Report Form (IRF)
- Incident Investigation Form
- Root Cause Analysis Form

All Loss and Near Loss incident involving personal injury, property damage in excess of \$1,000 or near loss incidents that could have resulted in serious consequences shall be investigated by completing the incident investigation forms and submitting them to the PM and HSM within 24 hours of incident occurrence. A preliminary Incident Investigation and Root Cause Analysis shall be submitted to the Project Manager and HSM within 24 hours of incident occurs. The final Incident Investigation and Root Cause Analysis shall be submitted after completing a comprehensive investigation of the incident.

A.16 Approval

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

A.16.1 Original Plan

Written By: Stacin Martin

Date: March 24, 2006

Approved By: Michael Goldman

Date: March 31, 2006

A.16.2 Revisions

Revisions Made By: Stephen Brand

Date: October 3, 2006

Revisions to Plan: Added BBLPS and modified emergency contact requirements.

Revisions Approved By: Michael Goldman

Date: October 13, 2006

A.17 Attachments

- Attachment A-1: Employee Signoff Form – Site Safety and Health Plan
- Attachment A-2: CH2M HILL HSE&Q- 610, Explosives Usage and Munitions Response (MR)
- Attachment A-3: Project-Specific Chemical Product Hazard Communication Form
- Attachment A-4: Chemical-Specific Training Form
- Attachment A-5: Applicable Material Safety Data Sheets
- Attachment A-6: Lead Awareness Training
- Attachment A-7: Landing Zone Map for Medical Evacuation Helicopter
- Attachment A-8: Toxic Flora
- Attachment A-9: Job Hazard Analysis
- Attachment A-10: Pre-Task Safety Plan
- Attachment A-11: Safe Work Observations
- Attachment A-12: CH2M HILL HSE&Q-111 Incident Notification and Reporting
- Attachment A-13: CH2M HILL HSE&Q-601 Serious Incident Reporting Process
- Attachment A-14: CH2M HILL HSE&Q-124 Injury Management/Return-to-Work

ATTACHMENT A-2

CH2MHILL

CH2M HILL Explosives Usage and Munitions Response (MR) HSE&Q-610

Note: This Standard of Practice covers the entire spectrum of
MEC-related project activities, including investigation and removal.

CH2MHILL

Explosives Usage and Munitions Response (MR) Standard of Practice HSE&Q-610

1.0 Applicability and Scope

1.1 Applicability

This Standard of Practice (SOP) applies to:

- (1) CH2M HILL employees who enter areas known or suspected of having munitions,
- (2) Areas where explosives are used for construction or demolition purposes, and
- (3) Managers who may be responsible for oversight of a subcontractor's explosives usage, MR operations, or Controlled Detonation Chamber (CDC) operations.

Explosives usage or MR operations may be conducted on active, inactive, closed, transferring, or transferred ranges; former battlefields; disposal sites; munitions manufacturing and storage sites; and construction sites.

1.2 Scope

This SOP provides information regarding the spectrum of hazards and issues to be addressed during each phase of a project associated with operations involving the use of explosives. Hazardous situations addressed in this SOP include exposure to explosives used for construction or demolition work; munitions and explosives of concern (MEC), which include unexploded ordnance (UXO), discarded military munitions (DMM), and material that presents a potential explosive hazard (MPPEH); chemical warfare materiel (CWM), or munitions constituents (MC) contaminated soil and groundwater; munitions demilitarization operations; Controlled Detonation Chamber (CDC) operations; and operations to locate, identify, remove, and dispose of munitions.

CH2M HILL employees who enter areas where explosives may be encountered or used must take precautions to avoid these hazards and be aware of associated safe work practices.

As described in SOP [HSE&Q-215](#), Contracts, Subcontracts, & HSE&Q Management Practices, responsibilities for health, safety, and environmental (HS&E) protection are expressly defined through subcontract terms and conditions. CH2M HILL's HS&E practices in the field are determined on the basis of these defined responsibilities. Consistent with [HSE&Q-215](#), the subcontractor must determine how to operate safely, comply with applicable HS&E regulations and industry standards, and correct any deficiencies.

1.3 Regulatory Review

Projects involving the use of explosives are often complex (may require the acquisition, receipt, storage, and use of explosives to include insurance, permits/license, public safety, etc.) and have a myriad of regulatory requirements to ensure safety. A brief description of the major requirements follows:

U.S. Department of Defense (DOD) Ammunition and Explosives Safety Standards, DOD 6055.9-STD, establishes uniform safety standards that apply to ammunition and explosives, to associated personnel and property, and to unrelated personnel and property exposed to the potential damaging effects of an accident involving ammunition and explosives during their development, manufacturing, testing, transportation, handling, storage, maintenance, demilitarization, and disposal. Additional regulatory requirements are: Title 18 U. S. Code, 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.

The U.S. Environmental Protection Agency (EPA) regulates the disposal of military munitions, and of waste that contains military munitions, through the Military Munitions Rule (MMR) (62 Federal Register [Fed. Reg.] 6621, February 12, 1997; 40 Code of Federal Regulations [CFR] Part 260 et seq.) under authority of the Resource Conservation and Recovery Act (RCRA). The rule has two functions: (1) it identifies when conventional and chemical military munitions become a solid waste, and (2) it provides criteria for storing and transporting such waste, including a conditional exemption if the munitions are managed under DOD rules.

This SOP incorporates by reference the guidelines and requirements for MR operations that are published by the U.S. Army Corps of Engineers (USACE) Engineering Support Center, Huntsville, Alabama. These are generally accepted industry standards, similar to voluntary consensus standards published by such organizations as the National Fire Protection Association (NFPA) and the American National Standards Institute (ANSI).

2.0 Project Planning

2.1 Planning Requirements

Compliance with the applicable governing laws and regulations is the responsibility of the Project Manager. The Project Manager will contact the MR Operations Manager, or in his absence the MR Safety Officer or the Munitions Response Market Segment Director, prior to and post MR ORE approval and subsequent GO/NO GO decision for determination of applicable governing laws and regulations and to assist with planning and executing support for such activities as blasting operations, hazardous toxic radiological waste (HTRW) support, construction support, MR actions, handling of CWM or explosive-contaminated soils, and munitions demilitarization. The following types of support may be needed for MR operations:

- For on-site visits with known or suspected MEC, an Abbreviated Site Safety and Health Plan (ASSHP) (See **Attachment 1**) must be prepared. This ASSHP is to be used only for non-intrusive site visits, and it must be approved by the MR Safety Officer, or in his absence either the MR Operations Manager or MR Market Segment Director, before the field visit starts. All team members must read and comply with the ASSHP and attend the safety briefings. The UXO Safety Officer (UXOSO) shall ensure that the Safety Briefing Checklist and the Plan Acceptance forms are filled out before the site visit begins.
- On an HTRW site with known or suspected MEC, MEC support involves implementing anomaly avoidance techniques to avoid any potential surface MEC and any subsurface

anomalies. A Site Safety & Health Plan (SSHP) must be prepared. This SSHP is to be used only for non-intrusive anomaly avoidance activities, and it must be approved by the MR Safety Officer, or in his absence the MR Operations Manager or the MR Market Segment Director prior to the start of fieldwork. All team members must read and comply with the SSHP and attend the safety briefings. The UXOSO shall ensure that the Safety Briefing Checklist and Plan Acceptance Form are filled out prior to the start of the site work.

- On a construction site with known or suspected MEC, support must be provided by qualified UXO personnel during construction activities. The level of MEC support required depends on the probability of encountering MEC, determined on a project-by-project basis. This will be identified during the MR ORE.
- MR actions in which the intent is to locate, identify, excavate, remove, and dispose of MEC may require a Senior UXO Supervisor, UXO Safety Officer, and UXO Quality Control Specialist, to oversee UXO Teams performing operations.
- On an MR site that has MC contamination of soil or groundwater, MEC support may include both anomaly avoidance techniques and MEC construction support for excavating and/or treating MC-contaminated soil and groundwater.
- On ordnance demilitarization projects, MEC support is required to identify, handle, disassemble, process, certify, transport, and treat or dispose of munitions components.
- On projects where explosives waste is transported or disposed of off range, the MR Operations Manager and the BG Environmental Compliance Coordinator (ECC) may assist in identifying the applicable regulations and permits required.
- On projects where munitions debris (MD), material presenting a potential explosive hazard (MPPEH), or inert ordnance is recovered and processed for disposal as scrap, the MR Operations Manager and the BG ECC may determine whether treatment and certification is required, along with any permitting requirements.
- For drilling activities at project sites suspected of MEC contamination, the UXO team shall conduct a reconnaissance and MEC avoidance to provide clear access routes to each site before drilling crews enter the area. The procedures listed in [HSE&Q-204, Drilling](#), apply and shall be implemented.
- For excavation activities at project sites suspected of MEC contamination, the UXO team shall conduct a reconnaissance and MEC avoidance to provide clear access routes to each site before excavation crews enter the area. The procedures listed in [HSE&Q-307, Excavations](#), apply and shall be implemented.
- Safety and quality control (QC) audits shall be included in developing cost estimates for any MR or explosives usage project that will last more than two weeks.
- On projects that include intrusive activities to investigate MEC or use of explosives (blasting), an Explosive Safety Submission (ESS), an Explosive Siting Plan (ESP), and an Explosive Management Plan (EMP) may be required. The MR Operations Manager, or in his absence the MR Safety Officer or MR Market Segment Director, shall assist in evaluating project requirements and coordinate with others as appropriate.

The MR Operations Manager, or in his absence the MR Quality Control Manager, shall verify subcontractor training, personnel qualifications, and current medical examinations prior to the start of field operations. Any identified shortfalls in qualifications should be reported to the MR Operations Manager or in his absence to the MR Safety Officer or the Market Segment Director for resolution.

2.2 Opportunity and Risk Evaluation (ORE)

Every project or task involving the usage of explosives or a Munitions Response (MR) requires completion of paragraph 17 of the ORE form in **Attachment 2**. The most current form and assistance in filling out the form can be obtained from the MR Safety Officer, MR Operations Manager, or MR Market Segment Director. This document is a living form and should be updated as a project is developed and executed or upon change of scope of work (SOW), identification of previously unknown hazards, etc. Final acceptance of the MR portion (paragraph 17) of the ORE is done by the MR Safety Officer.

2.3 Alcohol, Tobacco, Firearms, and Explosives (ATF&E) Background Investigation

The "Safe Explosives Act of 2002" requires the employer (CH2M HILL) to submit to ATF&E identifying information, fingerprints, and photographs for all "Responsible Persons" and "Possessors of Explosives."

All personnel designated as Responsible Persons or Possessors of Explosives involved in explosives usage and MR projects must provide a 2-inch by 2-inch color picture and an ATF Form 5400.28 filled out for submission by the ATF&E License Holder (contact MR Operations for assistance) who will forward them to ATF&E so that a background investigation can be conducted to establish eligibility to work with explosives.

Under the "Safe Explosives Act," a "Responsible Person" and a "Possessor of Explosives" are 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, which means 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.

Assistance in filling out required forms can be obtained from the MR Operations Manager, or in his absence the MR Safety Officer or the MR Market Segment Director. Submission of completed forms to ATF&E is the responsibility of the ATF&E License Holder. Upon

submission of the required forms “responsible persons and possessors of explosives” may execute their duties pending completion of the background investigation.

ATF&E will notify employers in writing or electronically of the result of each background check and will supply the “responsible person” or “possessor of explosives” with a “Letter of Clearance” where appropriate.

2.4 Training Requirements

2.4.1 MR Projects

CH2M HILL employees and subcontractors who work on projects that involve MR must complete the following training:

- A one-time, 40-hour Hazardous Waste Operations and Emergency Response course, and a minimum of three days’ actual field experience under the direct supervision of a trained supervisor as specified in 29 CFR §1910.120(e).
- An annual 8-hour hazardous waste refresher course, as specified in 29 CFR §1910.120(e)(8).
- Hazardous waste supervisory training (required for managers and supervisors only) as specified in 29 CFR §1910.120(e)(4).

All UXO technicians must be graduates of one of the following:

- U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD;
- U.S. Naval Explosive Ordnance Disposal (EOD) School, Indian Head, MD;
- U.S. Naval EOD School, Eglin Air Force Base (AFB), FL;
- EOD Assistants Course, Redstone Arsenal, AL;
- EOD Assistant Course, Eglin AFB; or
- An equivalent course as identified in Department of Defense Explosives Safety Board (DDESB) Technical Publication (TP) 18

The MR Operations Manager, or in his absence the MR Safety Officer or the MR Market Segment Director, must review subcontractor personnel qualifications.

2.4.2 Commercial Blaster Requirements

Commercial blasting is most often done in support of construction projects to remove or reduce obstacles that interfere with the construction of new roads, bridges, tunnels, harbors, or other facilities.

In order to be qualified as a “Blaster,” the individual shall be able to understand and give written and oral orders; be in good physical condition and not be addicted to narcotics, intoxicants, or similar types of drugs; and be qualified by reason of training, knowledge, or experience in the field of transporting, storing, handling, and use of explosives, and have a working knowledge of state and local laws and regulations that pertain to explosives. A “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. A

Blaster must also be knowledgeable and competent in the use of each type of blasting method used.

Depending on the type and location of work performed, personnel that transport explosives may need to have a commercial driver's license (CDL) with a hazardous material endorsement in accordance with Department of Transportation Requirements specified in 49 CFR.

The following definitions provide an overview the types of explosives which may be used in commercial blasting:

Explosives -- any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion, i.e., with substantially instantaneous release of gas and heat, unless such compound, mixture, or device is otherwise specifically classified by the U.S. Department of Transportation; see 49 CFR Chapter I. The term "explosives" shall include all material which is classified as Class A, Class B, and Class C explosives by the U.S. Department of Transportation, and includes, but is not limited to dynamite, black powder, pellet powders, initiating explosives, blasting caps, electric blasting caps, safety fuse, fuse lighters, fuse igniters, squibs, cordeau detonant fuse, instantaneous fuse, igniter cord, igniters, small arms ammunition, small arms ammunition primers, smokeless propellant, cartridges for propellant-actuated power devices, and cartridges for industrial guns. Commercial explosives are those explosives which are intended to be used in commercial or industrial operations.

(i) **Class A explosives.** Possessing, detonating, or otherwise having maximum hazard, such as dynamite, nitroglycerin, picric acid, lead azide, fulminate of mercury, black powder, blasting caps, and detonating primers.

(ii) **Class B explosives.** Possessing flammable hazard, such as propellant explosives (including some smokeless propellants), photographic flash powders, and some special fireworks.

(iii) **Class C explosives.** Includes certain types of manufactured articles which contain Class A or Class B explosives, or both, as components but in restricted quantities.

2.5 Medical Surveillance Requirements

All CH2M HILL employees who perform field work on MR sites must participate in a medical monitoring program in accordance with 29 CFR 1910.120 and HSE&Q 113, *Medical Monitoring*.

Employees who terminate employment and who have performed field work at MR project sites may be required to undergo an exit examination.

Subcontractors are responsible for ensuring that their employees are enrolled in a medical surveillance or monitoring program that meets the requirements of 29 CFR 1910.120.

2.6 Drug Free Workplace Requirements

CH2M HILL employees who perform or oversee MR operations are subject to the provisions of [HSE&Q-105, Drug-Free Workplace](#).

Subcontractors are responsible for ensuring that their employees who perform MR operations on CH2M HILL projects are on a drug abuse surveillance program that meets the requirements of [HSE&Q-105](#).

2.7 Competent Person Requirements

2.7.1 Munitions Response

MR subcontractors are responsible for providing a competent person to oversee MR operations. A competent person may be a Senior UXO Supervisor, UXO Safety Officer, UXO Quality Control Specialist, or UXO Technician III. The competent person must meet the following minimum qualifications:

- Be a graduate of one of the schools and courses listed for all UXO technicians in Section 2.4.1 above,
- Have at least 8 years of combined active-duty military EOD experience and contractor UXO experience, and
- Have experience in MR operations and supervision of personnel.

CH2M HILL-competent person requirements are the same as for a subcontractor.

The MR Operations Manager, the MR Market Segment Director, and the MR Safety Officer will compose the Ammunition & Explosive Personnel Qualification and Certification Board for employees of CH2M HILL. This Board will review individual qualifications and experiences for determining who will be allowed to perform those duties and assignments associated with SUXOS, UXOQC, UXOSO, and CDC Chamber Operator.

2.7.2 Blasting

Blasting subcontractors are responsible for providing a competent person to oversee blasting operations. A competent person may be a state licensed blaster. The competent person must be qualified through a license or permit issued by a state or local jurisdiction based on testing, extensive knowledge, training, and experience with an ability to solve or resolve problems related to blasting, and must meet the following requirements:

- Able to understand and give written and oral orders.
- In good physical condition and not be addicted to narcotics, intoxicants, or similar types of drugs.
- Required to furnish satisfactory evidence of competency in handling explosives and performing in a safe manner the type of blasting that will be required.
- Knowledgeable and competent in the use of each type of blasting method used.

2.8 Safety Equipment

Subcontractors are responsible for providing all necessary personal protective equipment (PPE) for their employees. CH2M HILL will provide PPE only for its own employees. Other safety equipment will be provided as delineated in the subcontract and documents referenced by the subcontract. The MR Safety Officer, or in his absence the MR Operations Manager or the MR Market Segment Director, must review subcontractor work plans and site-specific HS&E plans to ensure that appropriate safety equipment has been included to meet the requirements of the scope of work (SOW).

Personnel who will be handling explosives will not wear outer or inner garments having static electricity-generating characteristics. These include clothing made of 100 percent polyester, nylon, silk, and wool, which are all highly static producing.

Protective shoes worn by personnel performing explosives operations should be constructed of nonferrous materials (e.g., fiberglass) to prevent interference with sensitive geophysical instruments.

UXO Technicians are required to wear hard hats when an overhead hazard exists or when specified in the site-specific HS&E plan. Hard hats should *not* be worn, however, when investigating suspect MEC. A hard hat can create an unsafe condition by falling off the technician's head at a critical moment. Also, if a MEC is accidentally detonated (the worst-case accident scenario), the hard hat will not protect the technician from fragments and may worsen the injury by reflecting fragments into the head of the technician. This is consistent with safety guidance from the Corps of Engineers, Huntsville Center, Military Munitions Center of Expertise (MM-CX).

2.9 Subcontractor Selection

Subcontractors are selected based on their past performance in working for CH2M HILL, safety record, experience, and compliance with federal, state, and local jurisdiction licensing and permitting.

Additional criteria may be developed, depending upon the specific SOW requirements for the subcontractor. When oversight is required by [HSE&Q-215](#), the CH2M HILL MR Safety Officer, or in his absence the MR Operations Manager or MR Market Segment Director, shall use these developed criteria to review the explosives procedures submitted by the subcontractor.

3.0 Definitions

Please see **Attachment 3** for definitions.

4.0 Project Execution

4.1 Safe Work Practices

Management is responsible to control and eliminate unsafe work conditions through training and engineering out the hazard. The requirements of this section are to be followed by all personnel where explosives are used, regardless of the company performing the operations. These requirements also pertain to subcontractor personnel.

4.2 MR Operations

On MR project sites, the MR Operations Manager will be contacted to establish requirements.

4.3 Regulations and Industry Standards

As described in [HSE&Q-215](#), the MR Safety Officer or MR Quality Control Manager may be required to oversee a subcontractor's field activities. Subcontractors retain control over their practices, and CH2M HILL's oversight does not relieve them of their own responsibility for effective implementation and enforcement of HS&E requirements. The following subsections provide the minimum regulatory and industry standards for operations.

The Military Munitions Response Program (MMRP) is a maturing program with different levels of regulatory oversight within each service component. Unless a service component has issued written regulations/guidance for execution of MR actions, then the default regulations/guidance followed will be those issued by the Department of Defense Explosive Safety Board (DDESB) and the U.S. Army Corps of Engineers. For commercial blasting operations, the following guidelines shall apply: ATF&E federal explosive laws and regulations (ATF P5400.7); ANSI A10.7, Safety Requirements for Transportation, Storage, Handling and Use of Explosives; and NFPA 495, Explosive Material Code.

4.3.1 General Safety Concerns and Procedures

Operations, including site visits, shall not be conducted until a complete plan for the site is prepared and approval for use is given by the CH2M HILL MR Safety Officer, MR Operations Manager, or MR Market Segment Director. These plans will be based upon the cardinal rule of explosive safety which is to limit exposure to the minimum number of personnel, for the minimum amount of time, to the least amount of explosives hazards consistent with safe and efficient operations.

Only UXO-qualified personnel shall perform MEC procedures. Non-UXO personnel may be used to perform MEC-related procedures when supervised by a UXO Technician III. All personnel engaged in field operations shall be thoroughly trained and capable of recognizing the specific hazards of the procedures being performed. To ensure that these procedures are performed to standards, all field personnel shall be under the direct supervision of a UXO Technician III or a Senior UXO Supervisor (SUXOS).

4.3.2 Explosives Safety Precautions

Comply with the cardinal rule for explosives safety: expose the minimum number of people to the minimum amount of explosives for the minimum amount of time. Project-specific explosives safety precautions shall be developed prior to field activities and included in Work Plans and Health & Safety Plans that must be reviewed and approved by the MR Safety Officer, or in his absence the MR Operations Manager or MR Market Segment Director.

4.3.3 Recognize, Retreat, and Report MEC

Any CH2M HILL project located on a present or former Department of Defense (DOD) facility, even if it is now under the control of a city, state, or private owner, should plan on the potential to encounter MEC/MPPEH. A contingency plan developed during pre-mobilization that addresses the three Rs of MEC/MPPEH (recognize the potential hazard, retreat upwind a safe distance, and report in accordance with approved plans) will lesson

the impact to the project and enhance employee safety if MEC/MPPEH is encountered. Assistance in developing this contingency plan should be obtained from the MR Safety Officer, or in his absence the MR Operations Manager or the MR Market Segment Director.

4.3.4 Explosives Management

Management of explosives material under the “Safe Explosives Act of 2002” implements stringent requirements that must be followed. Management of explosives is a process that, if in compliance with federal, state, and local jurisdiction, will reduce, control, or eliminate civil and criminal penalties, disciplinary actions, and potential risk to personnel, the public, and the environment. Details of explosives management are developed on a site-specific basis and included in a site-specific explosives management plan. These details are based on federal, state, and local jurisdiction requirements and on contractual specifications by the client.

4.3.5 Explosives Security

Security of explosives will conform to the requirements set forth by federal, state, and local jurisdictions. Provisions for explosives security during interstate or intrastate shipment will be performed by transportation vendors. Project site and overnight explosives security will conform to 49 CFR 171-173, transportation security requirements. Details of explosives security requirements are included in the explosives management plan for each project.

4.3.6 Controlled Detonation Chamber Operations

A Controlled Detonation Chamber (CDC) is capable of repeated controlled detonations of a suite of energetic materials that are currently demilitarized by open burn/open detonation (OB/OD). On CDC projects, the MR Operations Manager will be contacted to establish requirements.

4.3.7 Explosive Waste Disposal

When used or fired munitions are managed off range (i.e., transported off range and stored, reclaimed, treated, or disposed) or disposed of on range (i.e., buried without treatment), it is subject to regulation as a solid waste under RCRA. This means it may also be subject to regulation as a hazardous waste. Also, munitions that land off range and are not promptly retrieved are solid wastes. Table 4-1 describes how solid wastes may be characterized as hazardous in these situations. All characterization must be based on field observations by qualified MR personnel who are trained to properly identify waste munitions items and meet the requirements for an emergency response expert under RCRA. In the event that the explosive waste is regulated as hazardous waste, refer to SOP [HSE&Q-409](#), Waste Handling: Hazardous Waste for RCRA hazardous waste management requirements.

TABLE 4-1
Waste Characterization

Item	Characterization	Waste Code
Uncontaminated metal debris	If visual inspection determines that the item does not contain waste residue, then waste is non-hazardous scrap metal excluded from RCRA regulation under 40 CFR §261.6(a)(3). Waste may be subject to further incineration and certification requirements.	None

TABLE 4-1
Waste Characterization

Item	Characterization	Waste Code
Contaminated metal debris	If visual inspection determines that the item contains hazardous waste residue, then manage it as potential hazardous waste.	Potential D003 and/or D008
Ordnance items less than 0.50 caliber	Small-arms ammunition is not considered reactive hazardous waste in accordance with EPA policy (November 30, 1984 Memorandum, John Skinner, OSWER Director).	None
Ordnance items greater than 0.50 caliber	Untreated MEC is presumed to be reactive hazardous waste using generator knowledge under 40 CFR §261.23.	D003

4.3.8 Forms and Permits

(1) **Type-20 Manufacturer of High Explosives License/Permit** issued by the ATF&E is required to purchase, store, and use high explosives including on-site use of binary explosives in support of MR operations, construction projects, and demolition and deactivation (D&D) projects. The following must be done prior to execution of field activities:

- Explosives will not be ordered, shipped, stored, or used without the review and approval of the ATF&E License Holder.
- The ATF&E License Holder must review and approve all Explosive Siting Plans (ESPs) and Explosives Management Plans (EMPs) to ensure compliance with ATF&E regulations.
- Following compliance with the above, the ATF&E License Holder will provide procurement/contracting with a certified copy of our Type 20 license and the authorization letter (responsible persons & possessors of explosives) to procure explosives.
- Written authorization designating the “Responsible Persons” and “Possessors of Explosives” who can order, receive, store, and use explosives must be provided by the ATF&E License Holder to explosives supplier.
- A copy of the CH2M HILL ATF&E Type 20 Manufacturer of High Explosives license must be posted on the project site.
- A copy of the ESP must be provided through the ATF&E License Holder to the ATF&E Office that inspects the CH2M HILL records and to the nearest ATF&E Office to the project site.

Additional details are provided in **Attachment 4**, Explosives Management Check List, including required records that must be forwarded to the CH2M HILL ATF&E Type 20 License Holder upon completion of work.

(2) State and local explosives permits may be required for CH2M HILL and individuals to purchase, store, and use explosives in support of MR operations, CDC operations, construction projects, and D&D projects. In addition there may be local requirements to notify law enforcement or fire department agencies when establishing explosives storage.

5.0 Attachments

The following attachments are included with this SOP:

Attachment 1 [Abbreviated Site Safety and Health Plan \(ASSHP\)](#)

Attachment 2 [Opportunity Risk Evaluation \(ORE\)](#)

Attachment 3 [Glossary, Acronyms, and Abbreviations](#)

Attachment 4 [Explosives Management Check List](#)

CH2MHILL

Explosives Usage and Munitions Response (MR) Standard of Practice HSE&Q-610

Attachment 1: Abbreviated Site Health, Safety, and Environmental Protection Plan (ASSHP)

For

Site name _____

Site location _____

Purpose of visit _____

ASSHP prepared by _____

Office _____

Address _____

Telephone _____

Date prepared _____

Signature and date _____

ASSHP reviewed and approved by:

Safety office: _____ Date: _____

Date: _____

NOTE: This ASSHP is to be used only for non-intrusive site visits and must be approved by the MR Safety Office, or in his absence the MR Operations Manager or the MR Market Segment Director, prior to the start of the field visit. All team members must read and comply with the ASSHP and attend the safety briefings. The UXOSO shall ensure that the Safety Briefing Checklist and Plan Acceptance Form are filled out prior to the start of the site visit.

I. Site Description and Previous Investigation

A. Site Description

. Size ____ + acres

. Present usage

- | | | |
|---------------------------------------|---------------------------------------|--|
| <input type="checkbox"/> Military | <input type="checkbox"/> Recreational | <input type="checkbox"/> Other (wildlife refuge) |
| <input type="checkbox"/> Residential | <input type="checkbox"/> Commercial | <input type="checkbox"/> _____ |
| <input type="checkbox"/> Natural area | <input type="checkbox"/> Industrial | <input type="checkbox"/> _____ |
| <input type="checkbox"/> Agricultural | <input type="checkbox"/> Landfill | <input type="checkbox"/> _____ |
| <input type="checkbox"/> Secured | <input type="checkbox"/> Active | <input type="checkbox"/> Unknown |
| <input type="checkbox"/> Unsecured | <input type="checkbox"/> Inactive | |

B. Past Uses

All members of the site visit team have been provided with a copy of the ASR.

Yes

No

C. Surrounding Population

- | | | |
|--------------------------------|--------------------------------------|--|
| <input type="checkbox"/> Rural | <input type="checkbox"/> Residential | <input type="checkbox"/> Other (specify) |
| <input type="checkbox"/> Urban | <input type="checkbox"/> Industrial | <input type="checkbox"/> _____ |
| | <input type="checkbox"/> Commercial | <input type="checkbox"/> _____ |

D. Previous Sampling and Investigation Results

1. MEC Encountered

Location	Description
----------	-------------

2. Samples (air, water, soil, and/or vegetation)

Chemical	Concentration	Medium	Location
----------	---------------	--------	----------

II. Description of On-Site Activities

- | | | |
|---------------------------------------|--|--------------------------------|
| <input type="checkbox"/> Walk-through | <input type="checkbox"/> Drive-through | <input type="checkbox"/> Other |
| <input type="checkbox"/> On-road | <input type="checkbox"/> Off-road | <input type="checkbox"/> _____ |
| <input type="checkbox"/> On-path | <input type="checkbox"/> Off-path | <input type="checkbox"/> _____ |
| <input type="checkbox"/> Other | <input type="checkbox"/> Other | <input type="checkbox"/> _____ |

Activities and/or tasks to be performed: _____

III. Site Personnel and Responsibilities

Project Manager

Office _____
Address _____
Phone _____
Responsibilities _____

MEC Safety

Office _____
Address _____
Phone _____
Responsibility _____

Safety Office

Address _____
Phone _____
Responsibility _____

Team Leader

Office _____
Address _____
Phone _____
Responsibilities _____

UXOSO

Office _____
Address _____

Phone _____

Responsibilities _____

First Aid and CPR

Certified _____

Office _____

Address _____

Phone _____

Responsibilities _____

IV. Hazard Analysis

A. Safety and Health Hazards Anticipated

- Chemical (be specific and include warning signs and symptoms of overexposure)
- Ordnance (specify)
- Heat stress Cold stress Tripping hazard
- Noise Electrical Falling objects
- Foot hazard Biological Overhead hazard
- Radiological Confined space Water hazard
- Explosive Climbing hazard Sunburn
- Flammable Other

B. Overall Hazard Evaluation

- High Moderate Low Unknown

Justification

V. Accident Prevention

A. General Precautions

Before the on-site visit, all team members are required to read this ASSHP and sign the form acknowledging that they have read and will comply with it. In addition, the UXOSO shall hold a brief tailgate meeting in which site-specific topics regarding the day's activities are discussed. The buddy system shall be enforced at all times. If unanticipated hazardous conditions arise, team members are to stop work, leave the immediate area, and notify the SSHO.

VI. Standard Operation Safety Procedures, Engineering Controls, and Work Practices

A. Site Rules and Prohibitions

At any sign of unanticipated hazardous conditions, stop tasks, leave the immediate area, and notify the UXOSO. Smoking, eating, and drinking are allowed in designated areas only.

B. Material-Handling Procedures

Do not handle.

C. Drum-Handling Procedures

Do not handle.

D. Confined Space Entry

Do not enter.

E. Ignition Source and Electrical Protection

Smoke in designated areas only.

F. Spill Containment

N/A

G. Excavation Safety

Do not enter trenches and excavations.

H. Illumination

Work during daylight hours only.

I. Sanitation

Use existing sanitary facilities.

J. Buddy System

Two persons shall be on-site maintaining constant contact with each other; this shall be adhered to at all times.

K. Engineering Controls

N/A

L. Heat Stress and Cold Stress

Dress appropriately, take sufficient breaks, and drink plenty of fluids. Watch for signs and symptoms of cold or heat stress. Monitoring may be applicable depending on site weather conditions and type of PPE worn.

M. Ordnance

1. General Information

- a. The cardinal principle to be observed involving explosives, ammunition, severe fire hazards, or toxic materials is to limit the exposure to a minimum number of personnel, for the minimum amount of time, to a minimum amount of hazardous material, consistent with a safe and efficient operation.
- b. The age or condition of an ordnance item does not decrease its effectiveness. Ordnance that has been exposed to the elements for extended periods of time becomes more sensitive to shock, movement, and friction because the stabilizing agent in the explosive may be degraded.
- c. When chemical agents may be present, further precautions are necessary. If the munitions item has green markings, leave the area immediately, since it may contain a chemical filler.
- d. Consider ordnance that has been exposed to fire as extremely hazardous. Chemical and physical changes may have occurred to the contents which render it more sensitive than it was in its original state.

2. On-Site Instructions

- a. DO NOT touch or move any ordnance item regardless of the marking or apparent condition.
- b. DO NOT visit an ordnance site if an electrical storm is occurring or approaching. If a storm approaches during a site visit, leave the site immediately and seek shelter.
- c. DO NOT use radio or cellular phones in the vicinity of suspected ordnance items.
- d. DO NOT walk across an area where the ground cannot be seen. If dead vegetation or animals are observed, leave the area immediately due to the potential of contamination by a chemical agent.
- e. DO NOT drive a vehicle into a suspected MR area; use clearly marked lanes.
- f. DO NOT carry matches, cigarettes, lighters, or other flame-producing devices into an MR site.

- g. DO NOT rely on color code for positive identification of ordnance items or their contents.
- h. Approach ordnance items from the side. Avoid approaching the front and rear areas.
- i. Always assume that an ordnance item contains a live charge until it can be determined otherwise.

3. Specific Actions upon Locating MEC

- a. DO NOT touch, move, or jar any ordnance item regardless of its apparent condition.
- b. Approach the item cautiously; take photographs and a full description. Take notes of the markings or any other identifiers.
- c. DO NOT be misled by markings on the ordnance item stating “practice bomb,” “dummy,” or “inert.” Even practice bombs have explosive charges that are used to mark or spot the point of impact; or the item could be mismarked.
- d. DO NOT roll the item over or scrape the item to identify the markings.
- e. The location of any ordnance items found during site investigation should be clearly marked so they can be easily located and avoided.
- f. Notify CEHND upon location of any ordnance. See Section VIII for phone number.

N. Other

Specify: _____

VII. Site Control and Communications

A. Site Map

Attach copy

B. Site Work Zones

N/A

C. Buddy System

To be adhered to at all times.

D. Communications

1. On Site

Use verbal communications among team members to communicate to each other on-site. If this communication is not possible, develop and use hand signals. Here are some examples:

Hand gripping throat:	“Breathing problems, can’t breathe.”
Thumbs up:	“OK, I’m all right, I understand.”
Thumbs down:	“No, negative.”
Hand(s) on top of head:	“Need assistance.”
Grab buddy’s wrist:	“Evacuate site now, no questions.”
One long airhorn blast:	“Evacuate site to assembly point.”
Two short airhorn blasts:	“Condition under control, return to site.”

2. Off Site

Off-site communications shall be established on every site. Communications may be established by using an on-site cellular phone or by locating the nearest public or private phone that may be readily accessed. Mark the appropriate box:

- Cellular phone
- Public or private phone
- Other: _____

3. Emergency Signals

In the case of small groups, a verbal signal for emergencies shall suffice. The emergency signal for large groups (i.e., airhorn) should be incorporated at the discretion of the UXOSO. Mark the appropriate box:

- Verbal
- Nonverbal (specify) _____

VIII. Emergency Response

A. Alert Procedures

Team members are to be alert to the dangers associated with the site at all times. If an unanticipated hazardous condition arises, stop work, evacuate the immediate area, and notify the UXOSO. Practice MEC avoidance. If a suspected MEC is encountered during field activities, the appropriate person will contact local authorities and government Project Manager. The local authorities will

contact military EOD. The suspected item will be marked with colored tape by on-site UXO specialist as applicable.

B. First Aid

A first aid kit and emergency eyewash (as applicable) will be located in the UXOSO's field car. If qualified persons (i.e., a fire department, medical facility, or physician) are not accessible within five minutes of the site, at least one team member shall be qualified to administer first aid and cardiopulmonary resuscitation (CPR).

C. Emergency Telephone Numbers

1. Medical Facility

2. Fire Department

3. Police Department

4. Poison Control Center (NJ): (800) 962-1253

5. Government Safety Office:

For emergencies involving the discovery of MEC, contact the appropriate government Safety Office. If there is no answer at the appropriate government Safety Office, contact the local law enforcement office.

6. Local EOD

7. Project Manager

8. Others (list)

D. Hospital and Medical Facility Information

Route to hospital: Attach a map with the route to the hospital marked; if a map is not available, then provide clear, written instructions.

IX. Monitoring Equipment and Procedures

A. Exposure Monitoring

For non-intrusive on-site activities such as site visits, air monitoring is typically not required. However, if the site situation dictates the need for monitoring, then complete the following information on a separate page and attach the page to the ASSHP.

- Monitoring equipment to be utilized
- Documentation of equipment calibration and results
- Action levels

B. Heat and Cold Stress Monitoring

If heat stress monitoring is necessary, the monitoring criteria published in Chapter 8 of *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH/OSHA/USCG/EPA, October 1985) shall be followed. If cold stress monitoring is necessary, it shall be conducted in accordance with the most current American Conference of Governmental Industrial Hygienists (ACGIH) cold stress standard.

X. Personal Protective Equipment

A. General

Typically, for non-intrusive site visits, Level D PPE is required. Hard hats shall be worn if an overhead hazard exists, safety shoes if a foot hazard exists, and safety glasses if an eye hazard exists. If a higher level of protection is to be used initially or as a contingency, attach a brief discussion.

B. Non-intrusive Site Visit

Level of Protection

- Initial: C D Modified (specify)
- Contingency: C D Modified (specify)
- Evacuate site if higher level of protection is needed.

XI. Decontamination Procedures

If decontamination is required, attach an additional sheet with the requirements.

Decontamination procedures are not anticipated for this site investigation. Team members are cautioned not to walk, kneel, or sit on any surface with potential leaks, spills, or contamination.

XII. Training

All site personnel shall have completed the training required by EM 385-1-1 and 29 CFR §1910.120 (e). The Project Manager shall ensure, and the UXOSO shall verify, that all on-site persons have completed appropriate training prior to submitting the plan to the safety office for review. Additionally, the UXOSO shall inform personnel, before they enter the site, of any potential site-specific hazards and procedures.

XIII. Medical Surveillance Program

The Project Manager shall ensure, and the UXOSO shall verify, that all on-site personnel are in the Medical Surveillance Program meeting the requirements of 29 CFR §1910.120 (NAVMED P-117 or equivalent) and ANSI Z-88.2, as appropriate, depending on the PPE and site-specific tasks.

Provide the following information on training and medical surveillance:

Name:

Course Date:

Medical Exam:

40-Hour/8-Hour

Date

XIV. Logs, Reports, and Recordkeeping

Site logs are maintained by the team leader. These are to include historical data, personnel authorized to visit the site, all records, standard operating procedures, any air monitoring logs, SOPs, and attachments to plans.

XV. General

The number of persons visiting the site shall be held to a minimum. No more than 8 people per UXOSO shall be allowed on-site. The more persons on-site, the greater the potential for an accident. The UXOSO may modify this ASSHP if site conditions warrant it and if it does not risk the safety and health of the team members. This modification shall be coordinated with the team members, and the UXOSO shall notify CEHND PM-SO of the change as the situation allows.

XVI. Natural Resources

The following is a list of threatened and endangered species:

Safety Briefing Checklist

(Check subjects discussed)

Location: _____ Date: _____

General Information

Purpose of visit: _____

Identification of key site personnel: _____

Training and medical requirements: _____

Specific Information

Site description and past uses: _____

Results of previous studies: _____

Potential site hazards: _____

MEC safety procedures: _____

Site SOPs: _____

Site control and communications: _____

Emergency Hand Signals

Emergency Response: _____

Location of First Aid Kit

Emergency Phone Numbers and Location

Location of Nearest Medical Facility and Location of Map to Facility

PPE and Decontamination: _____

Note: Stress the following during the briefings: If an unanticipated hazardous condition arises, stop work, evacuate the immediate area, and notify the UXOSO.

Plan Acceptance Form: Abbreviated Site Safety and Health Plan

For:

I have read and agree to abide by the contents of this Abbreviated Site Safety and Health Plan and I have attended the Safety Briefing for the aforementioned site.

Name (printed)	Office	Signature	Date
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Person presenting the safety briefing:

_____	_____
-------	-------

Signature

Date

Equipment List

(The following items may be necessary to support the non-intrusive site visit)

CH2MHILL

Explosives Usage and Munitions Response (MR) Standard of Practice HSE&Q-610

Attachment 2: Opportunity Risk Assessment (ORE)

17.0 PROJECTS INVOLVING OR POTENTIALLY INVOLVING THE USE OF EXPLOSIVES, MATERIALS POTENTIALLY PRESENTING AN EXPLOSIVE HAZARD (MPPEH), MUNITIONS AND EXPLOSIVES OF CONCERN (MEC), AND RELATED ACTIVITY.

Administrative Information: (Fill in or highlight appropriate information)

Project Name:
Project Number:
Project Location: (Address, City, State, Zip Code, Country)
Address
City:
State:
Zip Code:
Country:
Contracting Organization:
Client Organization:
Department of Defense
Department of State
Department of Energy
Department of Interior
Other
Client Organization Name:
Contract:
U.S. Army Corps of Engineers
Navy
Air Force
Marine Corps
Other

PART A:

Common questions for Explosives Usage, Munitions Response (MR), and Controlled Detonation Chamber (CDC) projects. (Highlight Appropriate Number)

Scoring criteria

0 = none, 1 - 2 = Low Risk 3 Moderate Risk 4 - 5 High Risk

17.A1 Client Scope of Work E&MR Risk Factor	
Project Risk Category?	Check Correct Item
Military Munitions	
Military Explosives	
Commercial Explosives	
Commercial Ammunition	
Commercial Pyrotechnics	
HTRW	

17.A2 Client – END LAND USE	
Which factor best describes the project end land use?	Point Value
Like Use –	0
Not Yet Determined –	1
Limited Public Access – livestock grazing/wildlife preserve/historic area	2
Public Access – Farming/Agriculture	3
Unrestricted – Commercial	4
Unrestricted – Residential	5

17.A3 Chemical Warfare Materiel (CWM)	
Which factor best describes this risk factor?	Point Value
None	0
No-specific reference - but possible	3
CWM Known or Suspected	5

17.A4 Are Munitions and Explosives of Concern (MEC) Suspected?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
Don't Know	3
Yes	5

17.A5 Does Owner acknowledge that it will retain ownership of, and responsibility for MEC & wastes?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Yes	1
Don't Know	3
No	5

17.A6 Does Client indemnify CH2M HILL from third party claims for: Liability, Workers Comp, Pollution, etc.	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Yes	1
Don't Know?	3
No	5

17.A7 Is Owner responsible for obtaining necessary permits?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Yes	1
Don't Know	3
No	5

17.A8 Will CH2M HILL write site-specific work/safety plan for this project?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Yes	1
Don't Know	3
No	5

17. A9 Will CH2M HILL subcontract MR or Explosive operational actions?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
Don't Know	3
Yes	5

17.A10 Will CH2M HILL be responsible for MPPEH to include scrap?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
Don't Know	3
Yes	5

17.A11 Is CH2M HILL HILL responsible for the disposal of Solid Waste and Hazwaste?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
Don't Know	3
Yes	5

17.A12 Are commercial explosives required?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
Don't Know	3
Yes	5

17.A13 Is Explosives storage required on site?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
Don't Know	3
Yes	5

17.A14 Are there adjacent facilities/operations?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
Don't Know	3
Yes	5

17.A15 Are there inhabited buildings in close proximity to the site?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
Don't Know	3
Yes	5

17.A16 Are there public transportation routes in close proximity to the site or airport operations?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
Don't Know	3
Yes	5

17.A17 Will explosive safety procedures adversely affect schedule?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
Don't Know	3
Yes	5

17.A18 Are there emergency response services in close proximity to site (e.g., fire, hospital)?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Yes	1
Don't Know	3
No	5

17.A19 Are there sensitive environments that need to be considered?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
Don't Know	3
Yes	5

PART B:
Explosives Usage Project Questions

17.B1 Source of Explosives	
Which factor best describes the source?	Check (x)
Vendor - Authorized ATF&E Dealer	
Government Furnished	
Client Furnished	
Local Manufactured (Binary Explosives)	
Subcontractor Provided	
Transferred from another CH2M HILL project	

17.B2 Explosive Operations General RISK Requirements/Concerns	
Which factors apply to regulatory conformance risk factor?	Check (x)
State Blasting License (Individual)	
State Blasting License (Corporation)	
State Explosive Storage Permit (Fire Marshal Inspection)	
Vehicle Inspection (state of registration) for hazard materials transportation	
Hazard Materials License (federal and/or state)	
Operator – Commercial Drivers License with Hazmat Endorsement	
Miss Utilities Permit – underground gas lines, pipelines, alarms, internet, fiber optics, cable crossings, communications, sewer lines – Ground Shock/vibrations	
Airport/flight paths – Notice to Airmen (NOTAM) – Airspace	
Navigable Waterways – Notice to Mariners (NOTM)	
Power lines/ Radar/ Microwave tower/Antenna – Electro Magnetic Radiation Hazards	
Military - training corridor/area/test area/research and development area	
Need to establish a Temporary Open Detonation Area	
Need to establish an Explosive Holding Area	
Need to establish an Explosive Inspection Area for MPPEH/MD	
Need to establish a storage area for MEC	
Need to establish a storage area for MPPEH	

17.B3 Explosive Storage Risk Factors	
Which factor best describes this risk factor Magazine Condition?	Point Value
Not Applicable	0
Fire Inspector Permit/ground tests documents/ventilator and doors and locks and hasps IAW NFPA Code 495	1
	2
Do Not Know	3
	4
Surplus excess	5

17.B4 Explosive Transportation	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Within project area – private roads	1
	2
Public Roads	3
	4
Federal Roads (interstate)	5

17.B5 Explosive Security	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Provided by Military	1
	2
Don't Know	3
	4
Not Provided by Others	5

17.B6 Is underwater work required?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
	2
Don't Know	3
	4
Yes	5

PART C:
Munitions Response Project Questions

17.C1 Type of Munitions Response (MR) project	
Which factor best describes this risk factor?	Point Value
Environmental Records Search and Confirmation Study – Non-intrusive actions	0
Escort and/or Avoidance Activities – (site visit, reconnaissance, sediment sampling, develop wells, perform O&M, land survey, area preparation, design work, etc.)	1
Construction Support Trenching, Excavation, Soil Sifting, In Situ Treatment, Demolition, Land Clearing/grubbing etc.)	2
Demilitarization/ MPPEH/ Blasting/	3
Removal Action	4
Demining, IEDs	5

17.C2 What is Potential Land Use?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Same Use	1
Wildlife Preserve	2
Commercial	3
Industrial	4
Residential	5

17.C3 Type of Munitions Constituent (MC) Contaminated Soil and/or Groundwater	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Low concentrations of explosives measured in ppb/ppm	1
High concentrations of explosives measured in ppb/ppm	2
High concentrations of explosives measured in ppb/ppm - No explosive hazard	3
Soil with 5% to 10% energetic material by weight - initiation hazard	4
Soil with >10% energetic material by weight - explosive hazard	5

17.C4 Type of MEC Disposal	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Discarded Military Munitions (DMM)	1
MEC Unfused	2
MEC Fused but safe for movement	3
Munitions requiring disassembly prior to demilitarization	4
Unknown deteriorated material	5

17.C5 Is an explosive safety submission (ESS) anticipated by the Client?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
	2
Don't Know	3
	4
Yes	5

17.C6 Is underwater work required?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
No	1
	2
Don't Know	3
	4
Yes	5

PART D:

Controlled Detonation Chamber (CDC) Project Questions

17.D1 Type of MEC Hazard	
Which factor best describes this risk factor?	Point Value
Small arms ammunition up to and including 0.50-caliber	0
Demilitarization	1
MPPEH	3
Fireworks	4
CWM	5

17.D2 Quality and Completeness of Inventory	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Subject to Direct Inspection and Verification by CH2M HILL	1
Inspection/Verification by Others	3
Client Statement	5

17.D3 Condition of MEC	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Unserviceable ammunition (Code H)	1
MEC Unfused	2
MEC Fused but safe for movement	3
Munitions requiring disassembly prior to demilitarization	4
Unknown deteriorated material	5

17.D4 Will CH2M HILL provide CDC operator services?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Yes	1
Don't Know	3
No	5

17.D5 If CDC leased to Owner, will CH2M HILL train Owner's operators?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Yes	1
Don't Know	3
No	5

17.D6 Will Owner accept CH2M HILL rejection of MEC deemed unsuitable for CDC destruction?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Yes	1
Don't Know	3
No	5

17.D7 Are all MEC items of type, size and condition previously destroyed in CDC?	
Which factor best describes this risk factor?	Point Value
Not Applicable	0
Yes	1
Don't Know	3
No	5

17. __	
Risk Management Strategy	

17. __	
Risk Management Strategy	

17. __	
Risk Management Strategy	

17. __	
Risk Management Strategy	

17. __	
Risk Management Strategy	

17.____	
Risk Management Strategy	

17.____	
Risk Management Strategy	

17.____	
Risk Management Strategy	

17.____	
Risk Management Strategy	

CH2MHILL

Explosives Usage and Munitions Response (MR) Standard of Practice HSE&Q-610

Attachment 3: Glossary, Acronyms, and Abbreviations

Active munitions inventory (or stockpile): The supply of chemical and conventional military munitions that is available for issue and use for combat, training, demonstrations, research, development, testing, or evaluation. (See **munitions stockpile** and **demilitarization inventory**.)

Active range: An operational military range that is currently in service and being regularly used for training, demonstrations, research, development, testing, or evaluation.

AEDA: ammunition, explosives, and dangerous articles.

Anomaly avoidance: Techniques employed by EOD or UXO personnel at sites with known or suspected MEC to avoid any potential surface MEC or subsurface anomalies. This usually occurs at mixed-hazard sites when HTRW investigations must occur before an MEC removal action is executed. Intrusive anomaly investigations are not authorized during ordnance avoidance operations.

Anomaly: Any item that is seen as a subsurface irregularity after geophysical investigation. This irregularity should deviate from the expected subsurface ferrous and nonferrous material at a site.

AP: armor piercing: Munitions that may or may not contain HE and are designed to penetrate hard targets.

APERS: antipersonnel munitions: May be loaded with high explosives or incendiary fillers and are designed to kill, wound, or obstruct personnel.

APT: armor-piercing tracer: Munitions, designed to penetrate hard targets, that contain a pyrotechnic element that produces bright light and/or smoke to aid in visual tracking of the munitions in flight.

ATV: all-terrain vehicle.

BD: base detonating: Impact fuse designed to function when the projectile comes in contact with the surface of the target. The fuse is located in the base or tail of the munitions.

bgs: below ground surface.

BRAC: Base Realignment and Closure.

CAD: cartridge-actuated device: An explosive device designed to produce gas pressure to expel or eject an item.

Cal: caliber: The diameter of a projectile or the bore of a weapon (i.e., .50-cal, 3-inch, 90-millimeter).

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act.

Chemical warfare materiel (CWM): An item configured as ammunition, containing a chemical substance intended to kill, seriously injure, or incapacitate a person through its physiological effects. Also includes V- and G-series nerve agents, 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 agents, chemical herbicides, smoke- and flame-producing items, or soil, water, debris, or other media contaminated with a chemical agent.

Closed range: A military range that has either been taken out of service as a range and has been put to new uses that are incompatible with range activities, or that is no longer considered to be a potential range area. A closed range is still under the control of a DOD component.

Construction support: Support provided by qualified UXO personnel during construction activities at potential MR sites to ensure the safety of construction personnel from the harmful effects of MEC. When it is determined that the probability of encountering MEC is low (current or previous land use leads to a determination that MEC may be present), a two-person UXO team will stand by in case the construction contractor encounters a suspected MEC. When it is determined that the probability of encountering a MEC is moderate to high (current or previous land use leads to a determination that MEC was employed or disposed of in the parcel of concern, e.g., open burn and open detonation areas), UXO teams are required to conduct subsurface MEC clearance for the known construction footprint, either in conjunction with the construction contractor or before construction.

Controlled detonation chamber (CDC): Also known as the Donovan Blast Chamber (DBC), the CDC is a system for controlled detonation of MEC and MEC-related materials. It is capable of repeated controlled detonations of a suite of energetic materials that are currently demilitarized by OB/OD. This offers the DOD an alternative to OB/OD while at the same time increasing throughput, efficiency, and safety and controlling air, soil, water, and noise pollution. The CDC system meets all state and federal air discharge regulations.

CQC: Contractor Quality Control.

CTT: closed, transferring, and transferred (refers to a subset of military ranges).

DAC: Defense Ammunition Center.

DDESB: Department of Defense Explosives Safety Board.

DERP: Defense Environmental Restoration Program.

Demilitarization (“demil”): The process that removes the military characteristics from unused munitions that are either unsuitable for continued storage, excess to DOD needs, or about to be released from DOD control. Demilitarization applies equally to munitions in unserviceable or serviceable condition. Used (i.e., fired) munitions items also sometimes undergo demilitarization. There are many demilitarization methods, such as recovery, recycling, remanufacture, disassembly, reclamation, mutilation, alteration, melting, burning, detonating, destruction, treatment, and disposal. Methods involving R3 currently constitute approximately two-thirds of the DOD demilitarization programs.

Demilitarization (demil) inventory: The demilitarization inventory consists of excess, obsolete, and unserviceable munitions. Munitions are moved from the active inventory to the demilitarization inventory after it is determined that they are not economically repairable, they are obsolete, or they are excess to DOD needs and cannot be sold under the Foreign Military Sales program. (Also see **active munitions inventory** and **munitions stockpile**.)

DENIX: Defense Environmental Network and Information Exchange.

Department of Defense Components: The Office of the Secretary of Defense, the Military Departments and Services, the Joint Staff, the Unified and Specified Combatant Commands, the Defense Agencies, the DOD Field Activities, and the National Guard.

Department of Defense Explosives Safety Board (DDESB): A Joint Service board comprising a chairperson, voting representatives from each of the Armed Services, and a permanent military and civilian secretariat to perform operational and administrative functions. The DDESB provides impartial and objective advice to the Secretary of Defense and DOD components on explosives safety matters. (See DOD 6055.9-STD for a detailed assignment of DDESB functions.)

DGPS: differential global positioning system.

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. (10 U.S.C. 2710(e)(2))

DLA: Defense Logistics Agency.

DMM: discarded military munitions.

DOD: U.S. Department of Defense.

DODD: Department of Defense Directive.

DODIG: Department of Defense Inspector General.

DOI: U.S. Department of Interior.

DRMO: Defense Reutilization and Marketing Office.

DRMS: Defense Reutilization and Marketing Service.

EBS: environmental baseline survey.

Emergency response (to munitions- or explosives-related or UXO emergencies): An immediate response by explosives and munitions emergency response personnel (i.e., DOD EOD personnel) to control, mitigate, or eliminate the actual or potential threat encountered during an explosives or munitions emergency. The response action may include in-place or on-site render-safe procedures, treatment, or destruction of the explosives or munitions or

their transport to another location where these operations may be conducted. (See 40 CFR Part 260 et seq., the Military Munitions Rule.)

Energetic material: A component or item of ammunition that is designed to produce the necessary energy required for ignition, propulsion, detonation, fire, or smoke, thus enabling the item to function. Also a material (e.g., corrosive or oxidizer) that is inherently dangerous and capable of causing serious damage and that requires regulated handling to avoid accidents in connection with its existence and use.

EOD: explosive ordnance disposal.

EPA: U.S. Environmental Protection Agency.

EPCRA: Emergency Planning and Community Right-to-Know Act.

ERGM: extended-range guided munitions.

ESOH: Environmental, Safety, and Occupational Health.

ESOHPB: Environmental, Safety, and Occupational Health Policy Board.

Essential personnel. Personnel whose duties require them to remain within an ESQD arc for one or more of the following reasons:

- a. Direct involvement in an ammunition and explosives handling operation.
- b. Provision of mission-required services.
- c. Provision of mission-related repairs and/or tests.

ESTCP: Environmental Security Technology Certification Program.

Exclusion zone (EZ): A safety zone established around an MR work area. Only project personnel and authorized, escorted visitors are allowed within the EZ. Examples of EZs are safety zones around MEC-intrusive activities and safety zones where MEC is intentionally detonated. (See DDESB-KO, 27 January 1990.)

Explosive Equivalent. The amount of a standard explosive which, when detonated, will produce a blast effect comparable to that which results at the same distance from the detonation or explosion of a given amount of the material for which performance is being evaluated. It is usually expressed as a percentage of the total net weight of all reactive materials contained in the item or system. For the purpose of this manual, TNT is used for comparison.

Explosive Ordnance Disposal (EOD): Includes detecting, identifying, field evaluating, rendering safe, and final disposing of MEC.

Explosive Ordnance Disposal (EOD) Personnel: Military members who have graduated from the Naval School, EOD. They have received highly specialized training to provide time-critical MEC hazard mitigation services during both peacetime and wartime. EOD personnel are trained and equipped to perform render-safe procedures (RSP) on nuclear, biological, chemical, conventional, and improvised explosive devices. (Note that EOD personnel are distinguished from UXO Technicians, who are civilian contractor or

government personnel with specialized training and qualifications in the long-term remediation of MEC.)

Explosive Safety Quantity Distance (ESQD): The prescribed minimum distance between sites storing or handling hazard Class 1 explosive material and specified exposures (i.e., inhabited buildings, public highways, public railways, other storage or handling facilities, or ships, aircraft, etc.) to afford an acceptable degree of protection and safety to the specified exposure. The size of the ESQD arc is proportional to the NEW present.

Explosive Safety Submission (ESS): The document that serves as the specifications for conducting work activities at the project. The ESS details the scope of the project, the planned work activities, potential hazards, and the methods for their control.

Explosive Siting Plan (ESP): The document that serves as a DDESB Permit approving the site-specific storage locations, quantities, and safe distances for explosive operations.

Explosive soil: Mixtures of explosives in soil, sand, clay, or other solid media at concentrations such that the mixture itself is explosive. The following also defines an explosive soil: The concentration of a particular explosive in soil necessary to present an explosion hazard depends on whether an explosive is classified as “primary” or “secondary.” Primary explosives are those extremely sensitive explosives (or mixtures thereof) that are used in primers, detonators, and blasting caps. They are easily detonated by heat, sparks, impact, or friction. Examples of primary explosives include lead azide, lead styphnate, and mercury fulminate. Secondary explosives are bursting and boosting explosives (i.e., they are used as the main bursting charge or as the booster that sets off the main bursting charge). Secondary explosives are much less sensitive than primary explosives. Soil containing 10 percent or more by weight of any mixture of secondary explosives is considered “explosive soil.” Soil containing propellants (as opposed to primary or secondary high explosives) may also present explosion hazards.

°F: degrees Fahrenheit.

FAR: Federal Acquisition Regulations.

FFA: Federal Facilities Agreement.

FFCA: Federal Facilities Compliance Act.

FOST: finding of suitability to transfer.

Frag: fragment or fragmentation: Munitions material projected away from the point of detonation at a high velocity.

Free from explosive hazard: Material that has been inspected for explosives and determined not to present a danger of explosion or combustion from explosive or energetic material.

FUDS: formerly used defense sites.

GIS: geographic information system.

GPS: global positioning system.

Hazardous waste: A solid waste that meets the following criteria: (1) is or contains a hazardous waste listed in 40 CFR Part 261, or (2) exhibits characteristics of ignitability, corrosivity, reactivity, and/or toxicity. (Refer to 40 CFR § 261.3 for further explanation.)

HE: high explosive: Explosive that normally detonates rather than burns.

HEAT: high-explosive antitank: Ordnance designed to defeat armor by the use of a shaped charge.

HEI: high-explosive incendiary: High-explosive-filled ordnance with additional ingredients to give a fire-producing effect.

HQMC: Headquarters, U.S. Marine Corps.

ICM: improved conventional munition.

Impact area: The identified area within a range intended to capture or contain ammunition, munitions, or explosives and resulting debris, fragments, and components from various weapon system employments. In simple terms, normally the target area where live-fire rounds or bombs impact the earth.

Improved conventional munition (ICM): ICMs or submunitions, cluster bombs, and cargo rounds are considered sensitive-fused munitions and require special authority to enter contaminated areas.

Inactive range: An operational military range that is not currently being used but is still under military control, and which the military both considers to be a potential range area and has not put to a new use that is incompatible with range activities. A potential range area is defined as meeting one of three criteria:

- (1) Mobilization and force projection: ranges that are held by a DOD component for the purpose of preparing individuals and units for worldwide deployment, redeployments, or demobilization in response to war, stability, and support operations or projected training requirements that would exceed current active range capabilities;
- (2) Force structure: ranges held as inactive during realignment, reorganization, stationing, or reequipping of units projected to use these ranges under new training requirements; or
- (3) Future: ranges that are held by DOD components for future use in support of National Security Policy or DOD component doctrine that ensures the capability to produce, establish, and maintain conditions needed for operational success.

Inhabited Building Distance (IBD): The minimum distance permitted between an inhabited building and an ammunition or explosives location for the protection of administration, quarters, industrial, and other similar areas within a naval shore establishment. Inhabited building distances shall be provided between ammunition or explosives locations and the boundary of a shore establishment of the nearest point beyond the boundary where such inhabited structures could be erected.

Integrated Training Area Management (ITAM): A U.S. Army program designed to improve range conditions by inventorying and monitoring land conditions, determining

carrying capacity of the land in terms of the training requirements, and providing for land rehabilitation and maintenance measures.

Intentional detonation: An intentional detonation is a planned, controlled detonation.

Intrusive activity: An activity that involves or results in the penetration of the ground surface at an area known or suspected to contain MEC. Intrusive activities can be of an investigative or removal action nature.

IR: Installation Restoration.

ITAM: Integrated Training Area Management (a U.S. Army program).

JOCG: Joint Ordnance Commanders Group.

JUXOCO: Joint UXO Coordination Office.

Material that presents a potential explosive hazard (MPPEH): Military munitions, including: their components; munitions packaging material; residues from research, development, testing, and evaluation (RDT&E), production, use (to include range scrap), operational and quality testing, or demilitarization of munitions; or any other materials, equipment, or facilities potentially contaminated with explosives. MPPEH includes both end items and residues derived from processing end-items within United Nations Organization (UNO) Hazard Class (HC). It also includes munitions-related items, pieces, models, training aids, etc., that are suspected but not confirmed to be wholly inert.

Maximum credible event (MCE): The worst single event that could occur at any time with maximum release of a chemical agent from a munition, container, or process as a result of an unintended, unplanned, or accidental occurrence.

MEC: munitions and explosives of concern.

MIL SPECS/STDS: military specifications and standards.

Military munitions: 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 military munitions under the control of the DOD, the U.S. Coast Guard, the U.S. DOE, and the National Guard. The term 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. It does not include: wholly inert items; improvised explosive devices; and nuclear weapons, devices, and components thereof. However, it does include nonnuclear components of nuclear devices, managed under DOE's nuclear weapons program after all required sanitation operations under the Atomic Energy Act of 1954, as amended, have been completed.

Military range: A designated land or water area set aside, managed, and used to conduct research on, develop, test, and evaluate military munitions and explosives, other ordnance, or weapon systems, or to train military personnel in their use and handling. Ranges include

firing lines and positions, maneuver areas, test pads, detonation pads, impact areas, and buffer zones with restricted access and exclusionary areas.

MLLW: mean lower low water.

Most probable event (MPE): The most likely event, as a result of an accidental, unplanned, or unintended detonation of an item of ordnance, that could occur during MR activities. The event must be realistic, with reasonable probability of occurrence.

MPPEH: munitions that present a potential explosive hazard.

MT: mech time or mechanical time: fuses designed usually for airburst. MT fuses are located in the nose of the munition.

Munitions and explosives of concern (MEC): Military munitions that are UXO or have been abandoned, as defined in the EPA Munitions Rule. Also includes soil, facilities, equipment, or other materials contaminated with a high enough concentration of explosives that it presents an explosive hazard.

Munitions constituents (MC): Any materials originating from military munitions, including explosive and/or non-explosive materials, and emission, degradation, or breakdown products. [The following additional explanation is offered for purposes of this SOP: Munitions constituents are the substances or chemical residues that result from the proper functioning or use of munitions (e.g., residues created and remaining in the soil, water, or air from the burning or explosion of energetic material) or that are present in MEC. Such constituents may or may not present an immediate risk of acute physical injury from fire or explosion resulting from accidental or unintentional detonation or ignition of MEC or energetic materials. Similarly, such constituents may or may not result in environmental contamination requiring a response (i.e., response action).]

Munitions Debris (MD): Metal fragments resulting from the intended use of munitions or detonations.

Munition with the Greatest Fragmentation Distance (MGFD): The munition with the greatest fragment distance that is reasonably expected (based on research or characterization) to be encountered in any particular munition response area (MRA) or munitions response site (MRS).

Munitions Response Area (MRA): Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Examples include former ranges and munitions burial areas. A munitions response area is comprised of one or more munitions response sites.

Munitions Response Site (MRS): A discrete location within a MRA that is known to require a munitions response.

Munitions Rule Implementation Policy: Detailed guidance and procedures issued by the Services that explains how DOD will implement and comply with the EPA Military Munitions Rule.

Munitions stockpile: Munitions in the active and demilitarization inventories as well as unused waste munitions as defined in the EPA's Military Munitions Rule (MMR). (See **active munitions inventory** and **demilitarization inventory**.)

Munitions: see **military munitions**.

Net Explosive Weight (NEW): The actual weight of explosive mixture or compound including the TNT equivalent of other energetic material which is used in the determination of explosive limits and ESQD arcs.

Non-stockpile chemical warfare materiel: CWM (defined above) that is not included in the chemical stockpile. Non-stockpile CWM is divided into five categories: (1) buried CWM; (2) recovered chemical weapons (items recovered during range clearing operations, from chemical burial sites, and from research and development testing); (3) former chemical weapon production facilities; (4) binary chemical weapons; and (5) miscellaneous CWM (unfilled munitions and devices and equipment specially designed for use directly in connection with employment of chemical weapons).

OB: open burn.

OCR: Office(s) of Collateral Responsibility.

OD: open detonation.

ODEP: Office of Defense Environmental Programs.

ODUSD (I&E): Office of the Deputy Under Secretary of Defense (Installations and Environment).

OE Safety Specialist: a USACE employee involved in the execution, supervision, or oversight of ordnance-related activities inside the exclusion zone who has graduated from the U.S. Naval EOD School, Indian Head, MD. An OE Safety Specialist shall be on-site each day during intrusive and MEC destruction activities. The OE Safety Specialist is on-site to ensure that the contractor establishes the appropriate daily safety routines at the beginning of UXO field operations, to perform quality assurance oversight, to verify contractor employee UXO qualifications, to advise the contractor on UXO procedures, to coordinate with the PM, and to facilitate EOD response when needed.

OEESCM: Operational and Environmental Executive Steering Committee for Munitions.

Open burn (OB): A controlled open-air process by which excess, unserviceable, and obsolete munitions are destroyed to eliminate their inherent explosives safety hazards. DOD OB units contain the munitions with pans or pads to minimize environmental contamination. DOD OB units are permitted as "miscellaneous units" in EPA's environmental permitting process.

Open detonation (OD): A process used for the treatment of unserviceable, obsolete, and/or waste munitions whereby an explosive donor charge initiates the munitions to be detonated. Although surface detonations can be performed under certain circumstances, most munitions are treated in 4- to 6-foot-deep pits for safety purposes. Most OD sites are permitted as miscellaneous units as part of the EPA environmental permitting process. DOD's units are generally permitted as combined OB/OD facilities.

Operational range: A military range that is currently under military control and management; includes both active ranges (currently in service or use) and inactive ranges (not in current use or service).

OPR: Office(s) of Primary Responsibility.

OSD: Office of the Secretary of Defense.

OU: Operable Unit.

OUSD (AT&L): Office of the Under Secretary of Defense (Acquisition, Technology, and Logistics).

PD: point detonating: impact fuse, designed to function when the projectile comes in contact with the surface of a target; located in the nose of the munition.

Potential Explosion Site (PES): The location of a quantity of explosives that will create a blast, fragment, thermal, and/or debris hazard in event of an accidental explosion of its contents. Quantity limits for ammunition/explosives at a PES are determined by the distance to an exposed site.

POL: petroleum, oil, and lubricants.

PPE: personal protective equipment.

Primer: Small, sensitive explosive component used as the first element in the explosive train.

Proj: projo or projectile: A weapon that is projected through a tube or barrel into the air toward a target.

PSE: preliminary source evaluation.

PTT: powder train time fuse: Fuses designed usually for airburst, normally used with illumination rounds to light up the battlefield.

QA: quality assurance.

QC: quality control.

Quantity-distance (Q-D): the quantity of explosives material and distance separations that provide defined types of protection. These relationships are based on levels of risk considered acceptable for the stipulated exposures and are tabulated in the appropriate Q-D tables provided in DOD 6055.9-STD. Separation distances are not absolute safe distances but are relative protective safe distances. Greater distances than those shown in the Q-D tables shall be used whenever possible.

R&D: research and development.

RAB: Restoration Advisory Board.

RAC: Remedial Action Contract.

Range clearance: An operation or procedure conducted to remove and properly dispose of munitions or munitions fragments. (e.g., MEC, "duds," etc.). Several types or degrees of clearance may be conducted (e.g., surface clearance based on visual inspection of the surface; shallow clearance where an area is systematically swept with detectors – normally to a depth of 20-24 inches; etc.) Range clearance, though technically applicable to any range category (closed, transferred, active, etc.) is often considered as occurring only at active,

operational ranges. Clearance operations at these active ranges are normally conducted as part of range maintenance activities to maintain or enhance operational safety conditions at the range facility. Even though it is possible for MEC to cause environmental contamination (pollution of soil, surface water, groundwater, etc., from the chemical constituents present in munitions), range clearance is focused on removing and safely disposing of munitions/ordnance items or fragments – not the removal or treatment of any chemical residues or constituents from the munitions or associated environmental contamination. Cleanup of environmental contamination or pollution is normally achieved by removal or remedial actions.

Range: see **military range**.

RCRA: Resource Conservation and Recovery Act.

RCWM: recovered chemical warfare material.

RDT&E: research, development, test, and evaluation.

Regional Environmental Coordinator (REC): A senior military officer or DOD civilian assigned to one of ten EPA regions who is responsible for the dissemination of information and coordination of environmental matters and public affairs among military installations and environmental regulatory organizations within their respective region. RECs have a liaison role and fully adhere to the Services' chain of command.

Remedial actions/remediation/remedial action process: Longer-term activities that complete the cleanup of contamination (or a contaminated site or location) if a removal action has not achieved or cannot achieve the required degree of cleanup for the contamination problem. A distinction is sometimes made between the control or cleanup measures to be implemented, which are called "remedial actions," and the identification, evaluation, decision-making, and design and construction steps required to implement the control measures. These steps collectively are called the "remedial action process."

Removals/removal action(s): Relatively quick actions designed to address imminent threats to human health and the environment posed by releases or spills of hazardous substances. Removals should satisfy one or more of the following tests:

- (1) **Imminent threat:** the site or situation poses an imminent threat to public health.
- (2) **Source control:** the removal action either removes the source of contamination off-site or effectively contains it on-site so that continuing releases to the environment are prevented or reduced.
- (3) **Access limitation:** the removal action substantially reduces the possibility of human exposure to hazardous substances. The EPA has categorized removal actions as emergency, time-critical, and non-time-critical. Each of these categories possesses its own criteria and procedural requirements.

Resource recovery and recycling (R3): Technologies and processes used by DOD to demilitarize military munitions. These include reuse, sale "as is" (e.g., Foreign Military Sales), conversion to a commercial product for sale or industrial use, or disassembly, modification, and partial or whole use for a military application.

Response(s) or response action(s): Responses or response actions are broadly defined in environmental law and regulations as any scientific or engineering investigation, evaluation, decision-making, design, or implementation step taken in response to (i.e., to clean up) a release or spill of hazardous substances. Removals and remedial actions (or remedial action processes) are subcategories of response actions. Procedural requirements (established in environmental regulations) for these two types of actions differ substantially, but their definitions are almost as broad as for “responses,” allowing the terms to be used almost interchangeably. The various terms are best defined by the procedural requirements imposed on them by the applicable environmental regulations.

RI/FS: remedial investigation/feasibility study.

ROD: Record of Decision.

Senior UXO Supervisor (SUXOS): Supervises all contractor on-site UXO activities. This individual must be a graduate of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD, or the U.S. Naval EOD School, Indian Head, MD. Must have at least 15 years of combined active-duty military EOD and contractor UXO experience, to include at least 10 years in supervisory positions.

SERDP: Strategic Environmental Research and Development Program.

SHPO: State Historic Preservation Officer.

Single Manager for Conventional Ammunition (SMCA): A DOD executive agent responsibility performed by the U.S. Army Operations Support Command. The Secretary of the Army is DOD’s SMCA. The U.S. Army OSC is the day-to-day operator of the SMCA and serves as the central program manager for the execution of most of DOD’s demilitarization requirements. The objectives and responsibilities of the SMCA can be found in DOD Directive 5160.65.

Sustainable range management: Management of a military range in a manner that supports national security objectives and maintains the operational readiness of the Armed Forces and ensures the long-term viability of the range while protecting human health and the environment. [The following additional explanation is offered for purposes of this SOP: A comprehensive DOD approach that develops and implements the policies, plans, practices, and procedures necessary to achieve sustainable ranges. Sustainable ranges are managed and operated in a manner that supports their long-term viability and utility to meet the national defense mission. Sustainable ranges will implement the planning, management, coordination, and public outreach necessary to ensure viable continuity of test and training operations and long-term coexistence with neighboring communities and natural ecosystems.]

Sustainable use: Actions taken to ensure that ranges maintain the ability to conduct training, research, development, testing, and evaluation of munitions in support of the national defense mission while minimizing adverse effects to human health and the environment.

SUXOS: Senior UXO Supervisor.

SWMU: solid waste management unit.

TNT equivalent: Considering the peak overpressure produced by detonation of a given weight of TNT as 100 percent, the TNT equivalency of an explosive is the amount of overpressure produced by detonation of an identical quantity of propellant under comparable conditions, expressed as a percentage.

Transferred range: A military range that is no longer under the control of a DOD component and has been leased, transferred, or returned to another entity (including other federal, non-DOD entities) for use.

Transferring range: A military range that is proposed to be leased or transferred from DOD to another entity or disposed of by conveying title to a non-federal entity. An active range will not be considered a “transferring range” until the transfer is imminent.

TRI: Toxic Release Inventory (required by the EPCRA).

Unexploded ordnance (UXO): Military munitions that have been primed, fused, armed, or otherwise prepared for use and that have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or materiel and that remain unexploded by malfunction, design, or any other cause. UXO presents an immediate risk of acute physical injury from fire or explosion resulting from accidental or unintentional detonation.

Unintentional detonation: A detonation not planned in advance.

USACE: U.S. Army Corps of Engineers.

Used or fired military munitions: Those military munitions that meet the following criteria: (1) have been primed, fused, armed, or otherwise prepared for use, and have been fired, dropped, launched, projected, placed, or otherwise used; (2) munitions fragments, (e.g., shrapnel, casings, fins, and other components, to include arming wires and pins) that result from the use of military munitions; or (3) malfunctions or misfires (e.g., fail to properly fire or detonate).

USFWS: U.S. Fish and Wildlife Service.

USGS: U.S. Geological Survey.

UST: underground storage tank.

UTM: Universal Transverse Mercator.

UXO: unexploded ordnance.

UXO personnel: Contractor personnel who have completed specialized military training in EOD methods and have satisfactorily performed the EOD function while serving in the military. Various grades and contract positions are established based on skills and experience.

UXO Quality Control Specialist (UXOQCS): Contractor personnel with the responsibility of enforcing the contractor’s Quality Control Program for all MR-related evolutions; conducting quality control inspections of all UXO and explosives operations for compliance with established procedures; and directing and approving all corrective actions to ensure that all MR-related work complies with contractual requirements.

UXO Safety Officer (UXOSO): Contractor personnel with the responsibility of enforcing the contractor's SSHP. This individual must, therefore, be in the field whenever possible to observe operations. Must have the same minimum qualifications as the UXO Technician III. In addition, must have the specific training, knowledge, and experience necessary to implement the SSHP and verify compliance with applicable safety and health requirements.

UXO Technician II: must be a graduate of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD; the U.S. Naval EOD School, Indian Head, MD; U.S. Naval EOD School, Eglin AFB, FL; or a DOD-equivalent certified course. Must have a minimum of five years of military EOD or contractor UXO experience.

UXO Technician III: supervises a UXO team. Must be a graduate of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD; the U.S. Naval EOD School, Indian Head, MD; U.S. Naval EOD School, Eglin AFB, FL; or a DOD-equivalent certified course. This individual must have a minimum of ten years of military EOD or contractor UXO experience.

UXO: unexploded ordnance.

UXOQCS: UXO Quality Control Specialist.

UXOSO: UXO Safety Officer.

Waste military munitions: A military munition that is a solid waste per 40 CFR §266.202. Such a waste military munition may also be a hazardous waste if it meets the definition found in 40 CFR §261.3. Waste munitions are hazardous wastes when they exhibit the hazardous waste characteristic of ignitability, corrosivity, reactivity, or toxicity, or are listed as hazardous wastes.

WP: white phosphorus: A screening smoke that burns on contact with air and can be used as an incendiary.

CH2MHILL

Explosives Usage and Munitions Response (MR) Standard of Practice HSE&Q-610

Attachment 4: Explosives Management Check List

N/A	Check List Item	PM Date Completed	MR Review Date	MR QC NTP Date
	Identify Contract and SOW Requirements			
	Complete Corporate Opportunity Risk Evaluation (ORE), Paragraph 17 Explosives Usage and MR Projects			
	Complete Project Site Specific Work Plans: (Explosive Management Plan, & Explosive Siting Plan*)			
	Obtain State/local (if required) Explosive Permit* for CH2M HILL to use high explosives within the state and or local jurisdiction.			
	Obtain State/local (if required) Permit* for CH2M HILL to site explosives magazine within the state and or local jurisdiction.			
	Identify CH2M HILL licensed Blaster* (if self-performing)			
	Complete CH2M HILL ATF&E "Explosives Procurement Work Sheet" for Review and obtain approval from MR Operations Manager			
	Request copy with original signature of ATF&E Type 20 Explosives Manufacture License* from CH2M HILL License Holder			
	Request "Authorization Letter*" identifying "Responsible Persons" and "Possessor of Explosives" that are authorized to order, receive, store, and use explosives under the CH2M HILL ATF&E Type 20 Explosives Manufacturer License from the License Holder			
	Complete "Materials Purchase Requisition Form*" for Contracting (Must be in corporate name of CH2M HILL, Inc & authorized by the CH2M HILL ATF&E License Holder or MR Market Segment Director)			
	Vender Identified by contracting (If sole source - justification is required)			
	Vender required to provide a copy of their ATF&E License* to CH2M HILL for evaluation and certification by CH2M HILL ATF&E License Holder			
	Purchase Order* is provided to the vender with a copy of our ATF&E Type 20 Manufacturer of High Explosives License and Authorization Letter for Responsible Persons and Possessor of Explosives			
	Award the purchase order to the selected vender and			

N/A	Check List Item	PM Date Completed	MR Review Date	MR QC NTP Date
	identify Possessor of Explosives authorized to receive explosives at the project site, telephone number and address of receiving location			
	Vender accepts purchase order and holds for contracting release of shipment			
	Vender identifies carrier and provides a shipment schedule with copy of manifest* to CH2M HILL contracting and contracting notifies the Project Manager			
	Establish Explosives Storage Area (Security, Lightning Protection, Grounding)			
	Schedule State and or local jurisdiction site inspection for "Explosive Storage" (Magazines) if required.			
	Magazine storage area inspected and approved* for storage by local jurisdictions.			
	CH2M HILL contracting notifies vender to release shipment			
	Notify ATF&E servicing office for CH2M HILL ATF&E License*, local ATF&E office*, and local jurisdictions* of storage of explosives and provide an Explosives Siting Plan that includes ATF Form 5400.13/5400.16, Explosives Storage Magazine Description Worksheet*.			
	Post CH2M HILL ATF&E Type 20 License on the project site			
	CH2M HILL "Responsible Person" or Possessor of Explosives" person receives shipment (presents identification to transporter, verifies manifest, and inventories shipment to ensure accuracy between purchase order and manifest. Discrepancies should be resolved IAW the project Explosive Management Plan)			
	Explosive materials are properly inventoried (date shift codes, acquisition dealer, (permit address), POC), and stored IAW project Explosives Management Plan			
	Material Safety Data Sheets (MSDS) for explosives materials are on-site			
	Magazine Data Cards (Daily Summary of Magazine Transactions*) are completed and maintained IAW project Explosives Management Plan			
	Magazine has two mortise type 5 pin high security locks			
	Security Checks conducted a minimum of every 72 hours and documented*			
	Responsible person or possessor of explosives has control of keys			
	Daily Usage (Shot) Log maintained for expenditure of explosive materials including target materials			
	Weekly inventories of all explosives materials conducted and documented*			
	Notify local jurisdictions and ATF&E offices when			

N/A	Check List Item	PM Date Completed	MR Review Date	MR QC NTP Date
	explosives materials are no longer being stored*			
	*Project Manager to provide to the ATF&E License Holder completed purchase orders, manifest documents, inventories, magazine data cards, usage logs, and any other associated information for ordering, storage and use of explosives material along with an end user certification that all explosives materials have been accounted for.			
	MR Safety Officer shall conduct a quality control audit of the project explosives management plan and checklist compliance with ATF&E requirements and report on the conformance of the Project Manager & License Holder.			
	* Indicates documents that upon completion of project will be forwarded to the License Holder			

ATTACHMENT A-4

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project # :
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

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

- Physical and health hazards
- Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)
- Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

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

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

ATTACHMENT A-5: APPLICABLE MATERIAL SAFETY DATA SHEETS

MSDS file copies to be attached to approved HASP. List available upon request.

ATTACHMENT A-6: LEAD AWARENESS (SEE HSE&Q SOP 508, Lead)

Lead Exposure Training Instructions

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

Lead Exposure Training Program

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

Objectives

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

How to complete this training

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

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

Lead Exposure Training

1. Uses And Occurrences

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

2. Physical Characteristics

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

3. Toxicity and Hazards

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

4. Regulations

Inorganic lead has been specifically regulated in general industry by OSHA since 1981 (29 CFR 1910.1025) and in construction (29 CFR 1926.62) since 1994. The 8-hour permissible exposure limit is $50 \mu\text{g}/\text{m}^3$. There is no short-term exposure limit. OSHA also specifies an action level of $30 \mu\text{g}/\text{m}^3$. These limits apply to both general industry and construction. Initial air monitoring must be done whenever there are indications of lead exposure above the action level. If the action level is not exceeded, air monitoring can cease. If the action level is exceeded, initial blood lead level monitoring must be made available. If exposed above the action level for more than 30 days in a year, medical surveillance must be provided which includes further blood lead level monitoring and a medical examination. If specified blood levels are exceeded, the employee must be removed from the job or task where lead exposure occurs. Training must also be provided. If the PEL is exceeded, engineering controls must be implemented to reduce exposure. If engineering controls are not feasible or ineffective, respirators must be provided and worn. Air-purifying respirators with high-efficiency (HEPA) filters can be worn when airborne levels are as high as $500 \mu\text{g}/\text{m}^3$. If levels exceed this amount, supplied air respirators must be worn. In addition, if the PEL is exceeded, OSHA requires the establishment of regulated areas, showers, change rooms, separate clean lunchrooms and warning signs. Regulated areas are demarcated from the rest of the workplace to limit access to authorized personnel who have received lead training. To enter a regulated area you must also wear protective clothing. Tetraethyl and tetramethyl lead each have separate PELs of $100 \mu\text{g}/\text{m}^3$ and $150 \mu\text{g}/\text{m}^3$ respectively, and are not covered under the inorganic lead regulation.

5. How Exposures Can Occur At CH2M HILL Projects

Exposure to lead can occur at hazardous waste sites where lead is found in soil or groundwater and at old mining sites or former smelter sites. Exposure to lead-containing

dust could occur during drilling, heavy equipment movement or other soil-disturbing activities. Dust formation can be minimized by wetting soils. Exposure could also occur during lead paint removal activities, during welding on metal surfaces with lead-containing paint, or in project work in smelters, battery recycling or manufacturing plants or at some mines.

6. Additional Information

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

Lead Quiz

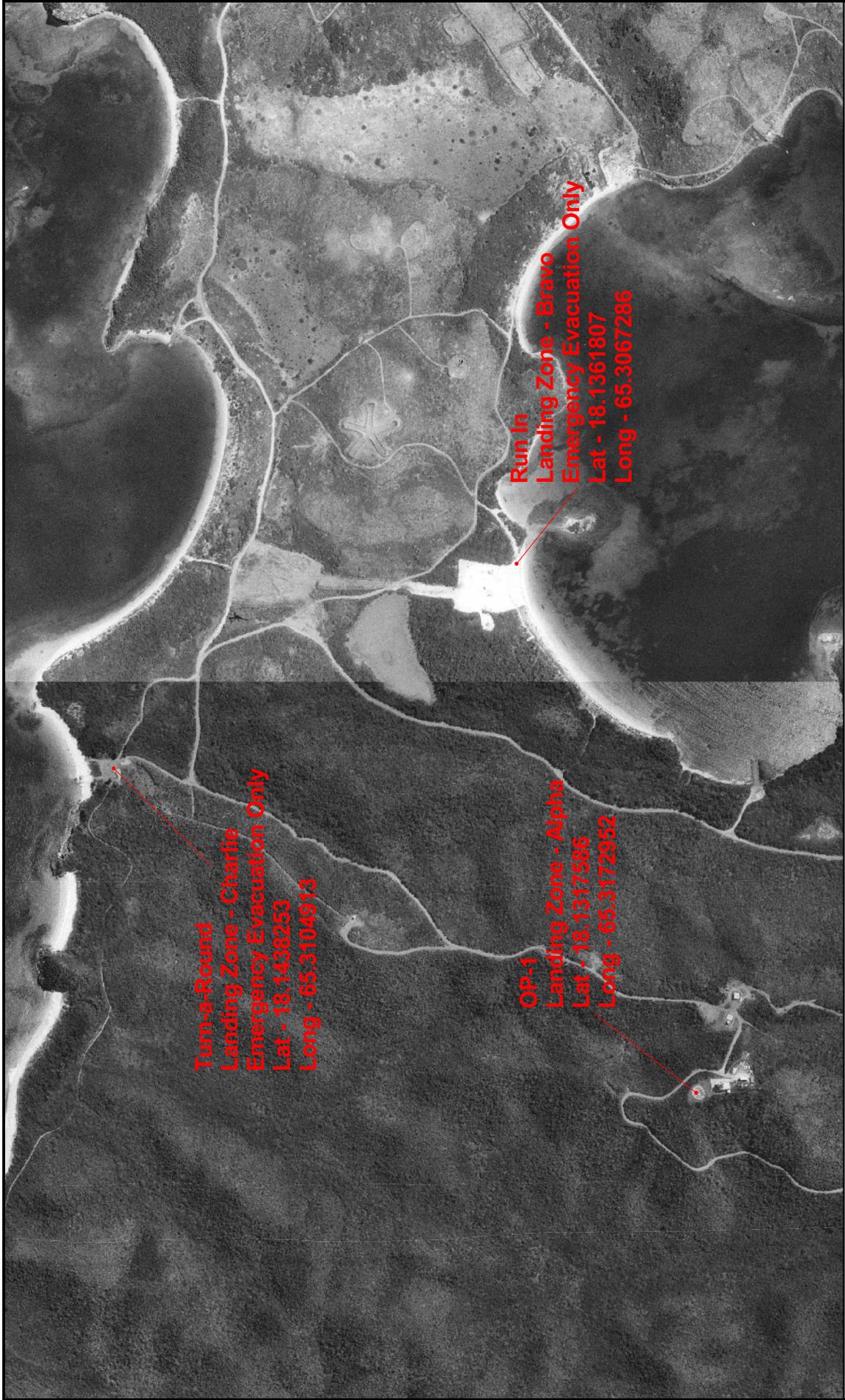
1. Which of the following is not a mode of entry of lead?
 - A. Inhalation
 - B. Ingestion
 - C. Skin absorption
 - D. All of the above are modes of entry
2. Which of the following is not a common symptom of lead exposure?
 - A. Loss of appetite
 - B. Metallic taste in mouth
 - C. Muscle and joint pain or soreness
 - D. All are common symptoms of lead exposure
3. What are the OSHA exposure limits for lead (PEL and action level)?
 - A. $50 \mu\text{g}/\text{m}^3$ and $25 \mu\text{g}/\text{m}^3$ respectively
 - B. 50 ppm and 25 ppm respectively
 - C. 50 ppm and 30 ppm respectively
 - D. $50 \mu\text{g}/\text{m}^3$ and $30 \mu\text{g}/\text{m}^3$ respectively
4. When is air monitoring required for lead exposures?
 - A. When exposed to lead for 30 days or more in a year
 - B. Anytime lead is present in the workplace
 - C. When there are indications of lead exposure above the action level
 - D. When the PEL is exceeded
5. When must medical surveillance be made available for lead exposures?
 - A. When the action level is exceeded
 - B. When the action level is exceeded for 30 days in a year
 - C. When the PEL is exceeded
 - D. When the PEL is exceeded for 30 days in a year
6. When is respiratory protection required for lead exposures?
 - A. When the action level is exceeded
 - B. When the action level is exceeded for 30 days in a year
 - C. When engineering controls do not reduce exposure below the PEL
 - D. When the PEL is exceeded for 30 days in a year
7. What respiratory protection is considered acceptable for protection against lead exposures?
 - A. Air-purifying with organic vapor cartridge
 - B. Air-purifying with HEPA cartridge
 - C. Air-purifying with lead cartridge
 - D. Supplied-air respirator is the only acceptable respiratory protection

8. What are the requirements for entering a lead-regulated area?
 - A. Must be an authorized person
 - B. Must complete lead training
 - C. Must wear protective clothing
 - D. All of the above

9. What control measure should be used to minimize dust formation when disturbing lead-containing soil?"
 - A. Training
 - B. Wetting the soil
 - C. Air purifying respirators
 - D. None of the above

10. What level of lead in the soil might require a lead blood test?
 - A. 1% or 10,000 ppm
 - B. 3% or 30,000 ppm
 - C. 5% or 50,000 ppm
 - D. None of the above

**ATTACHMENT A-7: Landing Zone Map for Medical Evacuation
Helicopter.**



Turn-a-Round
Landing Zone - Charlie
Emergency Evacuation Only
Lat - 18.1438253
Long - 65.3104913

OP-1
Landing Zone - Alpha
Lat - 18.1317586
Long - 65.3172952

Run In
Landing Zone - Bravo
Emergency Evacuation Only
Lat - 18.1361807
Long - 65.3067286



Medical Evacuation Landing Zones

ATTACHMENT A-8: Toxic Flora

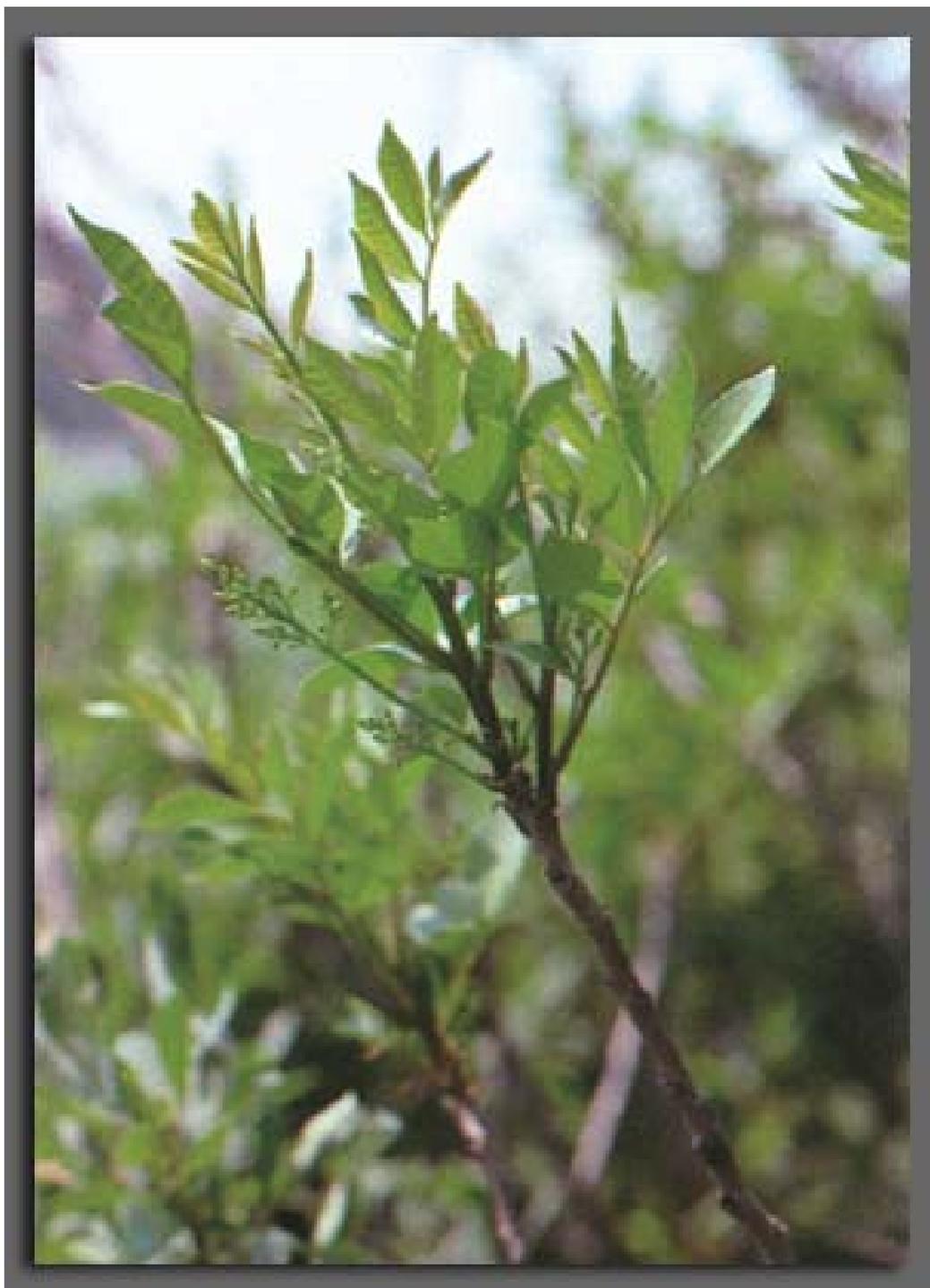
Poison Oak



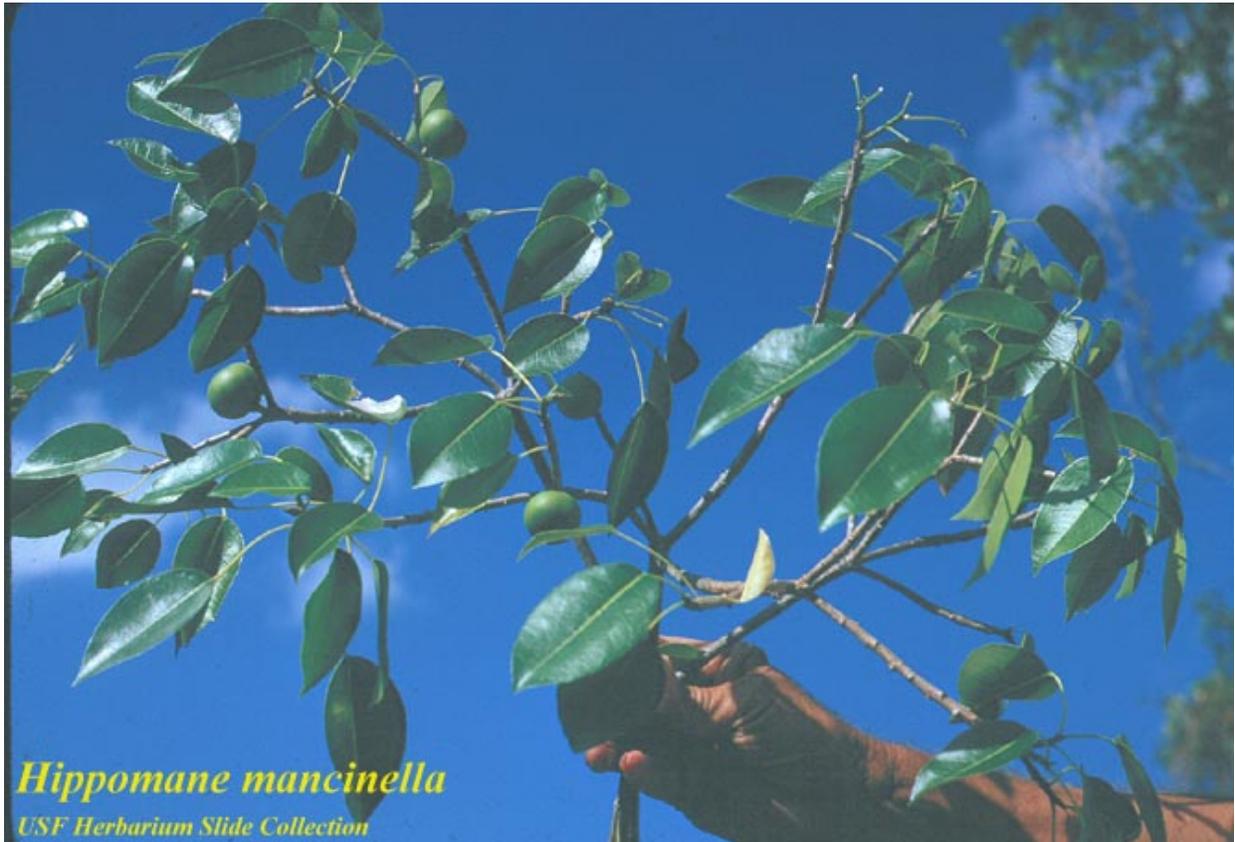
Poison Ivy



Poison Sumac



Manchineel



Hippomane mancinella
USF Herbarium Slide Collection

Castor Bean



Comocladia



Croton



Tragia Volubilis (commonly known as pica-pica or cowitch)



Malpighia fucata (commonly known as palo bronco)



Cordia rupicola



Pictetia aculeate (commonly known as tachuelo, gumbo limbo, or turpentine tree)



ATTACHMENT A-9: Job Hazard Analysis

Activity:	Date:
	Project:
Description of the work:	Site Supervisor:
	Site Safety Officer:
	Review for latest use: Before the job is performed.

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)

Equipment to be used (List equipment to be used in the work activity)	Inspection Requirements (List inspection requirements for the work activity)	Training Requirements (List training requirements including hazard communication)

PRINT NAME

SIGNATURE

Supervisor Name: _____

Date/Time: _____

Safety Officer Name: _____

Date/Time: _____

Employee Name(s): _____

Date/Time: _____

ATTACHMENT A-10: Pre-Task Safety Plan

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Pre-Task Safety Plan (PTSP)

Project: _____ Location: _____ _____ Date: _____		
Supervisor: _____ Job Activity: _____ _____		
Task Personnel: _____ _____ _____ _____		
List Tasks: _____ _____ _____ _____		
Tools/Equipment Required for Tasks (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools): _____ _____ _____		
Potential H&S Hazards, including chemical, physical, safety, biological and environmental (check all that apply):		
<input type="checkbox"/> Chemical burns/contact	<input type="checkbox"/> Trench, excavations, cave-ins	<input type="checkbox"/> Ergonomics
<input type="checkbox"/> Pressurized lines/equipment	<input type="checkbox"/> Overexertion	<input type="checkbox"/> Chemical splash
<input type="checkbox"/> Thermal burns	<input type="checkbox"/> Pinch points	<input type="checkbox"/> Poisonous plants/insects
<input type="checkbox"/> Electrical	<input type="checkbox"/> Cuts/abrasions	<input type="checkbox"/> Eye hazards/flying projectile
<input type="checkbox"/> Weather conditions	<input type="checkbox"/> Spills	<input type="checkbox"/> Inhalation hazard
<input type="checkbox"/> Heights/fall > 6 feet	<input type="checkbox"/> Overhead Electrical hazards	<input type="checkbox"/> Heat/cold stress
<input type="checkbox"/> Noise	<input type="checkbox"/> Elevated loads	<input type="checkbox"/> Water/drowning hazard
<input type="checkbox"/> Explosion/fire	<input type="checkbox"/> Slips, trip and falls	<input type="checkbox"/> Heavy equipment
<input type="checkbox"/> Radiation	<input type="checkbox"/> Manual lifting	<input type="checkbox"/> Aerial lifts/platforms
<input type="checkbox"/> Confined space entry	<input type="checkbox"/> Welding/cutting	<input type="checkbox"/> Demolition
Other Potential Hazards (Describe): _____ _____ _____ _____		

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Hazard Control Measures (Check All That Apply):

PPE <input type="checkbox"/> Thermal/lined <input type="checkbox"/> Eye <input type="checkbox"/> Dermal/hand <input type="checkbox"/> Hearing <input type="checkbox"/> Respiratory <input type="checkbox"/> Reflective vests <input type="checkbox"/> Flotation device	Protective Systems <input type="checkbox"/> Sloping <input type="checkbox"/> Shoring <input type="checkbox"/> Trench box <input type="checkbox"/> Barricades <input type="checkbox"/> Competent person <input type="checkbox"/> Locate buried utilities <input type="checkbox"/> Daily inspections	Fire Protection <input type="checkbox"/> Fire extinguishers <input type="checkbox"/> Fire watch <input type="checkbox"/> Non-spark tools <input type="checkbox"/> Grounding/bonding <input type="checkbox"/> Intrinsically safe equipment	Electrical <input type="checkbox"/> Lockout/tagout <input type="checkbox"/> Grounded <input type="checkbox"/> Panels covered <input type="checkbox"/> GFCI/extension cords <input type="checkbox"/> Power tools/cord inspected
Fall Protection <input type="checkbox"/> Harness/lanyards <input type="checkbox"/> Adequate anchorage <input type="checkbox"/> Guardrail system <input type="checkbox"/> Covered opening <input type="checkbox"/> Fixed barricades <input type="checkbox"/> Warning system	Air Monitoring <input type="checkbox"/> PID/FID <input type="checkbox"/> Detector tubes <input type="checkbox"/> Radiation <input type="checkbox"/> Personnel sampling <input type="checkbox"/> LEL/O2 <input type="checkbox"/> Other	Proper Equipment <input type="checkbox"/> Aerial lift/ladders/scaffolds <input type="checkbox"/> Forklift/heavy equipment <input type="checkbox"/> Backup alarms <input type="checkbox"/> Hand/power tools <input type="checkbox"/> Crane with current inspection <input type="checkbox"/> Proper rigging <input type="checkbox"/> Operator qualified	Welding & Cutting <input type="checkbox"/> Cylinders secured/capped <input type="checkbox"/> Cylinders separated/upright <input type="checkbox"/> Flash-back arrestors <input type="checkbox"/> No cylinders in CSE <input type="checkbox"/> Flame retardant clothing <input type="checkbox"/> Appropriate goggles
Confined Space Entry <input type="checkbox"/> Isolation <input type="checkbox"/> Air monitoring <input type="checkbox"/> Trained personnel <input type="checkbox"/> Permit completed <input type="checkbox"/> Rescue	Medical/ER <input type="checkbox"/> First-aid kit <input type="checkbox"/> Eye wash <input type="checkbox"/> FA-CPR trained personnel <input type="checkbox"/> Route to hospital	Heat/Cold Stress <input type="checkbox"/> Work/rest regime <input type="checkbox"/> Rest area <input type="checkbox"/> Liquids available <input type="checkbox"/> Monitoring <input type="checkbox"/> Training	Vehicle/Traffic <input type="checkbox"/> Traffic control <input type="checkbox"/> Barricades <input type="checkbox"/> Flags <input type="checkbox"/> Signs
Permits <input type="checkbox"/> Hot work <input type="checkbox"/> Confined space <input type="checkbox"/> Lockout/tagout <input type="checkbox"/> Excavation <input type="checkbox"/> Demolition <input type="checkbox"/> Energized work	Demolition <input type="checkbox"/> Pre-demolition survey <input type="checkbox"/> Structure condition <input type="checkbox"/> Isolate area/utilities <input type="checkbox"/> Competent person <input type="checkbox"/> Hazmat present	Inspections: <input type="checkbox"/> Ladders/aerial lifts <input type="checkbox"/> Lanyards/harness <input type="checkbox"/> Scaffolds <input type="checkbox"/> Heavy equipment <input type="checkbox"/> Cranes and rigging	Training: <input type="checkbox"/> Hazwaste <input type="checkbox"/> Construction <input type="checkbox"/> Competent person <input type="checkbox"/> Task-specific (THA) <input type="checkbox"/> Hazcom
Field Notes: _____ _____ _____			

Name (Print): _____

Signature: _____

Date: _____

ATTACHMENT A-11: Safe Work Observations

CH2MHILL

Safe Work Observation Form			
Project:		Observer:	
		Date:	
Position/Title of worker observed:		Background Information/ comments:	
Task/Observation Observed:			
<ul style="list-style-type: none"> ❖ 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			Observer's Corrective Actions/Comments:
Focus/attentiveness			
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			Observed Worker's Corrective Actions/Comments:
Repetitive motion			
Other...			

**ATTACHMENT A-12: CH2M HILL HSE&Q-111 Incident Notification
and Reporting**

CH2MHILL

Incident Reporting and Investigation Standard of Practice HSE-111

1.0 Introduction

This Standard of Practice (SOP) provides procedures for reporting and investigating incidents. Emergency response procedures are included in the Emergency Response Plan (ERP), as discussed in [HSE-106](#), *Emergency Planning*.

An incident may be caused by natural forces, employees, subcontractors, or third parties in any location associated with CH2M HILL operations, including offices, warehouses, project sites, private property, or public spaces. An incident includes:

- Injury or illness
- Spill or release
- Damage to property
- Permit issue (e.g., permit violation)
- A “near-miss”
- Other (e.g., fire, explosion, bomb threat, workplace violence)

This SOP provides specific guidelines for immediate internal notification of all but the most serious incidents. It also describes procedures for accessing, creating, updating and reviewing the CH2M HILL Incident Report Form (IRF). Finally this SOP provides guidelines for conducting prompt incident investigations to determine the root causes and corrective actions to prevent recurrence.

If the severity of the incident meets any of the following criteria, implement HSE-601 “Serious Incident Notification Process”, which ensures timely notification of Business Group Presidents and allows for positive control over flow of information so that the incident is handled in conjunction with the senior management team.

- Work related death of employee or CH2M HILL subcontractor
- Life threatening injury or illness of employee or CH2M HILL subcontractor
- Kidnap/missing person (employee or CH2M HILL subcontractor)
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than \$50,000 in property 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.
- Event that may not have any significant real impact but will attract media attention.
- Significant near miss or negative trend that will likely require work suspension or significant company resources to resolve

2.0 Regulatory Review

Attachment 1 has a list, by country, of the regulations related to incident reporting and investigation. Compliance with the regulations listed in this attachment will be met if this SOP is followed. Contact the Regional Health and Safety Program Manager (RHSPM) for information on countries not listed in Attachment 1.

3.0 Responsibilities

3.1 Employee

The employee is responsible for:

- Providing immediate verbal notification of all incidents to the Emergency Response Coordinator (ERC) and immediate supervisor (e.g., Group Leader).
- Providing detailed information to the Human Resources Representative (HRR), upon request, for all work-related injury and illness incidents.
- Providing additional or updated information to the HRR (for injury/illness incidents) or the Regional Health and Safety Program Manager (RHSPM)/Environmental Compliance Coordinator (ECC) (for all other incidents) after the initial IRF has been submitted

3.2 Emergency Response Coordinator

The ERC is responsible for:

- Implementing emergency response procedures as directed in the ERP for all emergencies (see [HSE-106](#), *Emergency Planning*).
- Notifying the RHSPM of all incidents.
- Creating and submitting an IRF for all non-injury incidents.
- Creating and submitting an IRF for a work-related injury/illness of a CH2M HILL subcontractor.
- Providing additional or updated information about the incident to the RHSPM/ECC after the initial IRF has been submitted.
- Conducting incident investigations as directed by the RHSPM or ECC.

3.3 Regional Health and Safety Program Manager

The RHSPM is responsible for:

- Being available (or appointing a designee, if unavailable) to receive notification of all incidents.
- Providing incident verbal notification as directed in Section 6.2 of this SOP.
- Reviewing submitted Injury/Illness, Property Damage, Near-Miss, and Other IRFs for completeness and accuracy and completing the “RHSPM Injury Evaluation” and “RHSPM/ECC Evaluation” sections of the IRF.

- Updating the “RHSPM Injury Evaluation” and “RHSPM/ECC Evaluation” sections when additional or updated information becomes available.
- Determining the level of and directing incident investigations for Injury/Illness, Property Damage, Near-Miss, and Other incidents.

3.4 Environmental Compliance Coordinator

The ECC is responsible for:

- Being available (or appointing a designee if unavailable) to receive notification of environmental incidents and analyzing incidents for reportability and seriousness.
- Providing incident verbal notification as directed in Section 6.2 of this SOP.
- Reviewing submitted Spill/Release and Environmental/Permit Issue IRFs for completeness and accuracy and completing the “RHSPM/ECC Evaluation” section of the IRF.
- Updating the “RHSPM/ECC Evaluation” section when additional or updated information becomes available.
- Determining the level and directing incident investigations for Spill/Release and Environmental/Permit Issue incidents.

3.5 Legal and Insurance Department (LID)

The LID is responsible for:

- Assigning workers compensation case management.
- Granting approval for communication with external parties regarding incidents.
- Directing internal and external communication, reporting, and investigation of serious incidents.
- Addressing insurance issues associated with the incident.

3.6 Human Resources Representative (HRR)

The HRR is responsible for:

- Completing and submitting an IRF for CH2M HILL employee injury-related incidents.
- Updating CH2M HILL employee injury-related IRFs when additional or updated information about the incident becomes available.
- Completing and submitting necessary workers compensation forms.

3.7 Regional Human Resources Representative (RHRM)

The RHRM is responsible for:

- Ensuring that an IRF is completed for all CH2M HILL employee injury-related incidents.

- Sharing responsibility with LID for determining appropriate workers compensation issues.

3.8 Project Manager (PM)

Project Managers are responsible for:

- Reporting incidents to the client, if necessary, after discussing with the RHSPM.
- Ensuring that unnecessary communication of serious incidents is kept to a minimum, as outlined in Section 6.2.3 of this SOP.

3.9 Area Office Manager (AOM)

Area Office Managers are responsible for:

- Reporting incidents to the building owner, if necessary, after discussing with the RHSPM.
- Ensuring that unnecessary communication of serious incidents is kept to a minimum, as outlined in Section 6.2.3 of this SOP.

3.10 Corporate Director, Health, Safety, and Environmental Protection (CDHS&E)

The CDHS&E or designee is responsible for:

- Maintaining a log of all incidents and investigations.
- Distributing summaries of incidents with periodic management reports.
- Analyzing all incidents.
- Modifying the Health, Safety, and Environmental Protection (HS&E) program as necessary to prevent future incidents.

3.11 Corporate Health, Safety, and Environmental Protection (HS&E)

The Corporate HS&E unit is responsible for maintaining all submitted IRFs and Investigation Reports.

3.12 Environmental Program Manager (EPM)

The EPM is responsible for reviewing Spill/Release and Environmental/Permit Issue IRFs and Investigation Reports to verify accuracy, consistency, and compliance with applicable federal, state, and local environmental requirements.

3.13 Health and Safety Program Manager (HSPM)

The HSPM is responsible for reviewing Injury/Illness IRFs to verify that reports are being completed in a consistent manner and in compliance with occupational safety and health recordkeeping requirements.

4.0 CH2M HILL Policy

It is the policy of CH2M HILL to maintain an IRF for all work-related injuries and illnesses sustained by its employees in accordance with occupational safety and health recordkeeping and various state workers compensation requirements. An IRF will also be maintained for other incidents (property damage, fire or explosion, spill, release, potential violation or permit exceedance, and near-misses) as part of CH2M HILL's loss prevention and risk reduction initiative.

5.0 Definitions

5.1 Employee

The term "Employee" includes all CH2M HILL full-time, part-time, and temporary-duty employees, as well as contracted employment agency and temporary employees for which CH2M HILL is responsible for day-to-day direction. "Employee" does not include subcontractor employees who are supervised by subcontractor management. Questions regarding whether someone should be considered an employee should be directed to the RHSPM.

5.2 Work-Related Injury or Illness

Work-related injury or illness includes all injuries and illnesses that result from an event or exposure in the work environment. "Work environment" includes CH2M HILL premises and other locations where employees are engaged in work-related activities or are present as a condition of employment.

5.3 Incident

An incident may be caused by natural forces, employees, subcontractors, or third parties in any location associated with CH2M HILL operations, including offices, warehouses, project sites, private property, or public spaces. Incidents include:

- Injury or illness
- Hazardous substance exposure
- Damage to property
- Fire or explosion
- Spill, release, potential violation, or permit exceedance
- A "near-miss"

5.4 Near-Miss

A near-miss occurs when an intervening factor prevented an incident from occurring. Examples of near-miss situations include: a hard hat or other personal protective equipment (PPE) prevented an injury; secondary containment or emergency shutoff prevented a spill; or an alert co-worker prevented an accident.

5.5 Serious Incidents

The following are general criteria for determining whether an incident should be considered a serious one. Consultation with the RHSPM, CDHS&E, and LID will make the determination. The general criteria for serious incidents include:

- Intervention by external emergency response organizations
- Hospitalization
- Spills and releases of hazardous substances exceeding the reportable quantity (RQ)
- Potential violations of law or regulation
- Estimated property damage in excess of \$10,000

6.0 Incident Notification and Reporting

6.1 Emergency Reporting

Procedures for the immediate reporting of emergencies must be included in the ERP as discussed in SOP [HSE-106](#), *Emergency Planning*. All incidents must be reported to the ERC immediately. If required, the ERC must immediately report emergency situations to the appropriate response authorities as indicated in the ERP.

6.2 Incident Verbal Notification

The following notification procedures apply to all incidents, including after an ERP (and [HSE-106](#), *Emergency Planning*) has been implemented for emergencies.

6.2.1 Incidents

Incidents must be communicated verbally immediately, as shown in Attachment 2 (Incident Notification and Reporting Flowchart) and described as follows:

- All employees and subcontractors must immediately notify the ERC and their direct supervisor (e.g., Group Leader) of all incidents.
- The ERC must notify the RHSPM of all incidents.
- The RHSPM must notify the ECC of spills/releases and environmental/permit incidents.
- The RHSPM (or ECC for environmental incidents) refers serious incidents to the Legal and Insurance Department, which directs remaining procedures (non-serious incidents follow remaining procedures).
- The RHSPM/ECC consults with Corporate HS&E staff to determine reportability and notifies the appropriate occupational safety and health and/or environmental authorities and agencies of reportable incidents.
- The RHSPM must immediately notify the CDHS&E and the LID of any fatality or any incident that results in in-patient hospitalization of three or more employees.
- The RHSPM notifies the Project Manager (field) or Area Office Manager (office) of the incident.
- The Project Manager notifies the client of the incident, if necessary
- The Area Office Manager notifies the building owner of the incident, if necessary.
- The RHSPM/ECC directs the HRR to create an IRF for work-related injury/illness incidents.

6.2.2 Serious Incidents

The RHSPM/ECC must refer all incidents that meet the serious incident criteria (as defined in Section 5.5) to the LID, whose representative will direct all internal and external communications, including IRF creation, agency reporting, client or building owner notification, and incident investigation (unless infeasible because of differences in time zones).

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. Internal communications regarding a serious incident may be conducted with affected project, regional, and Business Group staff but must be kept to a minimum. Communication should be oral whenever possible. If e-mail communications are necessary, the following procedures must be used:

- Address the e-mail to Peggi Spencer/COR (or Dan Smith/COR in her absence).
- Send as "Confidential" e-mail (select under "Message Options").
- Include phrase "Confidential – Attorney/Client Privileged Communication" in the title and body of the e-mail.
- Include the following as the first paragraph of the e-mail:

This e-mail contains information pertaining to a project site accident and must be handled with confidentiality. Do not forward this e-mail without approval of Peggi Spencer/COR or Dan Smith/COR. All e-mails pertaining to this incident must be addressed to Peggi Spencer/COR (or Dan Smith/COR in her absence). All e-mail on this issue must contain, in both subject and content, the phrase "Confidential - Attorney/Client Privileged Communication." These practices are required to maintain attorney/client privilege. All other communication regarding this incident should remain verbal unless approved by Peggi Spencer/COR or Dan Smith/COR.

6.3 Incident Report Form Completion Process

The HRR is responsible for completing the IRF for incidents where injuries to CH2M HILL employees are involved. The ERC is responsible for completing the IRF for all other incidents including property damage, spills/releases, environmental/permit issues, near-misses, and injuries to subcontractors. *The IRF must be completed within 24 hours of the incident.* Responsibilities for initial IRF creation are shown in Attachment 3, IRF Completion Flowchart. Refer to Appendix A for specific guidelines for accessing and completing the IRF. Any problems encountered with the electronic IRF should be referred to the regional Information Technology (IT) staff. For serious incidents, the IRF is completed only as directed by the LID.

6.4 Incident Report Form Review Process

When an initial IRF is submitted, it generates a report that is automatically sent to various staff for review and evaluation as shown in Attachment 3, IRF Completion Flowchart. CH2M HILL employee injury-related IRFs are sent to the LID and the RHSPM. The review process is as follows:

- The LID shall review the IRF and determine, with assistance from the appropriate RHRM, the appropriate workers compensation issues.
- In the United States, the RHSPM shall review the IRF for completeness and complete the “RHSPM Injury Evaluation” and “RHSPM/ECC Evaluation” sections to determine if the incident is an OSHA-recordable injury or illness. In other countries, the RHSPM/ECC determines off-line whether the incident is recordable to the local agencies. See Attachment 1 for guidelines for Australia.
- Property Damage, Near-Miss, and Other IRFs are sent to the RHSPM. The RHSPM shall review the IRF for completeness and complete the “RHSPM/ECC Evaluation” section.
- Spill/Release and Environmental/Permit Issue IRFs are sent to the ECC. The ECC shall review the IRF for completeness and complete the “RHSPM/ECC Evaluation” section to determine if the incident is a reportable spill or violation.
- The HSPM shall review an Injury/Illness IRF for accuracy and verify that the incident is categorized consistent with local occupational safety and health recordkeeping requirements.
- The EPM shall review a Spill/Release and Environmental/Permit Issue IRF to verify accuracy, consistency, and compliance with applicable federal, state, and local environmental requirements.
- Corporate HS&E shall maintain all submitted IRFs.

6.5 Incident Report Form Updating Process

When additional or updated information becomes available, the HRR (for CH2M HILL injury-related incidents), the RHSPM (for incidents involving property damage, near-miss, or other), or the ECC (for incidents involving spills/release or environmental or permit issues) shall update the existing IRF and re-submit the form as shown in Attachment 4, IRF Updating Flowchart. The updated IRF will replace the original IRF in the system and will be routed and reviewed following the same process as described above. Refer to Appendix A, Section 4.0, for specific guidelines for updating the IRF.

7.0 Incident Investigation

The purpose of an incident investigation is to understand how the incident happened, analyze the root causes, and prevent recurrence by implementing corrective actions. To conduct an effective investigation, all information must be as detailed and comprehensive as possible. The investigation must be based on facts that clearly identify the sequence of events and the factors that contributed to the incident. The investigation team should not be involved with any punitive actions resulting from the investigation. Fairness and impartiality are essential.

Serious incidents are investigated as directed by the LID.

7.1 Non-Serious Incident Investigation Procedure

Incident investigations are to be initiated and completed as soon as possible, but no later than 72 hours after the incident has occurred. Except for serious incidents, the RHSPM or

ECC (depending on the type of incident) shall be responsible for determining the level of the investigation. The RHSPM/ECC may conduct the investigation directly or may delegate this function to the ERC or other party, depending on the extent of the incident and staff availability. The Investigation Guidelines in Appendix B must be followed when conducting incident investigations. Typically, non-serious investigations will be documented by updating the IRF and describing the investigation facts in the Comments section. A supplemental report may be required for more extensive investigations. The RHSPM/ECC shall ensure that the Project Manager (field) or Area Office Manager (office) is made aware of investigation findings and all corrective actions, and shall verify that corrective actions are implemented to prevent further incidents.

8.0 Attachments

Attachment 1	Regulatory Requirements and Standards
Attachment 2	Incident Notification and Reporting Flowchart
Attachment 3	IRF Completion Flowchart
Attachment 4	IRF Updating Flowchart
Appendix A	Incident Report Form Completion Guideline
Appendix B	Incident Investigation Guidelines

CH2MHILL

Incident Reporting and Investigation Standard of Practice HSE-111

Attachment 1: Regulatory Requirements and Standards

Australia

NSW – Regulation 2001

VIC – OHS (Incident Notification) Regulations 1996

TAS – Section 61 Workplace Health & Safety Regulations 1998

WA – Work Safety & Health Act – Notification of Accidents

QLD – OHS – Incident Record/Report

NT – Section 46 – Work Health Regulations

ACT – OHS Act

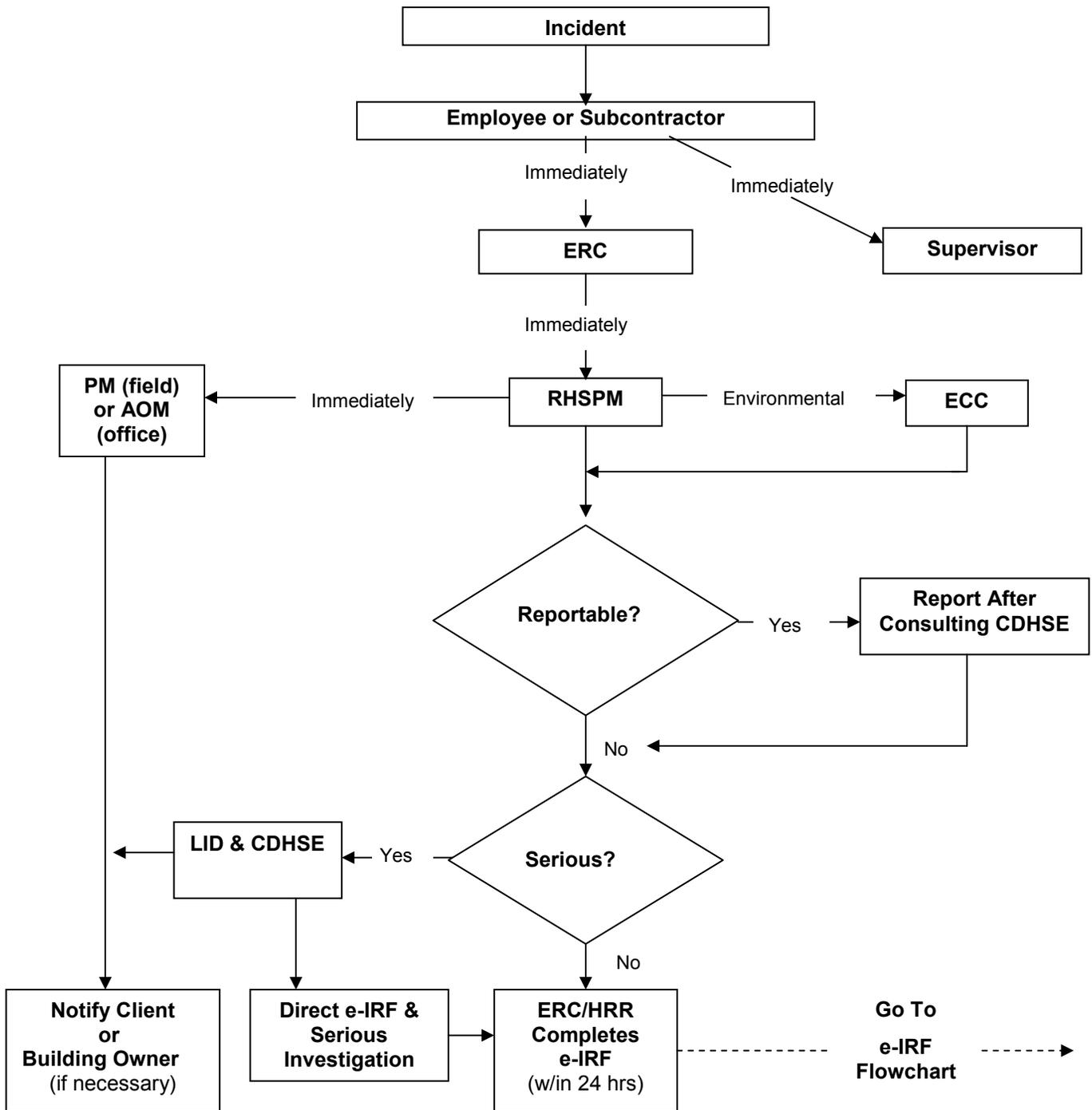
SA – OHS Act

United States

OSHA (29 CFR §1904.4) and various state workers compensation laws require employers to complete an injury/illness report after receiving information that a work-related injury or illness has occurred. CH2M HILL satisfies these requirements by using an IRF.

Investigations falling within the scope of the OSHA Process Safety Management Standard must meet the requirements of 29 CFR §1910.119(m).

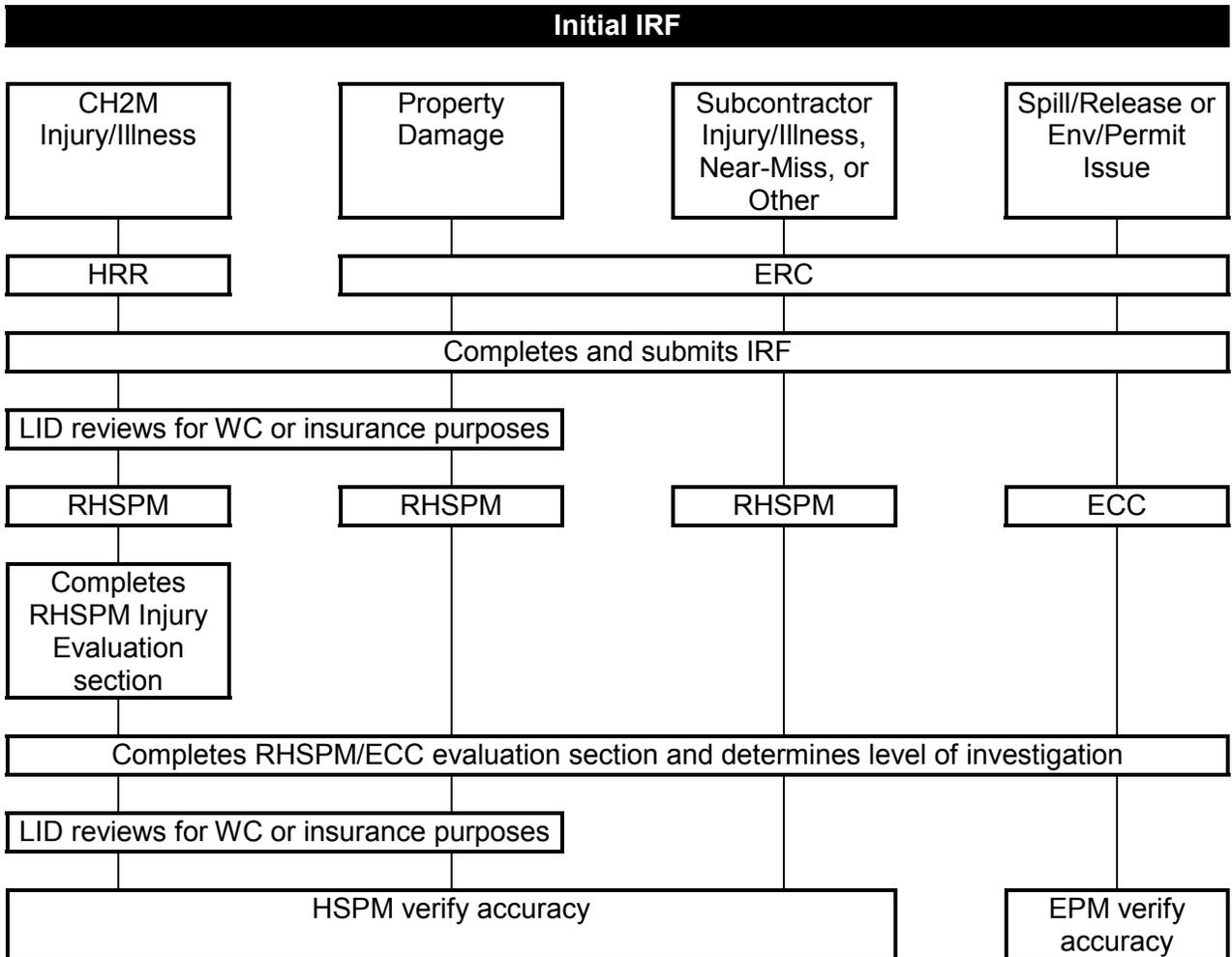
Attachment 2: Incident Notification and Reporting Flowchart



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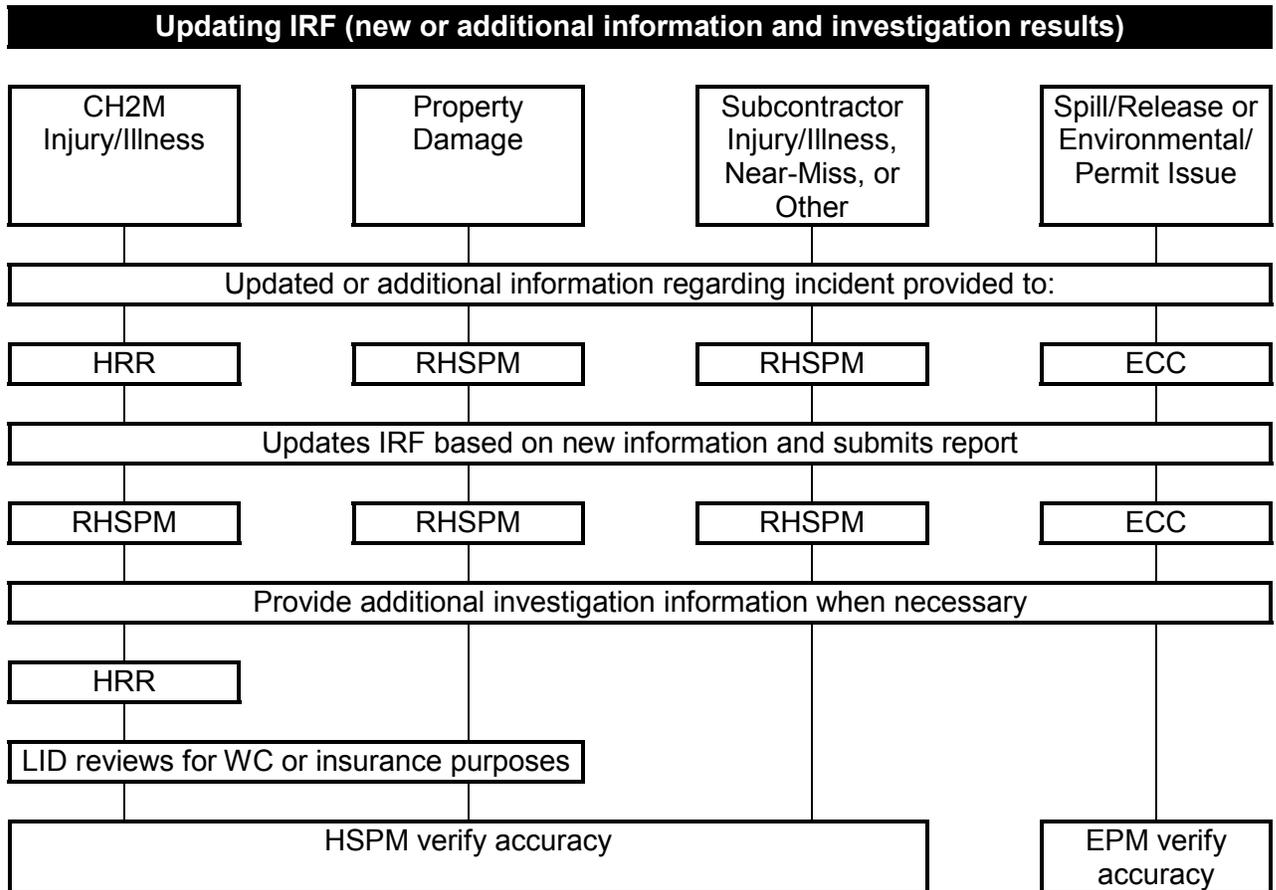
Attachment 3: IRF Completion Flowchart



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Incident Reporting and Investigation Standard of Practice HSE-111

Attachment 4: IRF Updating Flowchart



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Incident Reporting and Investigation Standard of Practice HSE-111

Appendix A: Incident Report Form Completion Guideline

1.0 Introduction

This guideline is provided to assist in accessing, creating, reviewing, and updating the Incident Report Form (IRF).

2.0 Access to IRF

The preferred method of submitting an IRF is by using the electronic IRF (e-IRF). The e-IRF may be accessed at the HS&E Home Page under Forms & Reports. If the e-IRF cannot be accessed, a hard copy of the form may be printed from Attachment 1. All fields on the hard copy must be completed and faxed to the Corporate HS&E Department for entry into the system. Faxed IRFs must be received within 24 hours of the incident. Problems encountered with the e-IRF should be referred to regional IT staff.

3.0 IRF Initial Entry

Human Resources Representatives (HRRs) are responsible for creating the IRF for CH2M HILL employee injury and illness incidents. The ERC is responsible for completing the IRF for all other types of incidents. An e-IRF may be created from the IRF Welcome Page by selecting the "Create" tab and then "Incident." All incidents require completion of the "Type of Incident" and "General Information" sections. Depending upon the type of incident, additional sections may require completion.

After completing the necessary information, hit the "Submit" button to generate an IRF report. If the information has been entered correctly, a separate window will momentarily appear stating that the IRF has been successfully submitted. Select the "OK" button; the completed report will open for review. Changes cannot be made to this screen; see section 4.0 to update e-IRF reports. Only HRR and HS&E staff have authority to edit existing reports. Submitted reports will be sent to the appropriate RHSPM and ECC for additional evaluation. If information has been entered incorrectly, the system will prompt the user to reenter the information. To clear the fields and reenter information, hit the "Reset" button. (Note: The "Reset" button will reset all fields on the current screen; therefore, all information on the current screen will require reentry.)

To make timely notifications to appropriate authorities, IRFs must be submitted within 24 hours of the incident occurrence.

3.1 General Sections for All Incident Types

Type of Incident Section

Select at least one of the incident types provided on the form. More than one incident type may be selected. The “Other” option may be used for incident types not provided on the form (e.g., fires, explosions, bomb threats, workplace violence).

General Information Section

Date of Incident – Provide the date the incident occurred. If the exact date is unknown, provide an approximate date. Enter date in the “mm/dd/yyyy” format. The system will prompt the user to reenter incorrect date entries.

Time of Incident – Provide the time the incident occurred. If the exact time is unknown, provide an approximate time. Enter time in military time or the “hh:mm am or pm” format. The system will prompt the user to reenter incorrect time entries.

Type of Activity – Select the activity being performed that resulted in the incident from the pick list. If activity is not listed, select “other” and provide a brief description. Only use “other” if no other option is appropriate.

Location of Incident – Select the location where the incident occurred from the pick list. If “Company Premises” is selected, provide the CH2M HILL office location. If “Field” is selected, provide the project number, project/site name, and client name. If “In Transit” is selected, provide traveling from and traveling to.

Geographic Location of Incident – Select the CH2M HILL region where the incident occurred from the pick list.

Subcontractor Involved – If a CH2M HILL subcontractor was involved in the incident, provide the subcontractor’s company name and telephone number.

Describe the Incident – Provide a brief description of the events that led to (caused) the incident. Be as specific as possible.

Verbal Notification Section

CH2M HILL Personnel Notified – Provide names, dates, and times of all CH2M HILL personnel notified in accordance with HSE-111.

Client Notified – Indicate if the Project Manager has notified the client in accordance with procedures in HSE-111, Section 6.2.

Witnesses Section

Witness information – Provide name, address, and telephone number of any witnesses to the incident.

Comments Section

Additional Comments/Changes – Provide any additional information that was not covered that will help clarify the reasons for the incident.

3.2 Injured Employee Data Section (Complete for Injury/Illness Incidents only)

Injured Employee General Information—If a CH2M HILL employee was injured, select the “Find” button and enter the first three letters of the employee’s last name. Allow the system a few seconds to search the global database. Select the injured employee from the pick list in option 2 and select “OK” in option 3. The system will automatically populate the general information fields. If the system could not locate the injured employee, select “Click to enter a subcontractor” and provide the information manually. If a CH2M HILL subcontractor was injured, select “Click to enter a subcontractor” and provide the information manually.

Injury Type—Select the injury type from the pick list. If injury type is not listed, select “Other” and provide a brief description. Use “Other” only if no other option is appropriate. If more than one injury type, select “Multiple” and provide a brief description.

Part of Body Injured—Select the body part injured from the pick list. If the body part injured is not listed, select “Other” and provide a brief description. Use “Other” only if no other option is appropriate. If more than one body part was injured, select “Multiple” and provide a brief description.

Nature of Injury—Select nature of injury from the pick list. If nature of injury is not listed, select “Other” and provide a brief description. Use “Other” only if no other option is appropriate. If more than one nature of injury, select “Multiple” and provide a brief description.

Initial Diagnosis/Treatment Date—Provide the initial date when the injury/illness was diagnosed or treated. Enter date in the “mm/dd/yyyy” format. The system will prompt the user to reenter incorrect date entries.

Type of Treatment—Select treatment from the pick list. If treatment is not listed, select “Other” and provide a brief description. Use “Other” only if no other option is appropriate. If more than one treatment, select “Multiple” and provide a brief description.

Required Days Off—Provide the number of days the doctor required the employee to be away from work. Do not count days in which the employee chooses to stay away from work without the doctor’s instruction. Do not count initial day of injury or onset of illness. Do not count days on which the employee would not have worked even if the employee had been able to work (e.g., holidays, vacations, weekends). This number may need to be updated if the doctor changes initial instructions.

Restricted Days of Work Activity—Provide the number of days the doctor restricted the employee’s work activity. Restricted days include: (1) days employee was assigned to another job on a temporary basis, (2) days employee worked at a permanent job less than full time, and (3) days employee worked at his/her permanent job but could not perform all the duties normally conducted. Do not count initial day of injury or onset of illness. Do not count days on which employee would not have worked even if the employee had been able to work (e.g., holidays, vacations, weekends). This number may need to be updated if the doctor changes initial instructions.

Equipment Malfunction—Select “Yes” if equipment malfunction caused or led to the incident.

Routine Task – Select “Yes” if incident occurred during a routine task.

Describe How You May Have Prevented This Accident – Provide a brief description of how this incident could have been avoided or prevented.

Physician Information – Provide name, address, and telephone number of physician visited.

Hospital Information – Provide name, address, and telephone number of hospital visited.

Emergency Room Information – Provide name, address, and telephone number of emergency room visited.

3.3 Property Damage Section (Complete for Property Damage incidents only)

Property Damaged – Provide a brief description of the property, including all vehicles, equipment, structures, etc.

Property Owner – Indicate if the property is owned by CH2M HILL or, if not, who owns the damaged property.

Damage Description – Provide a brief description of the physical damage on each damaged item.

Estimated Amount – Provide the estimated dollar value of damage or cost to repair.

3.4 Spill or Release (Complete for Spill/Release incidents only)

Substance – Provide the type of substance spilled or released to the environment.

Estimated Quantity – Provide the estimated quantity of the substance spilled/released.

Facility – Provide the name, address, and telephone number of the facility where the incident occurred.

Movement Off Property – Select “Yes” if the substance that was spilled/released moved off the property where the work was being performed.

Spill/Release From – Select from the pick list the type of container the substance was in prior to the spill/release. If the container type is not listed, select “Other” and provide a brief description. Use “Other” only if no other option is appropriate.

Spill/Release To – Select from the pick list where the substance ended up after the spill/release. If area is not listed, select “Other” and provide a brief description. Use “Other” only if no other option is appropriate.

3.5 Environmental/Permit Issue Section (Complete for Environmental/Permit Issue incidents only)

Describe Environmental or Permit Issue – Where a federal, state, or local law or regulation may have been violated, describe the requirement and how it was violated.

Permit Type – Select the type of permit that was exceeded from the pick list. If the permit type is not listed, select “Other” and provide a brief description. Use “Other” only if no other option is appropriate.

Permitted Level or Criteria – Provide the level or criteria exceeded (e.g., 5.0 ppm lead or surface water quality criteria).

Permit Name and Number – Provide name and number of permit exceeded (e.g., NPDES No. ST1234).

Substance and Estimated Quantity – Provide substance name and estimate the quantity of the exceedance.

Duration of Permit Exceedance – Provide an estimate of how long the exceedance lasted.

4.0 IRF Updating

The HRR (for incidents involving CH2M HILL injuries) or the ERC (for all other incidents) must update the IRF when additional or updated information becomes available. New or additional treatment, diagnosis, lost workdays, or restricted days may change nonrecordable cases to recordable cases, or more accurate calculations may result in a reportable spill. Therefore, IRFs shall be updated when additional or updated information is obtained. The RHSPM and ECCs must update the “RHSPM/ECC Evaluation” section when appropriate. The following steps must be used when updating existing IRFs. (Note: Any changes will overwrite the previous field information. It is recommended that the existing report be printed prior to updating. Lost information can then be reentered by reviewing the printed copy.)

1. Access the IRF system.
2. At the welcome page, select “Reports” tab, then “Query.”
3. Reports may be queried on almost any IRF field. If the IRF number is known, query by General Information>Incident-number. If the employee name is known, query by Injury>Injured employee. Several parameters may be selected to narrow the search.
4. Once query parameters are selected, click the “Search” button. In a few seconds the IRFs that match the parameters will be displayed.
5. Click the IRF number to view and edit the IRF.
6. Any field may be edited; however, you are required to provide your name, date, and brief summary of the edits made under “Additional comments/changes.”
7. After all the changes have been made, click the “Submit” button. Edits will be saved and sent to the appropriate RHSPM and ECC.

5.0 RHSPM/ECC Evaluation

The RHSPM and ECC are responsible for reviewing IRF reports for accuracy and completeness, and for completing additional evaluation sections. RHSPMs are required to complete the RHSPM Injury Evaluation and RHSPM/ECC Evaluation sections for Injury/Illness Reports, Property Damage, Near-Miss, and Other reports. ECCs are required to complete the RHSPM/ECC Evaluation and ECC Evaluation sections for Spill/Release and Environmental/Permit Issue reports.

Questions regarding Injury/Illness, Property Damage, Near-Miss, and Other reports should be directed to the HSPM. Questions regarding Spill/Release and Environmental/Permit Issue reports should be directed to the EPM.

5.1 RHSPM Injury Evaluation Section

Work Related – In general, an incident is considered work related when it results from an event or exposure in the work environment. The work environment includes CH2M HILL premises and other locations where employees are engaged in work-related activities or are present as a condition of employment. CH2M HILL premises include company restrooms, hallways, and lunchrooms, but exclude parking and recreational facilities. Incidents occurring on CH2M HILL premises are typically work related. Incidents occurring off CH2M HILL premises are also considered work related if: (1) the employee was engaged in a work-related activity, (2) the employee was present at the location as a condition of employment, or (3) the employee was in travel status and was engaged in work or travel function. If the employee was engaged in an activity for personal use or enjoyment while off CH2M HILL premises, the incident would not be considered work related. Determining work relationships can be difficult. For complex cases, call the HSPM for clarification.

Incident Status – Distinguishing between injuries and illnesses is determined by the original event or exposure that caused the incident, not by the resulting condition. Injuries are caused by instantaneous events and exposures; anything other than instantaneous is classified as an illness. Animal, insect, and snake bites are classified as injuries. Back injuries are classified as injuries. Repetitive motion disorders are classified as illnesses.

Fatality Date – This field is to be used only for an injury or illness that is fatal. The OSHA 200 log requires a fatality date, and this may be different from the date of injury or illness. Enter date in the “mm/dd/yyyy” format.

Illness Category – This field is to be used only for recordable illnesses. The OSHA 200 log requires that recordable illnesses be categorized within one of the seven categories provided on the IRF. Choose only one category. The seven illness categories, with examples of each, are listed below:

- Occupational skin diseases or disorders – Contact dermatitis, eczema, or rash caused by primary irritants and sensitizers or poisonous plants; oil acne; chrome ulcers; chemical burns or inflammations.
- Dust diseases of the lungs (pneumoconioses) – Silicosis, asbestosis, and other asbestos-related diseases, coal worker's pneumoconiosis, byssinosis, siderosis, and other pneumoconioses.
- Respiratory conditions due to toxic agents – Pneumonitis, pharyngitis, rhinitis, or acute congestion due to chemicals, dusts, gases, or fumes: farmer's lung.
- Poisoning (systemic effects of toxic materials) – Poisoning by lead, mercury, cadmium, arsenic, or other metals; by carbon monoxide, hydrogen sulfide, or other gases; by benzol, carbon tetrachloride, or other organic solvents; by insecticide sprays such as parathion or lead arsenate; by other chemicals such as formaldehyde, plastics, and resins.

- Disorders due to physical agents (other than toxic materials) – Heatstroke, sunstroke, heat exhaustion, and other effects of environmental heat; freezing, frostbite, and effects of exposure to low temperatures; caisson disease; effects of ionizing radiation (isotopes, x-rays, radium); effects of nonionizing radiation (welding flash, ultraviolet rays, microwaves).
- Disorders associated with repeated trauma – Noise-induced hearing loss; synovitis, tenosynovitis, and bursitis; Raynaud’s phenomenon; and other conditions due to repeated motion, vibration, or pressure.
- All other occupational illnesses – Anthrax, brucellosis, infectious hepatitis, malignant and benign tumors, food poisoning, histoplasmosis, or coccidioidomycosis.

Illness Diagnosed or Recognized – All commonly recognized and diagnosed illnesses are recordable. Commonly recognized illnesses are those that are simple to detect and can be identified without specialized medical training, such as poison ivy. Commonly recognized illnesses are recordable on the date the signs/symptoms are present. Complex illnesses (e.g., silicosis, asbestosis, and carpal tunnel syndrome) can be identified (diagnosed) only by properly trained medical personnel and become recordable only after they have been diagnosed. An individual who reports wrist pain should not be reported as recordable until a diagnosis has been made of a work-related illness. For injuries, select “Not diagnosed nor recognized.”

Medical Treatment – A guideline is provided in Attachment 2 for distinguishing between first aid and medical treatment. Distinguishing between first aid and medical treatment can be difficult; for complex cases call the HSPM for clarification.

Loss of Consciousness – Self-explanatory.

Restricted Work or Motion – The number of restricted days is provided in the “Incident Information” section that is completed by the HRR. This number may need to be updated if the doctor changes initial instructions. The HRR is responsible for updating the restricted workdays; the RHSPM should verify that this is being done.

Transfer to Another Job – Self-explanatory.

Lost Workdays – The number of lost workdays is provided in the “Incident Information” section that the HRR completes. This number may need to be updated if the doctor changes initial instructions. The HRR is responsible for updating the lost workdays; the RHSPM should verify that this is being done.

OSHA Recordable – A flowchart is provided in Attachment 3 for determining OSHA recordability. Recordability for incidents occurring outside the United States is not recorded in this section. Such determinations must be documented in the “Comment” section of the IRF. A flowchart is provided in Attachment 4 for determining recordability in Australia. Questions regarding recordability should be directed to the HSPM.

OSHA Log Date – This field is to be used only for recordable incidents in the United States. For recordable injuries, this is the date of the injury. For recordable illnesses, this is the date the illness was diagnosed or recognized. Illnesses are recordable only after they have been diagnosed or recognized. This field, along with the “OSHA Recordable” field, is used to

determine the recordable cases for the H&S quarterly report. Enter date in the “mm/dd/yyyy” format.

OSHA Log Location – This field is to be used only for recordable incidents in the United States. OSHA requires that each establishment maintain an OSHA 200 log and that recordable cases occurring at the establishment be entered onto the establishment log, regardless of where the employee normally reports for work. An establishment is defined as any operation with a continuous duration of 1 year or more. That means projects lasting more than 1 year are required to maintain their own OSHA 200 log.

From the pick list, choose the appropriate OSHA log location code. This should be the same as the region identified under the geographic location field. If a code is not available for an establishment project, one must be created. The code used, as well as the project’s name and location, must be provided to the HSPM.

5.2 RHSPM/ECC Evaluation Section

Comments – Provide any additional information that was not included in the responses to other questions that will help clarify and update the case. This may include doctor’s instructions from specific visits to assist in updating lost and restricted workdays and may include the specific reasons why this case is recordable or not.

Initial Determination of Cause(s) – Provide the root cause(s) of the incident to prevent recurrence. The form in Attachment 1 will be used to determine the cause of the incident. This form will be kept in project and/or regional HS&E files.

Corrective Actions/Lessons Learned – Indicate corrective actions required to address the situation and prevent recurrence. Provide lessons learned/suggestions that might have prevented the specific case or that may prevent future incidents of the same nature.

5.3 ECC Evaluation Section

Hazardous Substances and RQs – Indicate the status of the substance involved (CERCLA hazardous substance or extremely hazardous substance) in the spill or release and the applicable Reportable Quantity (RQ) by referring to the *BNA Spill Reporting Procedures Guide*.

Reportable to Agency – Indicate if the spill, release, or environmental issue is required to be reported to the regulatory agency. For example, “The exceedance is reportable to the State Water Quality Board because it was considered a bypass event under the terms of the NPDES permit.” This determination should have already been made when the incident was verbally communicated. Research applicable regulations to determine reportability. The agency should *not* be contacted to assist in making a determination. The incident should be reported after a determination is made. Note that most spills/releases must be reported within 24 hours.

State Reason – Provide the rationale behind the decision of whether or not to report the incident. For example, “The 0.03 ppm concentration of benzene in the mixture contained in the 50 gallons spilled did not exceed the federal or state RQ.”

6.0 Attachments

Attachment A-1	Incident Report (Hard Copy)
Attachment A-2	Treatment Classification Table
Attachment A-3	OSHA Recordability Flowchart
Attachment A-4	Australia Reportable Injury/Illness Guidelines

CH2MHILL

Attachment A-1: Incident Report Form (Hard Copy)

Fax completed form to:

425.462.5957

CH2M HILL Seattle Office

Attention: Corporate HS&E Department

Type of Incident (Select at least one)

- | | | |
|---|--|--|
| <input type="checkbox"/> Injury/Illness | <input type="checkbox"/> Property Damage | <input type="checkbox"/> Spill/Release |
| <input type="checkbox"/> Environmental/Permit Issue | <input type="checkbox"/> Near-Miss | <input type="checkbox"/> 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)

- | | | |
|--|--|--|
| <input type="checkbox"/> Asbestos Work | <input type="checkbox"/> Excavation Trench – Haz Waste | <input type="checkbox"/> Other (Specify) _____ |
| <input type="checkbox"/> Confined Space Entry | <input type="checkbox"/> Excavation Trench – Non Haz | <input type="checkbox"/> Process Safety Management |
| <input type="checkbox"/> Construction Mgmt – Haz Waste | <input type="checkbox"/> Facility Walkthrough | <input type="checkbox"/> Tunneling |
| <input type="checkbox"/> Construction Mgmt – Non-Haz Waste | <input type="checkbox"/> General Office Work | <input type="checkbox"/> Welding |
| <input type="checkbox"/> Demolition | <input type="checkbox"/> Keyboard Work | <input type="checkbox"/> Wetlands Survey |
| <input type="checkbox"/> Drilling – Haz Waste | <input type="checkbox"/> Laboratory | <input type="checkbox"/> Working from Heights |
| <input type="checkbox"/> Drilling – Non-Haz Waste | <input type="checkbox"/> Lead Abatement | <input type="checkbox"/> Working in Roadways |
| <input type="checkbox"/> Drum Handling | <input type="checkbox"/> Motor Vehicle Operation | <input type="checkbox"/> WWTP Operation |
| <input type="checkbox"/> Electrical Work | <input type="checkbox"/> Moving Heavy Object | |

Location of Incident (Select one)

- Company Premises (CH2M HILL Office: _____)
- Field (Project #: _____ Project/Site Name: _____ Client: _____)
- In Transit (Traveling from: _____ Traveling to: _____)
- At Home

Geographic Location of Incident (Select region where the incident occurred)

- | | | |
|------------------------------------|---|--|
| <input type="checkbox"/> Northeast | <input type="checkbox"/> Corporate | <input type="checkbox"/> Latin America |
| <input type="checkbox"/> Southeast | <input type="checkbox"/> Canadian | |
| <input type="checkbox"/> Northwest | <input type="checkbox"/> Asia Pacific | |
| <input type="checkbox"/> Southwest | <input type="checkbox"/> Europe Middle East | |

If a CH2M HILL 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 CH2M HILL employee injured

Employee Name: _____ Employee Number: _____

If CH2M HILL Subcontractor employee injured

Employee Name: _____ Company: _____

Injury Type

- | | | |
|--|--|---|
| <input type="checkbox"/> Allergic Reaction | <input type="checkbox"/> Electric Shock | <input type="checkbox"/> Multiple (Specify) _____ |
| <input type="checkbox"/> Amputation | <input type="checkbox"/> Foreign Body in Eye | <input type="checkbox"/> Muscle Spasms |
| <input type="checkbox"/> Asphyxia | <input type="checkbox"/> Fracture | <input type="checkbox"/> Other (Specify) _____ |
| <input type="checkbox"/> Bruise/Contusion/Abrasion | <input type="checkbox"/> Freezing/Frostbite | <input type="checkbox"/> Poisoning (Systemic) |
| <input type="checkbox"/> Burn (Chemical) | <input type="checkbox"/> Headache | <input type="checkbox"/> Puncture |
| <input type="checkbox"/> Burn/Scald (Heat) | <input type="checkbox"/> Hearing Loss | <input type="checkbox"/> Radiation Effects |
| <input type="checkbox"/> Cancer | <input type="checkbox"/> Heat Exhaustion | <input type="checkbox"/> Strain/Sprain |
| <input type="checkbox"/> Carpal Tunnel | <input type="checkbox"/> Hernia | <input type="checkbox"/> Tendonitis |
| <input type="checkbox"/> Concussion | <input type="checkbox"/> Infection | <input type="checkbox"/> Wrist Pain |
| <input type="checkbox"/> Cut/Laceration | <input type="checkbox"/> Irritation to Eye | |
| <input type="checkbox"/> Dermatitis | <input type="checkbox"/> Ligament Damage | |
| <input type="checkbox"/> Dislocation | | |

Part of Body Injured

- | | | |
|--|---|--|
| <input type="checkbox"/> Abdomen | <input type="checkbox"/> Hand(s) | <input type="checkbox"/> Neck |
| <input type="checkbox"/> Ankle(s) | <input type="checkbox"/> Head | <input type="checkbox"/> Nervous System |
| <input type="checkbox"/> Arms (Multiple) | <input type="checkbox"/> Hip(s) | <input type="checkbox"/> Nose |
| <input type="checkbox"/> Back | <input type="checkbox"/> Kidney | <input type="checkbox"/> Other (Specify) _____ |
| <input type="checkbox"/> Blood | <input type="checkbox"/> Knee(s) | <input type="checkbox"/> Reproductive System |
| <input type="checkbox"/> Body System | <input type="checkbox"/> Leg(s) | <input type="checkbox"/> Shoulder(s) |
| <input type="checkbox"/> Buttocks | <input type="checkbox"/> Liver | <input type="checkbox"/> Throat |
| <input type="checkbox"/> Chest/Ribs | <input type="checkbox"/> Lower (Arms) | <input type="checkbox"/> Toe(s) |
| <input type="checkbox"/> Ear(s) | <input type="checkbox"/> Lower (Legs) | <input type="checkbox"/> Upper Arm(s) |
| <input type="checkbox"/> Elbow(s) | <input type="checkbox"/> Lung | <input type="checkbox"/> Upper Leg(s) |
| <input type="checkbox"/> Eye(s) | <input type="checkbox"/> Mind | <input type="checkbox"/> Wrist(s) |
| <input type="checkbox"/> Face | | |
| <input type="checkbox"/> Finger(s) | <input type="checkbox"/> Multiple (Specify) _____ | |
| <input type="checkbox"/> Foot/Feet | | |

Nature of Injury

- | | | |
|---|---|---|
| <input type="checkbox"/> Absorption | <input type="checkbox"/> Inhalation | <input type="checkbox"/> Overexertion |
| <input type="checkbox"/> Bite/Sting/Scratch | <input type="checkbox"/> Lifting | <input type="checkbox"/> Repeated Motion/Pressure |
| <input type="checkbox"/> Cardiovascular/Respiratory | <input type="checkbox"/> Mental Stress | <input type="checkbox"/> Rubbed/Abraded |
| System Failure | <input type="checkbox"/> Motor Vehicle Accident | <input type="checkbox"/> Shock |
| <input type="checkbox"/> Caught In or Between | <input type="checkbox"/> Multiple (Specify) _____ | <input type="checkbox"/> Struck Against |
| <input type="checkbox"/> Fall (from Elevation) | | <input type="checkbox"/> Struck By |
| <input type="checkbox"/> Fall (Same Level) | <input type="checkbox"/> Other (Specify) _____ | <input type="checkbox"/> Workplace Violence |
| <input type="checkbox"/> Ingestion | | |

Initial Diagnosis/Treatment Date: _____

Type of Treatment

- | | |
|---|--|
| <input type="checkbox"/> Admission to hospital/medical facility | <input type="checkbox"/> Prescription – single dose |
| <input type="checkbox"/> Application of bandages | <input type="checkbox"/> Removal of foreign bodies |
| <input type="checkbox"/> Cold/heat compression – multiple treatment | <input type="checkbox"/> Skin removal |
| <input type="checkbox"/> Cold/heat compression – one treatment | <input type="checkbox"/> Soaking therapy – multiple treatment |
| <input type="checkbox"/> First-degree burn treatment | <input type="checkbox"/> Soaking therapy – one treatment |
| <input type="checkbox"/> Heat therapy – multiple treatment | <input type="checkbox"/> Stitches/sutures |
| <input type="checkbox"/> Multiple (specify) _____ | <input type="checkbox"/> Tetanus |
| <input type="checkbox"/> Heat therapy – one treatment | <input type="checkbox"/> Treatment for infection |
| <input type="checkbox"/> Nonprescription medicine | <input type="checkbox"/> Treatment of 2 nd /3 rd -degree burns |
| <input type="checkbox"/> None | <input type="checkbox"/> Use of antiseptics – multiple treatment |
| <input type="checkbox"/> Observation | <input type="checkbox"/> Use of antiseptics – single treatment |
| <input type="checkbox"/> Other (specify) _____ | <input type="checkbox"/> Whirlpool bath therapy – multiple treatment |
| | <input type="checkbox"/> Whirlpool therapy – single treatment |
| | <input type="checkbox"/> X-rays negative |
| <input type="checkbox"/> Prescription – multiple dose | <input type="checkbox"/> 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 might have prevented this injury:

Physician Information

Name: _____
Address: _____
City: _____
Zip Code: _____
Phone: _____

Hospital Information

Name: _____
Address: _____
City: _____
Zip Code: _____
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)

CH2M HILL Personnel Notified: _____
Client Notified: _____

Witnesses (Complete for all incident types)

Witness Information (First Witness)
Name: _____
Employee Number (CH2M HILL): _____
Address: _____
City: _____
Zip Code: _____
Phone: _____

Witness Information (Second Witness)
Name: _____
Employee Number (CH2M HILL): _____
Address: _____
City: _____
Zip Code: _____
Phone : _____

Additional Comments:

CH2MHILL

Incident Reporting and Investigation

Standard of Practice HSE-111

Appendix A: Incident Report Form Completion Guideline

Attachment A-2: Treatment Classification Table

FIRST AID TREATMENT	MEDICAL TREATMENT
	Treatment of INFECTION
Application of ANTISEPTICS during first visit to medical personnel	Application of ANTISEPTICS during second or subsequent visit to medical personnel
Treatment of FIRST-DEGREE BURN(S)	Treatment of SECOND- OR THIRD-DEGREE BURN(S)
Application of BANDAGE(S) during any visit to medical personnel	Application of SUTURES (stitches)
Use of ELASTIC BANDAGE(S) during first visit to medical personnel	Application of BUTTERFLY ADHESIVE DRESSING(S) or STERI STRIP(S) in lieu of sutures
Removal of FOREIGN BODIES NOT EMBEDDED IN EYE if only irrigation is required	Removal of FOREIGN BODIES EMBEDDED IN EYE
Removal of FOREIGN BODIES FROM WOUND ; if procedure is UNCOMPLICATED and is, for example, by tweezers or other simple technique	Removal of FOREIGN BODIES FROM WOUND ; if procedure is COMPLICATED because of depth of embedment, size, or location
Use of NONPRESCRIPTION MEDICATIONS and administration of single dose of PRESCRIPTION MEDICATION on first visit for minor injury or discomfort	Use of PRESCRIPTION MEDICATIONS (except a single dose administered on first visit for minor injury or discomfort)
SOAKING THERAPY on initial visit to medical personnel or removal of bandages by SOAKING	Use of hot or cold SOAKING THERAPY during second or subsequent visit to medical personnel
Application of hot or cold COMPRESS(ES) during first visit to medical personnel	Application of hot or cold COMPRESS(ES) during second or subsequent visit to medical personnel
Application of OINTMENTS to abrasions to prevent drying or cracking	CUTTING AWAY DEAD SKIN (surgical debridement)
Application of HEAT THERAPY during first visit to medical personnel	Application of HEAT THERAPY during second or subsequent visit to medical personnel
Use of WHIRLPOOL BATH THERAPY during first visit to medical personnel	Use of WHIRLPOOL BATH THERAPY during second or subsequent visit to medical personnel
NEGATIVE X-RAY DIAGNOSIS	POSITIVE X-RAY DIAGNOSIS (fractures, dislocations, etc.)

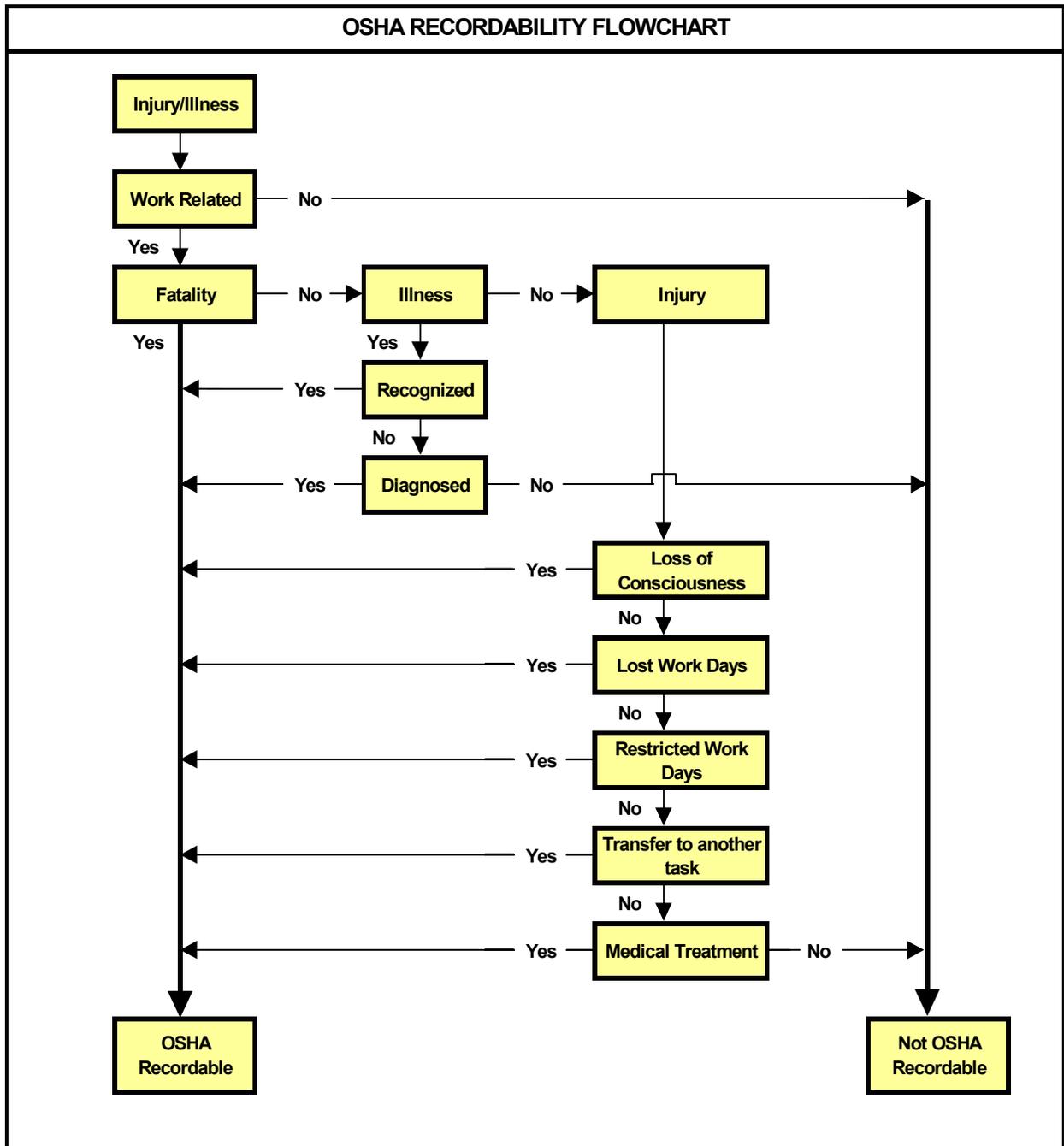
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Incident Reporting and Investigation

Standard of Practice HSE-111

Appendix A: Incident Report Form Completion Guideline

Attachment A-3: OSHA Recordability Flowchart



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Incident Reporting and Investigation

Standard of Practice HSE-111

Appendix A: Incident Report Form Completion Guideline

Attachment A-4: Australia Reportable Injury/Illness Guidelines

All work-related incidents must be reported within 24 hours to Corporate HS&E. However, only certain incidents must be reported to the local agencies. In Australia, the following incidents are reportable to the local occupational health and safety agency within seven (7) days of occurrence:

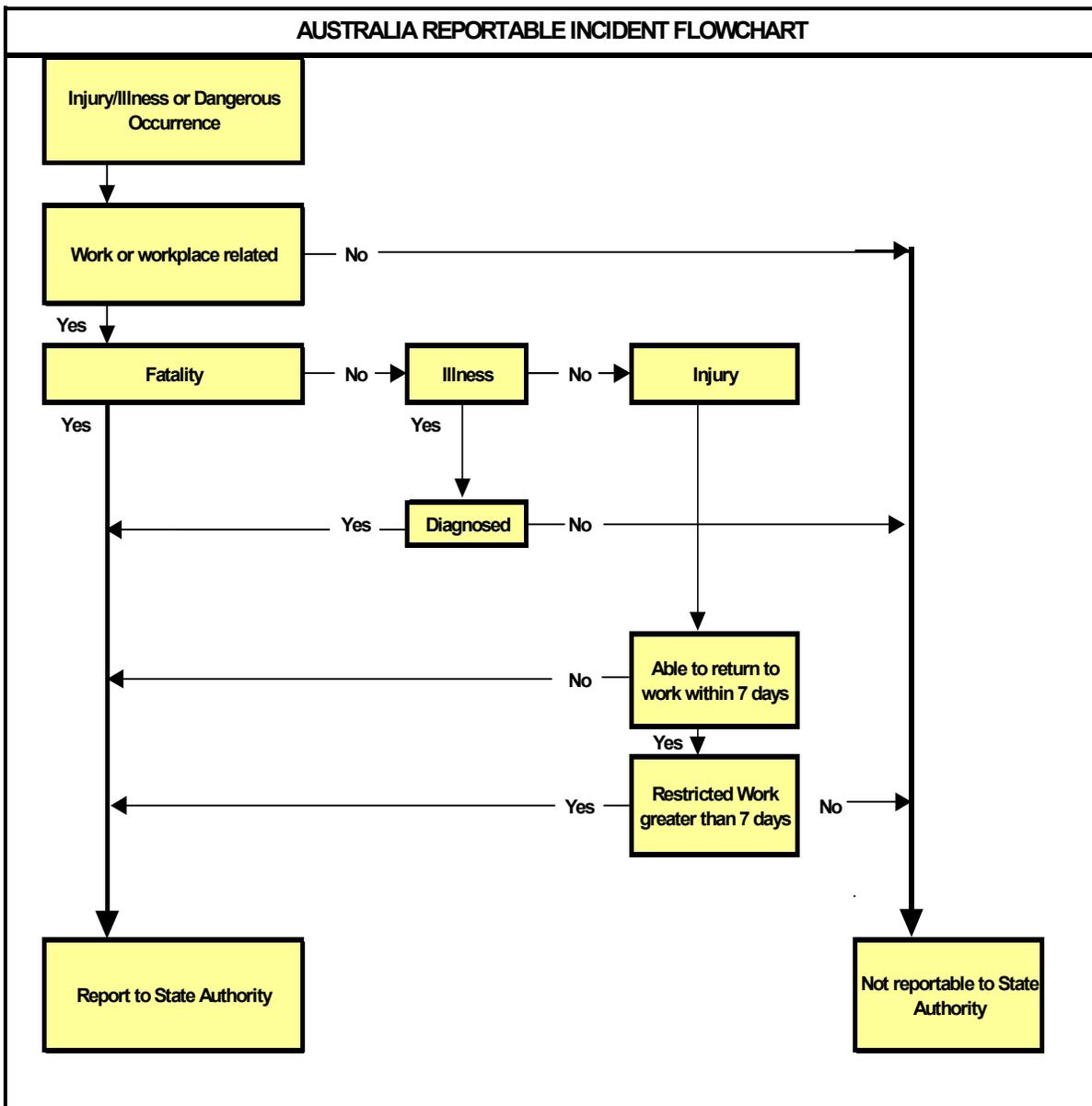
1. An accident or occurrence incurring death of a person in the workplace
2. Amputation of a limb as a result of the workplace and its operation
3. An injury to a person that results in the person being unfit, for a continuous period of at least (7) seven calendar days, to attend the person's usual place of work, to perform his or her usual duties at his or her place of work or, in the case of a nonemployee, to carry out his or her usual duties.
4. An illness of a person that is related to work processes and results in the person being unfit, for a continuous period of at least 7 days, to attend the person's usual place of work or to perform his or her usual duties at that place of work.
5. An accident or occurrence incurring electric shock
6. Damage to any plant , equipment, building, or structure or other thing that impedes safe operation,
7. An uncontrolled explosion or fire
8. An uncontrolled escape of gas, dangerous goods, or steam
9. A spill or incident resulting in exposure or potential exposure of a person to a notifiable or prohibited carcinogenic substance (as defined)
10. An accident or occurrence where an employee is injured and admitted to hospital as an in-patient following an exposure to a hazardous substance
11. An accident or occurrence involving the collapse, overturning, or failure of a load-bearing part of a lift, crane, hoist, lifting gear, or scaffolding
12. An accident or occurrence involving the collapse of shoring or an excavation which is more than 1.5m deep
13. Removal of workers from lead risk work due to excessive blood lead levels
14. Exposure to bodily fluids that presents a risk of transmission of blood-borne diseases

15. Any incident of violence at a place of work that results in an employee being unfit, for a continuous period of at least 7 days, to attend the employee's usual place of work or to perform his or her usual duties at that place of work

16. Any occurrence that involves a risk of:

- Explosion or fire
- Escape of gas, dangerous goods, or steam
- Serious injury to, or illness of, a person
- Substantial property damage

The following flowchart depicts when incidents must be reported to the appropriate agency in Australia.



In addition, some states in Australia have a category of incidents known as “non-disturbance occurrences,” which are serious, potentially life-threatening occurrences. Non-disturbance occurrences require immediate reporting to the authorities and often require the attendance of an inspector. These types of occurrences usually involve machinery, failure of structures or earthworks, or escape of hazardous substances.

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Incident Reporting and Investigation Standard of Practice HSE-111

Appendix B: Investigation Guidelines

1.0 Introduction

This guideline 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), which are basic causes on why an unsafe act/condition existed.
- Develop and implement solutions, matching all identified root causes with solutions.

2.0 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 of the preceding events that directly contributed to the incident. The information should identify why the event took place as well as who was involved, when and where the event took place, and what actions were taken.

Cause Analysis

Using the form and flowchart in Attachment 1, the root cause of the incident will be determined. This form must be retained in the project and/or regional HS&E 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

3.0 Attachments

Attachment B-1 Root Cause Analysis Form and Flowchart

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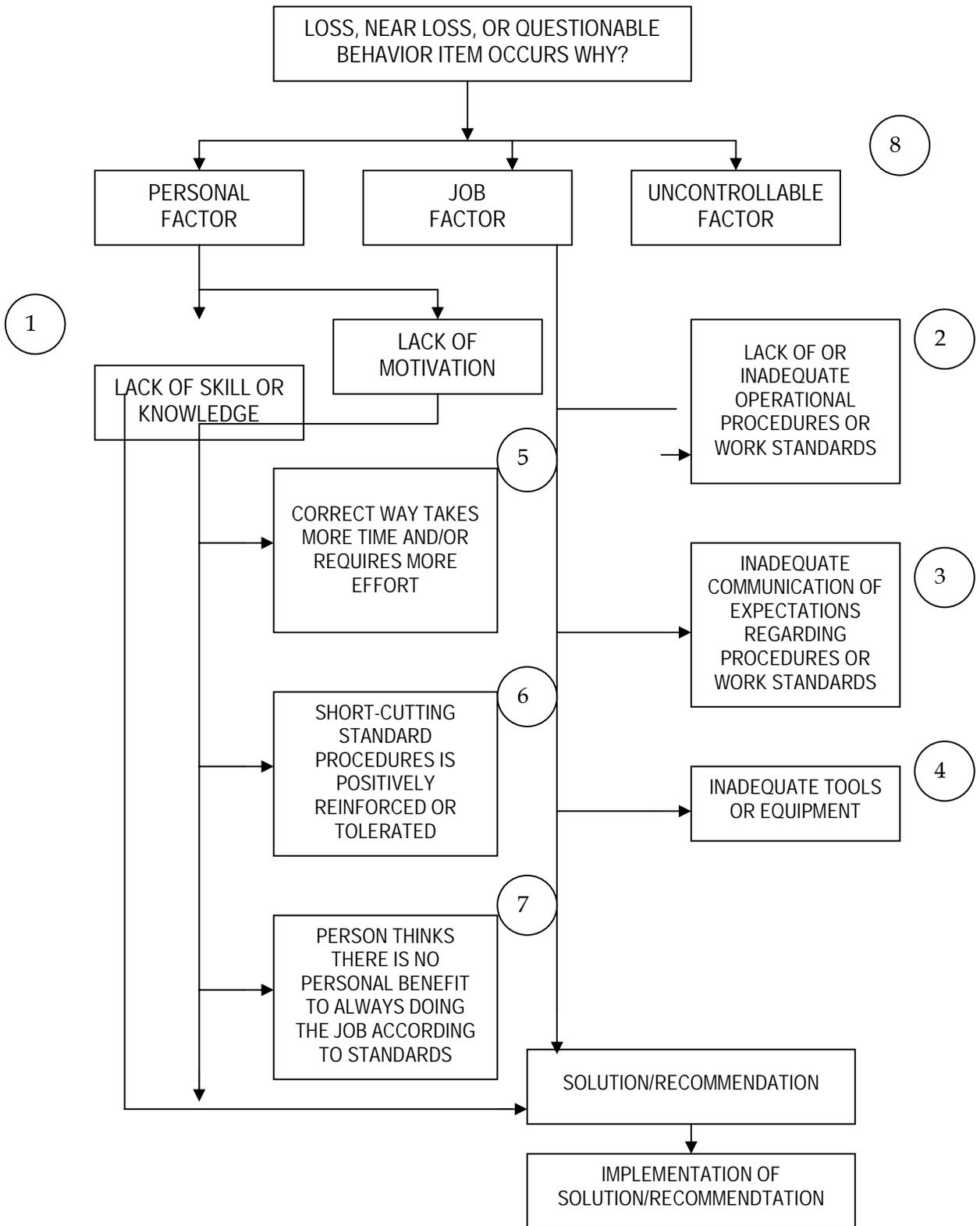
Incident Reporting and Investigation Standard of Practice HSE-111 Appendix B: Investigation Guidelines

Attachment B-1: Root Cause Analysis Form and Flowchart

Root Cause Analysis Form

Root Cause Analysis (RCA)							
<p>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.</p> <ol style="list-style-type: none"> 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	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 Flowchart



ATTACHMENT A-13: CH2M HILL HSE&Q-601 Serious Incident Reporting Process

1.0 Introduction

The purpose of this procedure is to provide direction on the required standard notification and reporting process for serious incidents. This standard ensures timely notification to the appropriate Business Group Presidents or Geographic Region Managers and allows for positive control over flow of information so that the incident is handled effectively, efficiently, and in conjunction with appropriate corporate entities. The standard notification process integrates Health, Safety, Environment & Quality (HSE&Q) and Firm Wide Security Operations (FWSO) requirements for the consistent reporting of and managing of serious events throughout our operations. The Standard of Notification applies to all CH2M HILL family of companies.

This document outlines the minimum requirements for the Serious Incident Reporting Process and is not intended as an exhaustive procedural description of the process. Exhaustive procedures for the Serious Incident Reporting Process are developed by each business group/facility or project in accordance with the direction stated herein.

2.0 Serious Incident Determination

Events which require prompt notification to senior management are determined through consideration of a number of factors including; type and seriousness of event, and need for quick Company response to expected client and public reaction. The following are general criteria for determining whether an incident on CH2M HILL owned or managed facilities or project sites is considered serious and must be immediately reported through the reporting/notification process:

- 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 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.

3.0 Reporting/Notification Guidelines

For all serious incidents this standard reporting process is implemented immediately so as to ultimately achieve notification to the Business Group President within 2 hours of incident onset or discovery, and notification to appropriate corporate Crisis Management Support Team (see responsibilities) within 3 hours of incident onset or discovery.

4.0 Responsibilities

4.1 Facility or Project Employees

Will:

- Provide immediate verbal notification of serious incident to their Project Manager, Facility Manager, and/or Security Manager. Initial notification of serious incident must include:
 - a) Provide verbal notification to appropriate emergency responders
 - b) Provide verbal notification to Facility or Project Management
 - c) Notification must include:
 - Name of Facility or Project
 - Date/Time of incident
 - Location of incident (City, State, Country)
 - Type of incident (fatality, life threatening injury/illness, kidnap/missing person, act or threat of terrorism, fire/explosion, hazardous material spill, or other)
 - The number of fatalities or victims, including name and family contact information if readily available
 - Reporting party's name and contact number
 - Description of how event occurred
 - Description of immediate and/or short-term corrective actions

4.2 Facility Manager, Project Manager, and/or Security Manager

Will:

- Provide immediate verbal notification to appropriate emergency responders if not already notified
- Provide immediate verbal notification to Team Leader to assemble Local Crisis Management Team
- Provide immediate verbal notification to Crisis Manager via pager #720.286.4911
- Provide information to Crisis Manager on immediate and/or short-term corrective actions

4.3 Crisis Manager

Will:

- Provide immediate verbal notification to Geographic Region Managers
- Provide immediate verbal notification to Business Group/Geographic Region HSE&Q Representatives
- Provide immediate verbal notification to Corporate HSE&Q Vice President
- Assemble Crisis Management Support Team as necessary
- Ensure incident updates are maintained

4.4 Geographic Region Manager

Will:

- Allocate time to provide guidance to Local Crisis Management Team and follow incident through to resolution.

4.5 Business Group/Geographic Region HSE&Q Representative

Will:

- Provide immediate (within 2 hours of incident onset or discovery) verbal notification to Business Group President or Facility Manager.
- Immediate notification to Corporate Legal/Insurance Department via e-mail with a description of the incident, parties involved, and incident circumstances. E-mail must be completed as follows:
 - Address e-mail to Al Jerman/DEN and copy Kirby Wright/DEN, Julie Zimmerman/DEN, Keith Christopher/WDC, and Tom Horton/DEN.
 - Include the phrase “Confidential-Attorney/Client Privileged Communication” in the subject line or title of the e-mail.
 - Include the following at the end of the e-mail:
"Content of communication is a privileged attorney-client communication or privileged attorney work product. If this message was misrouted and you are not an intended recipient, please delete it immediately and notify the sender."

4.6 Corporate HSE&Q Vice President

Will:

- Provide Corporate HSE&Q oversight support to the Business Group President and Crisis Management Support Team.

4.7 BG President or Facility Manager

Will:

- Provide immediate verbal notification to the Office of the Chief Executive Officer (OCEO) Coordinator, Bud Ahearn (or backup OCEO Coordinator Omur Akay).

4.8 OCEO Coordinator

Will:

- Make notification to OCEO
- Provide decision-making assistance or direction for incident resolution

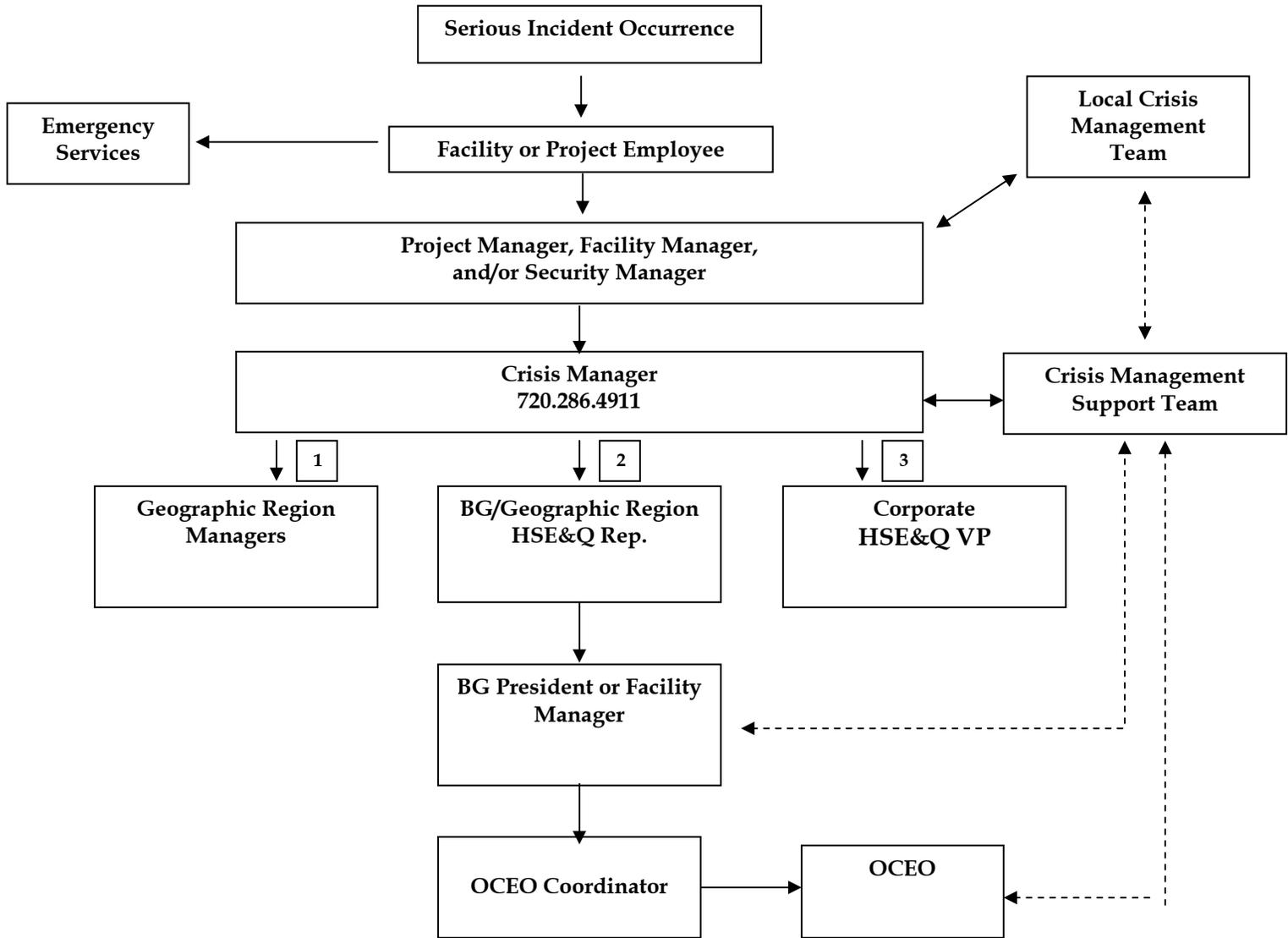
4.9 Local Crisis Management Team

- Team comprised of key local staff that is maintained at each facility and project and is activated to manage the crisis or serious event/incident on-scene. Each facility and project is responsible for staffing and managing the Local Crisis Management Team. The Local Crisis Management Team can be supplemented or augmented by members of the Crisis Management Support Team.

4.10 Crisis Management Support Team

- Team comprised of key corporate staff maintained at the corporate office and is activated to provide support, guidance, and augmentation to Local Crisis Management Operations.

5.0 Serious Incident Notification Chart



Legend:

—————> Direct line of communication

<-.-.-.-> Indirect line of communication

Definitions:

Local Crisis Management Team: Team comprised of key facility, project and/or business group personnel. Team is assembled as necessary and as appropriate to effectively manage and respond to a crisis situation (serious incident) at/on scene.

Crisis Management Support Team: Team comprised of key corporate personnel. Team is assembled as necessary and as appropriate to effectively support, direct, and /or supplement a Local Crisis Management Team.

Crisis Manager: Corporate based Crisis Manager, contactable by pager 24/7.

**ATTACHMENT A-14: CH2M HILL HSE&Q-124 Injury
Management/Return-to-Work**



Injury Management/Return-to-Work Enterprise Standard Operating Procedure HSE&Q-124

1.0 Purpose

This Core Standard applies enterprise-wide to all CH2M HILL legal entities including CH2M HILL, Inc., CH2M HILL Constructors, Inc. (CCI), Lockwood Greene, IDC, OMI and their employees within the United States and Puerto Rico. This Core Standard outlines the mandatory components and criteria to provide for the orderly, effective and timely medical treatment and return-to-work transition of an employee who sustains a work-related injury or illness. Each legal entity must revise their existing procedures and processes, as necessary, to comply with this core standard.

1.1 References

The following programs, regulations and sources were consulted to prepare this Core Standard:

- CH2M HILL H&S Standard Operating Procedure 111, Incident Reporting and Investigation
- CH2M HILL H&S Standard Operating Procedure 601, Serious Incident Reporting

2.0 Scope and Application

This Core Standard applies to all CH2M HILL Legal Entities, their employees within the United States, including Puerto Rico. It applies to non-emergency injuries and illnesses. In case of emergency, dial 911 and follow procedures specified in the office or project Emergency Response Plan.

3.0 Definitions

3.1 Injury/Illness Early Intervention

Involves a designated physician or licensed health care professional (PLHCP) providing guidance and care to an employee as soon as a work-related injury/illness occurs.

3.2 Injury Management/Return-to-Work/Return-to-Work Program (IMRTW)

The process of providing initial and ongoing treatment, administration, and counseling to employees who have sustained a work-related injury/illness with the objective of ensuring that appropriate treatment and care has been provided for the employee's capability to safely return to assigned work duties.

3.3 Occupational Health Management Provider

A firm in the business of providing occupational health services that includes administration of Injury/Illness Early Intervention and Injury Management/Return-to-Work.

3.4 Telephonic Case Management (TCM)

The process during the first 30 to 60 days of actively following the progress of an employee's treatment and healing to facilitate their being able to return-to-work without jeopardizing their health by a designated licensed health care professional or workers compensation case manager maintaining contact with the employee by telephone. Typically, TCM is applied in cases where the employee has sustained an injury/illness that involved medical treatment resulting in days away from work, work restriction or job transfer.

3.5 Field Case Management (FCM)

A 60-day process implemented by a designated licensed health care professional or workers compensation case manager to actively follow the progress of an employee's treatment and healing through visits with the employee and their place of work or home to facilitate their return to work without jeopardizing their health. Generally FCM is applied in cases where the employee has sustained a more severe injury/illness that involved more ongoing or long-term medical treatment resulting in days away from work, work restriction or job transfer.

4.0 Roles and Responsibilities

4.1 Business Group Presidents

Each Business Group (BG) President is responsible for the following:

- Demonstrating leadership and commitment to the Injury Management/Return-to-Work Program.
- Designating staff within the BG responsible for coordinating the Injury Management/Return-to-Work program with the Occupational Health Management firm administering the program for their BG.

4.2 Operation Leaders/Supervisors/Group Leaders

Operation Leaders, Supervisors, or Group Leaders are responsible for:

- Verifying that H&S program requirements are implemented in the work facility and/or during project delivery.
- Ensuring that workers are informed of the Injury Management/Return-to-Work/Return-to-Work Program.
- Ensuring that suitable duties are identified and available for injured/ill workers who are determined to be medically fit to assume.

- Promptly responding to injuries or illnesses and ensuring that employees immediately call the Injury Management/Return-to-Work/Return-to-Work Program Administrator using the designated toll-free number, or as the situation requires, the Operations Leader, Supervisor, or Group Leader, places the call for the employee.
- Promptly documenting reported incidents involving a work-related injury or illness in accordance with HSE-111, "Incident Reporting and Investigation Standard Practice," and coordinating follow-up with the H&S representative.
- Ensuring the injured/ill employee is transported safely to the occupational clinic using company vehicle, rental, or taxi service, and when the situation requires, accompany the employee or assign a designee.
- Promptly completing the CH2M HILL "Authorization to Treat" form (refer to Attachment 3) and having the employee take the completed form with him/her to the medical facility or complete the form emailed by the occupational health nurse and forward it to the medical facility within 24 hours.
- Immediately notifying the pre-designated H&S representative, Human Resources (HR) representative, or assigned BG Injury Management/Return-to-Work/Return-to-Work Coordinator of any reported work related injury or illness.
- Monitoring the recovery status of injured/ill employees with H&S, HR, or the BG Injury Management/Return-to-Work/Return-to-Work Coordinator.

4.3 Employees

Employees are responsible for:

- Complying with H&S program requirements for preventing work-related injuries and illnesses to self and others.
- Providing immediate, direct, verbal notification of any known or suspected work-related injury or illness to their immediate supervisor (e.g., Group Leader).
- Immediately contacting the Injury Management/Return-to-Work Program Administrator using the assigned toll-free number to report their injury or illness and to follow the prescribed treatment, or as the situation requires, have the Operations Leader, Supervisor, or Group Leader, place the call for him/her.

4.4 Business Group H&S Leads and Regional H&S Staff

BG H&S and Regional H&S staff are responsible for:

- Establishing and monitoring the effectiveness of H&S programs in the work facility and during project delivery.
- Identifying suitable duties to be made available to injured workers who are determined to be medically fit to assume.

- Coordinating with the Injury Management/Return-to-Work Program Administrator to identify medical clinics for new projects that may not already exist in the provider network
- Communicating to management, supervisors, and employees the requirement to immediately report all workplace injuries/illnesses to their supervisor and call the toll-free number to speak with the Injury Management/Return-to-Work Program Administrator occupational health nurse to receive assistance with the appropriate treatment.
- Ensuring the Injury Management/Return-to-Work Program toll-free number is prominently displayed in the work area or project site. (Refer to Attachment 4)
- Actively participating in the implementation of the program, including consulting with the employee, supervisor, HR, and the BG Injury Management/Return-to-Work Coordinator to ensure effective implementation
- Actively participating in the implementation of the program, including consulting with the employee, supervisor, HR, and the BG Injury Management/Return-to-Work Coordinator to ensure effective implementation
- Promptly following up with the Operation Leader/Supervisor/Group Leader on documenting reported incidents involving a work-related injury or illness in accordance with HSE-111,"Incident Reporting and Investigation Standard Practice."

4.5 Enterprise H&S

Enterprise H&S is responsible for:

- Development and implementation of the Injury Management/Return-to-Work Program with Legal and Insurance.
- Administrative management of the Occupational Health firm designated as the Injury Management/Return-to-Work Program Administrator.
- Periodic assessment of the Injury Management/Return-to-Work Program to determine its effectiveness, identify areas for improvement, and revise the procedure and elements of the core standard.

4.6 Legal and Insurance

The Legal and Insurance Department is responsible for:

- Overall administration of the Injury Management/Return-to-Work Program.
- Managing the Worker's Compensation Insurance Program including communication with Broker, Provider and Third-Party Administrator (TPA) regarding the expectations and requirements of the Injury Management/Return-to-Work Program.
- Implementing the Injury Management/Return-to-Work Program through the TPA and Injury Management/Return-to-Work Program Administrator, and establishing a reporting system to track worker compensation cases.

- Consulting with H&S, HR, and the BG Injury Management/Return-to-Work Coordinator to facilitate effective implementation.

4.7 Human Resources/Injury Management/Return-to-Work/Return-to-Work Coordinator

The Human Resources staffs are responsible for:

- Communicating to management, supervisors, and employees the requirement to immediately report all workplace injuries/illnesses to their supervisor and call the toll-free number to speak with the Injury Management/Return-to-Work Program Administrator occupational health nurse to receive assistance with the appropriate treatment.
- Managing the submittal of Worker's Compensation claims to our insurance provider.
- Assisting in the documentation of incidents involving a work-related injury or illness.
- Designating an Injury Management/Return-to-Work Coordinator.
- Actively participating in the implementation of the program including consulting with the employee, OL/Supervisor/GL, H&S, Legal and Insurance to ensure effective implementation.

4.8 Injury Management/Return-to-Work Program Administrator

The Injury Management/Return-to-Work Program Administrator is an Occupational Health Management Provider whose firm provides occupational health services that includes administration of Injury/Illness Early Intervention and Injury Management/Return-to-Work.

- Secure high quality medical providers who will endorse CH2M HILL policy regarding early intervention and Injury Management/Return-to-Work.
- Establish a toll-free reporting telephone line dedicated exclusively to CH2M HILL, provide an Occupational Health Nurse, 24 hours per day/7 day per week to receive employee calls and provide triage service.
- Provide direction on treatment and schedule appointments for employee to visit a selected network medical provider for treatment.
- Provide telephonic and field case management services to ensure appropriate treatment is followed, and maintaining ongoing communication with the employee, treating physicians, and insurance carrier to ensure the employee is able to safely resume work duties in a timely manner.
- Monitoring the employee's recovery status and providing feedback to their supervisor, H&S, HR, and Legal and Insurance to facilitate the employee assuming work duties in a timely manner.

5.0 Requirements

The following requirements outline the mandatory components and criteria that each business group must comply with when implementing this core standard. Each business group must implement the requirements of this Core Standard using their policies, procedures, processes, training and contracting documents.

5.1 General Requirements

CH2M HILL employees must immediately report workplace injuries/illnesses however minor, to their supervisor in accordance with HSE-111. When non-emergency work-related injuries or illnesses occur, the injured/ill employee immediately contacts his/her supervisor and calls the Injury Management/Return-to-Work toll-free number (Refer to Attachment 1, Injury Management/Return-to-Work Flow Chart). The employee's supervisor, Operation or Group Leader must ensure the employee calls the Injury Management/Return-to-Work toll-free number or place the call for him/her. Based on the outcome of the conversation with the Injury Management/Return-to-Work Occupational Nurse, an assessment will be made for the appropriate treatment and case management of the employee's injury/illness to facilitate recovery and the ability to assume work duties in a timely manner.

5.1.1 Workplace Injuries/Illnesses Requiring Emergency Services and Notification

In the event of a life threatening injury or illnesses immediately contact emergency services for response and treatment. Reporting of the incident must follow the CH2M HILL Serious Incident Reporting Procedure, HSE-601. After emergency services has responded and provided treatment and transport for the seriously injured/ill employee, the supervisor must contact the Injury Management/Return-to-Work Program Administrator toll-free number and brief the occupational health nurse on the incident for follow-up (Refer to Attachment 2, Emergency Procedure for Injury Management/Return-to-Work).

5.2 Subcontractors

Subcontractors shall not participate in the CH2M HILL Injury Management/Return-to-Work Program.

5.3 Injury Management/Return-to-Work Program Administrator Requirements

The Occupational Health firm designated as the Injury Management/Return-to-Work Program Administrator will be responsible for providing Early Medical Intervention services that include interviewing the injured or ill employee, performing a nursing assessment and triage decision process to determine the severity and appropriate treatment, followed by providing direction to the employee and their supervisor on what the treatment protocol will entail. Based on the severity and complexity of the employee injury or illness, the Injury Program Administrator will provide ongoing case management, initially by telephone, and in situations requiring longer -term follow-up (> 60 days) provide field case management.

5.4 Worker Compensation Carrier and Third-Party Administrator Requirements

The CH2M HILL worker compensation carrier and third-party administrator will coordinate with the Injury Management/Return-to-Work Program Administrator by sharing documentation on workers compensation cases and partnering on implementing treatment plans, telephonic and/or field case management activities.

5.5 Injury Management/Return-to-Work Operational Approach by the Program Administrator

The Occupational Health firm contracted as the Injury Management/Return-to-Work Program Administrator will implement the following operational approach:

- Establish a toll free reporting telephone line that is dedicated exclusively to CH2M HILL employees.
- When CH2M HILL employees experience a work-related injury or illness, they will use the toll-free number immediately to contact the occupational health nurse to receive an assessment of their injury/illness and follow the prescribed treatment protocol.
- In the event of a life threatening or serious injury requiring immediate medical attention, the occupational health nurse must instruct or assist the employee to immediately contact local emergency services for immediate response. After the employee's emergency medical needs have been attended to, the Injury Management/Return-to-Work Administrator occupational health nurse must be contacted by the supervisor for providing telephonic or field case management services.
- The occupational health nurse will implement triage protocol determining whether treatment is first-aid or requires referring the employee for medical treatment to a preferred provider within an established clinic network. All network clinics will have been educated on expected protocol and expectations for treatment.
- A consultation between the occupational health nurse and the attending physician will occur on the treatment protocol and any subsequent follow-up. In cases where a physician-to-physician consultation is preferred, the Medical Director of the Occupational Health firm will contact the treatment physician.
- A plan will be developed by the occupational health nurse for follow-up care and schedule ongoing examinations, or facilitate referral for rehabilitation (physical therapy, occupational therapy, vocational counseling) when needed.
- The occupational health nurse will contact the employee's supervisor, HR, and H&S, either by email, telephone or both, on the treatment plan and to coordinate appropriate work duties for the employee after initial consultation and treatment. Further, the occupational health nurse will email an electronic copy of the CH2M HILL "Authorization to Treat" form for the Supervisor to complete and forward to the medical facility/clinic within 24 hours.
- Documentation and communication of the ongoing treatment plan and progress will be provided to the employee, workers compensation TPA, Legal and Insurance, and HR, along with appropriate information to be shared with the OL/Supervisor/GL and H&S.

The Occupational Health firm must expressly, through contract, be responsible for compliance with the federal Health Insurance Portability and Accountability Act (HIPAA) and state medical privacy laws when documenting and disseminating medical information.

- The treatment plan will be established with realistic goals and based on CH2M HILL policy and applicable workers compensation law.
- The occupational health nurse will continue to provide either telephonic or field case management for the employee until return to full-duty is realized or the workers compensation case is closed.
- Reports on the status of existing cases will be provided by the Occupational Health firm to the Legal and Insurance Representative, and applicable cases to the BG H&S, HR or BG Injury Management/Return-to-Work Coordinator will be provided monthly.

5.6 H&S Requirements

Based on the extent of the employee's injury or illness and the treatment plan developed by the occupational nurse, the H&S representatives for the project and/or BG will provide employee work activity information to assist in the development of the employee treatment and recovery plan.

6.0 Training Requirements

CH2M HILL employees will receive training on key elements of the Injury Management/Return-to-Work Program as part of new employee orientation, as part of project start-up, annually, and periodically based on identified need by H&S (Enterprise, BG, Regional, Project) representatives.

7.0 Assessment Requirements

Periodic assessment of the effectiveness of the Injury Management/Return-to-Work Program will be conducted by the Enterprise H&S Programs & Services Director with the Enterprise Workers Compensation Program Manager.

8.0 Recordkeeping

Recordkeeping for the Injury Management/Return-to-Work Program will be maintained by the Occupational Health firm designated as the Injury Management/Return-to-Work Program Administrator, Workers Compensation Carrier and Third-Party Administrator, and the Enterprise Legal and Insurance Department.

9.0 Revision Log

Revision	Date	Description	File Name
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Attachment 1 – CH2M HILL Injury Management/Return-to-Work Flow Chart

Attachment 2 – CH2M HILL Emergency Procedure for Injury Management/Return-to-Work

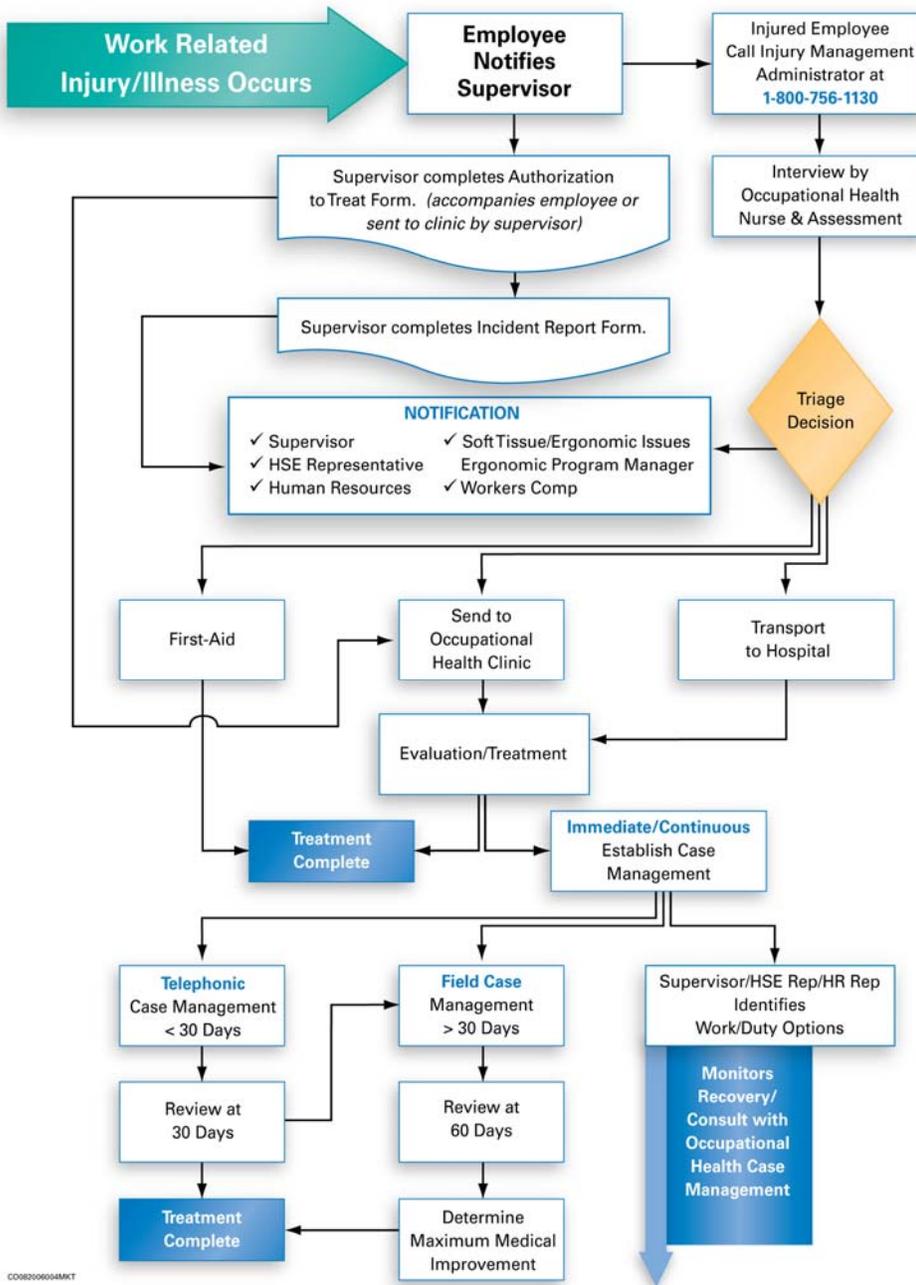
Attachment 3 – CH2M HILL Authorization to Treat Form

Attachment 4 – CH2M HILL Injury Management/Return-to-Work Poster

Attachment 1 – CH2M HILL Injury Management/Return-to-Work Flow Chart



CH2M HILL Injury Management/Return-to-Work Program



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Attachment 3 – CH2M HILL Authorization to Treat Form



Initial Medical Treatment Form

To be completed by CH2M HILL Supervisor – Send with employee visiting medical facility or forward within 24 hours.

Employee name: _____ Date of Injury: _____

Supervisor: _____ HS Representative: _____

Visit Authorized by: _____ Phone #: _____

CH2M HILL Workers Compensation Administrator: Cambridge

Send Bills to: CH2M HILL
Attn: Jennifer Rindahl
P.O. Box 22508
Denver, Colorado 80222-0508

To be completed by medical provider:

Physician's name: _____ Phone #: _____

Address: _____

CH2M HILL employee: _____ has been treated for: _____

It is the policy of CH2M HILL to provide temporary modified duty whenever possible for employees with physical restrictions resulting from an occupational injury or illness.

- Released to full duty
- Released to restricted duty only (list restrictions below)
- Out of work until _____ (date)

Please list any physical restrictions:

Expected duration of restricted duty? _____

CH2M HILL would like the best and most efficient care extended to all our employees. Please recommend over-the-counter (OTC) medication as a suitable alternative when medically feasible.

Prescribed medication: _____

Recommended OTC alternative: _____

Date of follow-up appointment: _____

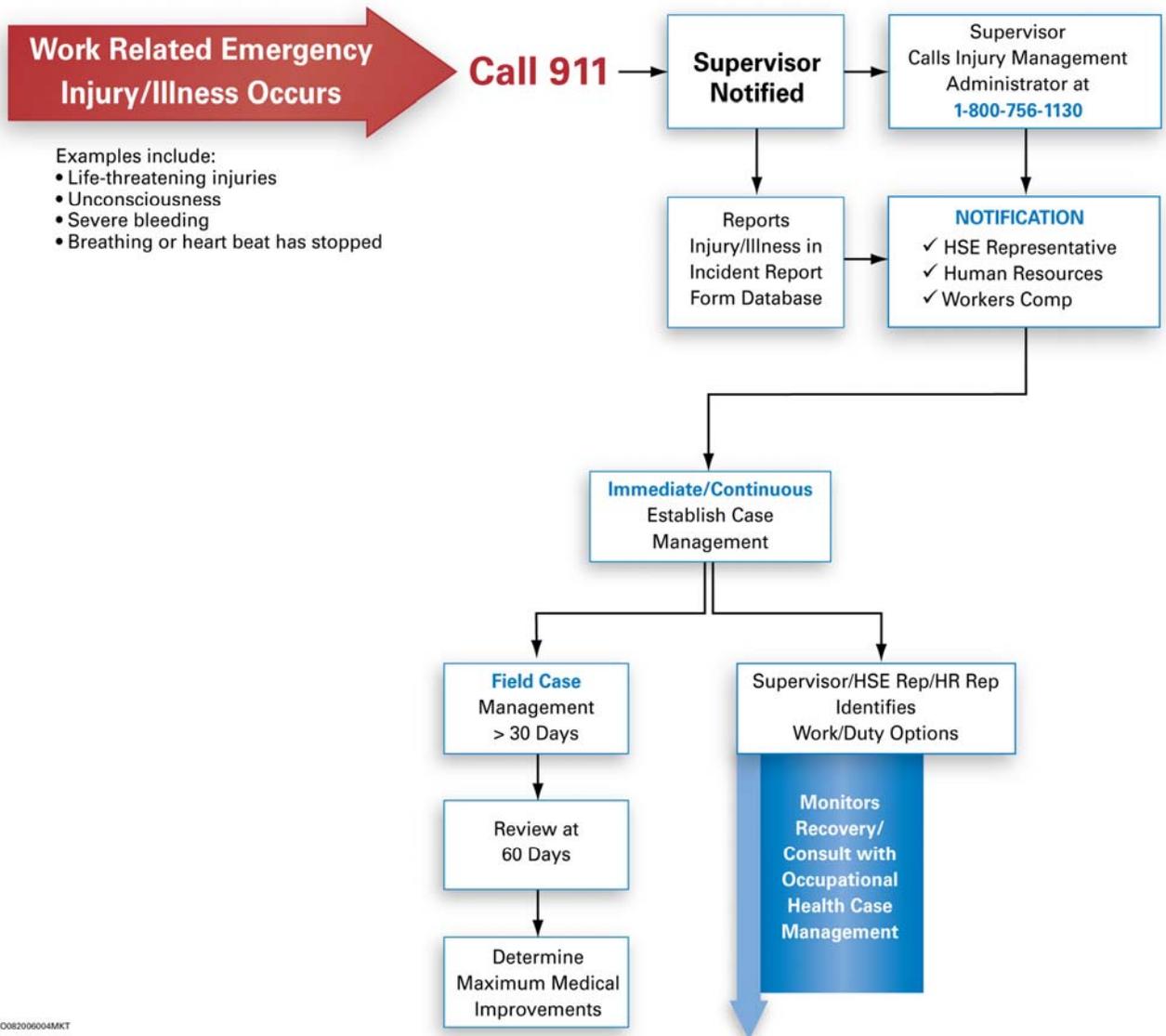
Physician's signature: _____ Date: _____

Please return this form to the injured employee and FAX to Health Resources at 1-800-853-2641. If you want to discuss the employee's work restrictions, please call the person listed in the "Visit Authorized by" field

Attachment 2 – CH2M HILL Emergency Procedure for Injury Management/Return-to-Work



CH2M HILL Emergency Procedure Injury Management/Return-to-Work Program



Attachment 4 – CH2M HILL Injury Management/Return-to-Work Poster



**Experienced a work-related
injury or illness?**



Notify your supervisor,
then contact the company Occupational Health Nurse:

1-800-756-1130

For more information about our Injury Management / Return to Work program
visit us on the VO at Company Resources | Corporate Groups | Health, Safety, Environment & Quality

World-class safety starts with you!



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Final

**Geophysical Investigation Plan
Former Vieques Naval Training Range (VNTR)**

Contract Task Order 0047

November 2006

Prepared for
**Department of the Navy
Naval Facilities Engineering Command
Atlantic Division**

Under the

**LANTDIV CLEAN III Program
Contract No. N62470-02-D-3052**

Prepared by



Virginia Beach, Virginia

2 **Geophysical Investigation Plan**

3 This GIP provides details of the equipment, approach, methods, operational procedures and
4 quality control to be used in performing the geophysical investigations at Vieques. The
5 following topics are covered in the GIP subsections: safety issues; geophysical data quality
6 objectives (DQOs); description of the site; anticipated MEC types, quantities, compositions,
7 and depths; site physical conditions (e.g., geology and topography); adverse geophysical
8 conditions; site utilities and manmade features that may affect the geophysical operation;
9 data acquisition and reporting; and geophysical program QC requirements.

10 **B.1 Geophysical Operations Overview**

11 Geophysical instruments will be used during DGM survey operations. DGM operations use
12 instruments that record instrument response digitally, allowing for the subsequent
13 download and interpretation of the data. DGM instruments will be operated by the DGM
14 subcontractor. Geophysical instruments used during operations such as clearance of
15 locations for emplacement of survey stakes will be analog, meaning these instruments will
16 be used to detect metallic items in the subsurface on a real-time basis and the instrument
17 response will not be recorded. Generally analog instruments indicate the presence of
18 metallic anomalies through sound or visual display. The analog instruments will be
19 operated by unexploded ordnance (UXO) technicians.

20 **B.2 Safety Issues**

21 Because MEC and MPPEH items may be present in the survey area, DGM survey personnel
22 are prohibited from touching, handling, moving, or investigating any item that resembles
23 MEC or MPPEH. Upon encountering such an item, survey personnel will immediately
24 inform the Senior UXO Supervisor (SUXOS) or a UXO technician. In the event that such an
25 item is discovered, either inside or outside the controlled project boundaries, and no UXO-
26 qualified personnel are present, survey personnel will conspicuously mark and secure a
27 perimeter around the item and immediately contact the SUXOS. DGM survey personnel
28 should not remain within 200 feet of any suspected MEC or MPPEH item.

29 DGM survey personnel will not access areas that have not been previously surface cleared
30 by a UXO technician. Personnel will also be required to adhere to the project Health and
31 Safety Plan (refer to Appendix A of this WP).

32 **B.3 DGM Personnel Qualifications**

33 DGM operations will be conducted by personnel experienced in MEC geophysical
34 operations and led by a qualified MEC geophysicist. All DGM support personnel onsite will
35 have documentation of 40-hour Occupational Safety and Health Administration (OSHA)
36 certification, any necessary re-certification (8-hour refresher), and OSHA-compliant medical

1 monitoring physical exams. Throughout DGM operations, DGM support personnel will
2 strictly adhere to the general practices given in this WP and specifically in the project Health
3 and Safety Plan (refer to Appendix A of this WP).

4 **B.4 Area to be Investigated**

5 The areas to be investigated include the beach areas and the roads identified in Section 3 of
6 this work plan and shown in Figure 3-1.

7 A system of grids will be established across the survey area to track progress and data
8 processing. Control points will be placed on the ground using either RTK GPS or
9 conventional survey equipment as required to use the DGM system selected through the
10 GPO process.

11 **B.5 Past, Current, and Future Site Uses**

12 A site history is provided in Section 2 of this work plan and in Section 3 of the *Draft*
13 *Munitions and Explosives of Concern (MEC) Master Work Plan, Former Vieques Naval Training*
14 *Range, Revision 1, (CH2M HILL, September 2005).*

15 **B.6 Anticipated MEC Types, Composition, and Quantities**

16 Section 2 of this work plan discusses the history of the former VNTR and includes the
17 various military operations. Because of the long history of the range and that both past and
18 current investigations/removal actions have shown a wide variety of military munitions,
19 specific types, composition, and quantities of MEC will likely be highly variable at all
20 locations.

21 **B.7 Anticipated Depth of MEC Items**

22 The anticipated depth of potential MEC items is from near-surface to greater than 4 feet
23 (based on EM1110-1-4009 penetration calculations).

24 **B.8 Vegetation and Topography**

25 Refer to Section 4 of the *Draft Munitions and Explosives of Concern (MEC) Master Work Plan,*
26 *Former Vieques Naval Training Range, Revision 1, (CH2M HILL, September 2005).*

27 **B.9 Geologic Conditions**

28 Refer to Section 4 of the *Draft Munitions and Explosives of Concern (MEC) Master Work Plan,*
29 *Former Vieques Naval Training Range, Revision 1, (CH2M HILL, September 2005).*

1 B.10 Shallow Groundwater Conditions

2 Refer to Section 4 of the *Draft Munitions and Explosives of Concern (MEC) Master Work Plan,*
3 *Former Vieques Naval Training Range, Revision 1, (CH2M HILL, September 2005).*

4 B.11 Adverse Geophysical Conditions

5 Because the geology of Vieques is characterized by volcanic rocks overlain by alluvial
6 deposits and patches of limestone, the ferrous mineral components of the volcanics may
7 interfere with DGM instruments that operate by measuring the earth's magnetic field. It is
8 likely that instruments utilizing time-domain electromagnetics will be used to reduce the
9 impact of the volcanics; however, this will be determined through the GPO process.

10 B.12 Site Utilities

11 No site utilities are expected in the areas where DGM will be performed; however, there are
12 some structures in the vicinity of the roads to be surveyed and underground utilities could
13 be encountered. The possibility of underground communication lines does exist,
14 particularly in the vicinity of any structures.

15 B.13 Manmade Features Potentially Affecting Geophysical 16 Operations

17 No manmade features are expected to affect the DGM; however, because of the history of
18 the former VNTR potential structures may be present in "buffer" areas that are heavily
19 vegetated and that to date have not been identified by current project personnel.

20 B.14 Site-Specific Dynamic Events

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

26 B.15 Overall Site Accessibility and Impediments

27 Prior to performing the DGM, the necessary repairs will be made to roadways and other
28 access routes.

29 B.16 Potential Worker Hazards

30 No potential worker hazards are apparent at the site other than those associated with
31 conducting project fieldwork, which are addressed in the project Health and Safety Plan
32 (refer to Work Plan Appendix A).

1 B.17 Geophysical Prove-out

2 A site-specific GPO will be compared to project DQOs (discussed in Section 5.13 of the *Draft*
3 *Munitions and Explosives of Concern (MEC) Master Work Plan, Former Vieques Naval Training*
4 *Range, Revision 1, [CH2M HILL, September 2005]*) to validate the geophysical system selected
5 for the DGM surveys. The GPO Work Plan is provided in Appendix C of this work plan.

6 B.18 DGM Data Quality Objectives

7 The primary objective of the DGM activities at the site is to identify metallic anomalies that
8 may be MEC or MPPEH. DQOs specific to the DGM surveys at the site are in the GPO Work
9 Plan.

10 B.19 Geophysical Instrumentation

11 B.19.1 Analog Geophysical Instruments

12 The analog geophysical instrument to be used during non-DGM operation where a
13 geophysical instrument is needed to detect metallic items will be a Schonstedt GA-52/Cx
14 magnetometer.

15 B.19.2 DGM Instruments

16 The actual instrumentation and system configuration to be used for DGM operations at the
17 site will be determined through the GPO process.

18 B.20 Data Acquisition, Processing and Reporting

19 B.20.1 Field Data Sheets

20 Field data sheets will be recorded in the Munitions Response Site Information System
21 (MRSIMS) field devices (Trimble GeoXT) and will include:

- 22 • Site ID
- 23 • Grid ID (or other identifier of surveyed area)
- 24 • Field team leader name
- 25 • Field team members' names
- 26 • Date of data collection
- 27 • Instrument used
- 28 • Positioning method used
- 29 • Instrument serial numbers
- 30 • File names in data recorders
- 31 • Data collection sampling rate
- 32 • Line numbers, survey direction, fiducial locations, start and end points
- 33 • Weather conditions
- 34 • Grid conditions
- 35 • Terrain conditions

- 1 • Cultural conditions
- 2 • Survey area sketch
- 3 • Associated QC data file names
- 4 • Field notes (other)

5 **B.20.2 Data Processing**

6 Instrument-specific software will be used for initial data processing and the output will be
7 imported into Geosoft Oasis Montaj™ for additional processing, graphical display, anomaly
8 selections and QA/QC. Types of processing will be system specific, but the general
9 processing steps that may be performed on the data include the following:

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

19 **B.20.3 Interpretation/Anomaly Selection**

20 MEC-experienced data processing geophysicists will use the following criteria,
21 supplemented by site- and system-specific criteria established during the GPO, for selecting
22 and locating anomalies:

- 23 • Maximum amplitude of the response with respect to local background conditions
- 24 • Lateral extent (plan size) of the area of response
- 25 • Three-dimensional shape of the response
- 26 • Decay curve characteristics (if EM61-MK2 selected from GPO)
- 27 • Location of the response with respect to the edge of the grid, unsurveyable areas, land
28 features, cultural features, or utilities within or adjacent to the grid
- 29 • Shape and amplitude of the response with respect to the response of known targets
30 buried in the GPO test plot
- 31 • Shape and amplitude of the response with respect to relevant anomalies encountered in
32 previous MEC removal grids
- 33 • Potential distortions in the response due to interference from nearby cultural features

1 B.20.4 Dig Locations

2 The target analysis process culminates in the creation of digital dig locations (a shape file
3 imported into the MRSIMS field devices for use by the intrusive investigation team), which
4 contain target information location, amplitude.

5 B.20.5 Grid Maps

6 With each dig sheet, the DGM subcontractor will also provide a grid map, which contains
7 the following:

- 8 • Client
- 9 • Project
- 10 • Contractor
- 11 • Map creator
- 12 • Map approver
- 13 • Date map was created
- 14 • Map file name (full path and file extension)
- 15 • Scale
- 16 • Grid identification
- 17 • Grid corner locations
- 18 • Contoured data
- 19 • Anomaly locations with unique identification numbers
- 20 • North arrow, legend, title block, etc.

21 B.20.6 Records Management

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

25 B.20.7 Final Reports, Maps, and Geophysical Mapping Data

26 No later than 3 work days after collection, the DGM subcontractor will provide each day's
27 data for QC inspection via the Internet using a File Transfer Protocol (FTP) site, electronic
28 mail (email) attachments for small files under 5 megabytes, or digital compact disk (CD).
29 Such data are considered to be in raw form. These data will be corrected for sensor offsets,
30 diurnal variations, latency, heading error (if magnetometer is used), and drift. Also
31 provided will be a digital planimetric map, in Geosoft format and coincident with the
32 location of the geophysical survey, so that each day's geophysical data set can be registered
33 within the original mission plan survey map.

34 All geophysical field data will be provided to CH2M HILL in delineated fields as x, y, z, v1,
35 v2, and so on, where x and y are UTM Grid Plane Coordinates in Easting (meters) and
36 Northing (meters) directions, z (elevation is an optional field in feet), and v1, v2, v3, and so
37 on are the instrument readings. The last data field will be a time stamp. Each data field will
38 be separated by a comma or tab. No individual file may be more than 100 megabytes in size
39 and no more than 600,000 lines long. Each grid of data will be logically and sequentially
40 named so that the file name can be easily correlated with the grid name used by other
41 project personnel.

- 1 Within 5 working days of data collection, the processed geophysical field data, all final
 2 maps, and supporting geophysical interpretations will be provided to CH2M HILL. All
 3 geophysical data will be accompanied by a report (standard report format out of MRSIMS)
 4 documenting the field activities associated with the data and the processing performed.
 5 Information provided by the MRSIMS report is summarized in Table B-1.

TABLE B-1
 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	
Heading correction and details (magnetometer data)	X	X	
Sensor bias, background leveling and/or standardization adjustment method and details		X	
Diurnal correction (magnetometer data)	X	X	
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 B-1
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 MR 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		

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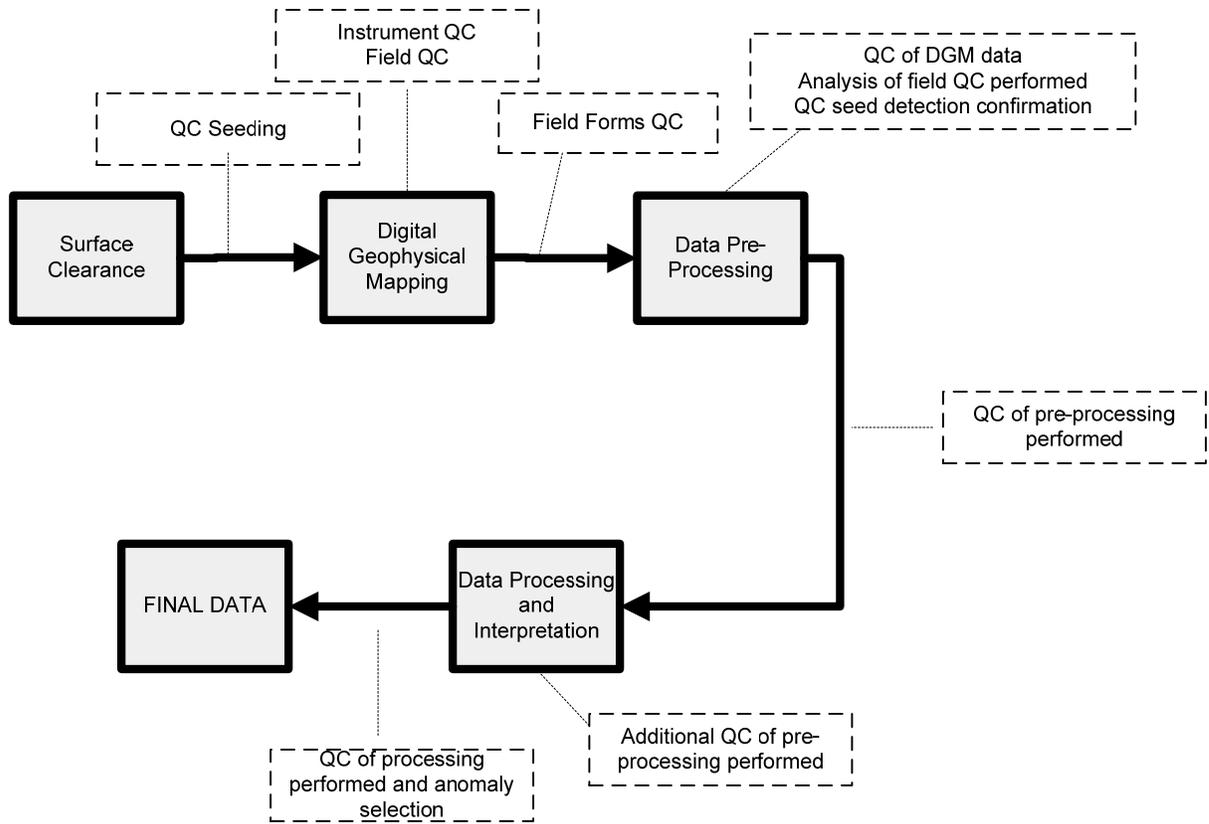
2 At the completion of the project, all project geophysical data described in this chapter will
3 be collected, organized, and submitted to NAVFAC Atlantic in a separate package that will
4 be referenced in the ERA/Phase II SI report.

5 All sensor data will be correlated with navigational data based upon a local “third order”
6 (1:5,000) monument or survey marker. If a suitable point is not available, a land surveyor
7 will establish a minimum of two new monuments or survey markers with a minimum of
8 third-order accuracy.

9 B.21 DGM Systems Quality Control

10 An extensive QC program will be applied to the DGM operations at the site. Figure B-1
11 shows an overall chart of the QC steps, and details for those steps are provided in the
12 following subsections. Table B-2 presents the 3-phae QC process for DGM associated tasks.

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FIGURE B-1
Overview of DGM Process QC

1 B.22 DGM Instruments Quality Control

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

- 6 1. **Equipment Warm-up.** This is an instrument-specific activity, although standard warm-
7 up time is 5 minutes. Some geophysical systems require more warm-up time than
8 others. Each system-specific SOP defines the equipment-specific warm-up time.
9 Equipment warm-up will be performed the first time an instrument is turned on for the
10 day or has been turned off for a sufficient amount of time for the specific instrument to
11 cool down.
- 12 2. **Record Sensor Positions.** Positioning accuracy of the final processed data will be
13 demonstrated by operating the equipment over one or more known points. The accuracy
14 of the data positioning will be assessed by calculating the difference between a known
15 location over which a positioning instrument is held and the displayed position. The
16 sensor position test will be conducted at the beginning of the survey operation for each
17 work day.
- 18 3. **Personnel Test.** This test checks the response of instruments to personnel and their
19 clothing/proximity to the system. On a daily basis, the instrument coils/sensors for
20 those instruments being used that day will be checked for their response to the
21 personnel operating the system. The response will be observed in the field for
22 immediate corrective action and transmitted back to the processor, and analyzed and
23 checked for spikes in the data that can possibly create false anomalies. The personnel
24 test will be conducted at the beginning of the survey operation for each work day.
- 25 4. **Vibration Test (Cable Shake).** This test checks the response of instruments to vibration.
26 On a daily basis, the instrument coils/sensors for those instruments being used that day
27 will be checked for their response to vibrations in the cables. The response will be
28 observed in the field for immediate corrective action and transmitted back to the
29 processor and analyzed and checked for spikes in the data that can possibly create false
30 anomalies. The vibration test will be conducted at the beginning of the survey operation
31 for each work day.
- 32 5. **Static Background and Static Spike.** Static tests will be performed by positioning the
33 survey equipment within or near the survey boundaries in an area free of metallic
34 contacts and collecting data for (minimally) a 1-minute period. During this time, the
35 instrument will be held in a fixed position without a spike (known standard) and then
36 with a spike. The purpose of the static test is to determine whether unusual levels of
37 instrument or ambient noise exist. The static background and static spike test will be
38 conducted at the beginning and end of each survey operation.
- 39 6. **Six Line Test.** The Six Line Test is a standard response test consisting of a
40 predetermined route (survey line) established on or near the site in an area free of
41 metallic contacts. The beginning, midpoint, and end of the line will be marked; data will
42 be collected along the line. The line will be traversed a total of six times as follows: 1)

- 1 *normal* data collection speed *without* a spike at the centerpoint; 2) *normal* data collection
 2 speed *without* a spike at the centerpoint; 3) *normal* data collection speed *with* a spike at
 3 the centerpoint; 4) *normal* data collection speed *with* a spike at the centerpoint; 5) *fast*
 4 data collection speed *with* a spike at the centerpoint; 6) *slow* data collection speed *with* a
 5 spike at the centerpoint. (Speed of data collection will also be evaluated as part of the
 6 GPO analysis process.) The Six Line Test will be conducted the first time a system is
 7 used at the site.
- 8 7. **Repeat Data.** This test is performed to verify repeatability of the data and will be
 9 performed after the initial survey over an area. At least 2% of the survey lines will be
 10 repeated.

TABLE B-3
 DGM Instruments Standardization Tests and Acceptance Criteria

Test	Test Description	Acceptance Criteria	Power On	Beginning of Day	Beginning and End of Day	First Time Instr. Used	2% of Total Area Surveyed
1	Equipment Warm-up	Equipment specific (typically 5 min)	X				
2	Record Sensor Positions	± 4 inch (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	Six Line Test	Repeatability of response amplitude ± 20%, Positional Accuracy ± 20 cm				X	
7	Repeat Data	Repeatability of response amplitude ± 20%, Positional Accuracy ± 20 cm					X

11

12 **B.23 QC Seed Items**

13 At least one inert MEC item (or surrogate if necessary) will be seeded per 3 acres in areas that
 14 will be surveyed with a towed array and 1 per acre in person-portable instrument survey
 15 areas. The seed items will be painted blue and tagged with a non-biodegradable label
 16 identifying the items as inert and providing a contract reference, a point of contact address,
 17 phone number, and a target identifier. CH2M HILL personnel will perform seeding using
 18 hand or mechanical tools, depending on soil conditions. The seed locations will be checked
 19 using a hand-held analog geophysical instrument to confirm that no existing anomalies are
 20 present at the seed location. Once placed, the locations of all seeded items will be surveyed

1 using an RTK DGPS or conventional survey equipment. The items will be placed at detectable
2 depths (as determined by the GPO). Detection of the QC seed items will be monitored by
3 CH2M HILL and should an item not be detected, a root-cause analysis will be performed and
4 corrective actions determined.

5 **B.24 Quality Control of DGM Data and Deliverables**

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

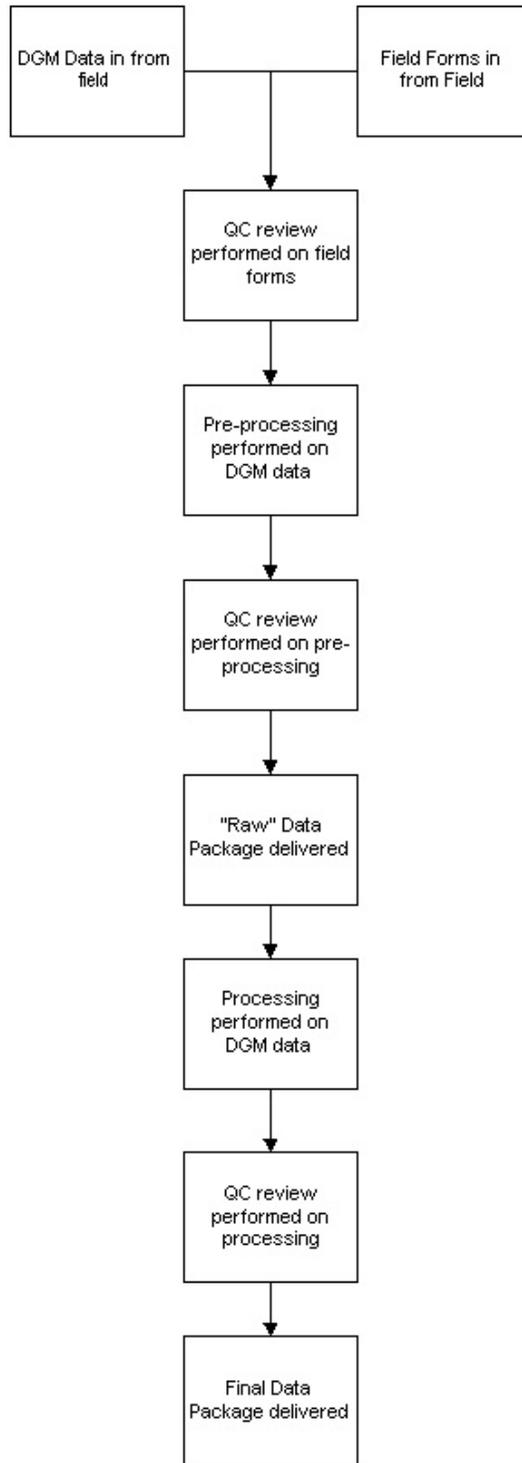
10 QC checks to be performed on field forms, pre-processed data and processed data can be
11 found in Table B-2.

12 The feedback process described in Section 5.16 of the *MEC Master Work Plan* will also be
13 followed using a feature designed for this activity in MRSIMS.

14 **B.25 Corrective Measures**

15 Specific corrective measures are dependent on the type of geophysical equipment used;
16 however, the following are the basic corrective measures to be followed in association with
17 DGM surveying:

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



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FIGURE B-2
QC of DGM Data – Process Flowpath

1 **B.26 Analog Geophysical Systems Quality Control**

2 QC over the analog geophysical instruments will be accomplished through daily checks that
3 the instruments are functioning prior to using them for field activities. The GPO plot will be
4 used for checking instrument functionality for each analog instrument at the start of each
5 work day. Each instrument will be operated over a small metallic item buried close to the
6 maximum detection depth determined for that item during the GPO. If the instrument is not
7 able to detect the item, it will be taken out of use until it is repaired.

8 **B.27 Anomaly Reacquisition**

9 The DGM Contractor who performed the initial DGM survey will reacquire target
10 anomalies. Wherever possible, coordinate locations of each targeted anomaly will be
11 uploaded into a Real-Time Kinematic (RTK) Differential Global Positioning System, which
12 will be used to navigate or re-occupy the point where a temporary mark will be placed.
13 Reacquisition of target locations where no GPS coverage exists will be conducted using laser
14 positioning, robotic total station, conventional total station survey equipment or (as a last
15 resort) tape measures pulled from corner stakes to locate the interpreted local x,y coordinate
16 position listed for each target on the dig sheet. Each reacquired target location will be
17 marked with a pin flag labeled with the anomaly's identifying number as specified on the
18 dig sheet.

19 Using the same type of geophysical equipment as was used for the DGM survey, the
20 reacquisition crew will then refine the location of the anomaly. This will be accomplished by
21 observing the DGM instrument response in a continuous mode while slowly maneuvering
22 the instrument over the anomaly. The pin flag will be moved (if necessary) to the refined
23 location and any offset (direction and distance) will be documented.

24 The reacquired anomaly locations and anomaly amplitudes (where possible) will be
25 recorded to compare to the initially selected locations as QC and for feedback to the
26 processing geophysicists.

TABLE B-2
DGM Definable Features of Work Auditing Procedures
Expanded Range Assessment/Phase II Site Inspection
Former VNTR, Vieques, Puerto Rico

Definable Feature of Work with Auditable Function	Responsible Person(s) ¹	Audit Procedure ²	QC Phase ³	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
Planning						
Geographical Information System (GIS) Setup (Pre-mobilization Activities)	Project GIS Manager	Verify GIS system has been set up and is ready for site data.	PP	O	GIS system has been set up and is ready for site data.	Do not proceed with field activities until criterion is passed.
Document management and control (Pre-mobilization Activities)	Project Manager	Verify appropriate measures are in place to manage and control project documents.	PP	O	Appropriate measures are in place to manage and control project documents.	Do not proceed with field activities until criterion is passed.
Data Management (Pre-mobilization Activities)	Project Manager, Project Geophysicist	Verify appropriate measures are in place to manage and control project data.	PP	O	Appropriate measures are in place to manage and control project data.	Do not proceed with field activities until criterion is passed.
Subcontracting (Pre-mobilization Activities)	Project Manager, Site Manager	Verify subcontractor qualifications, training, and licenses.	PP/IP	O	Subcontractors' qualifications, training, and licenses are up to date and acceptable.	Ensure subcontractor provides the qualifications, training, and licenses or change subcontractor.
Technical and Operational approach (Technical Project Planning)	Project Manager	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 Plans.	Do not proceed with field activities until criterion is passed
Geophysical Prove-out (GPO) Work Plan preparation and approval	Project Manager	Verify GPO Plan has been prepared and approved.	PP/IP	O	GPO Work Plan has been approved	Do not proceed with field activities until criterion is passed.
GPO Execution	Project Manager, Project Geophysicist	Verify data quality objectives (DQOs) established in GPO Work Plan have been accomplished.	PP/IP	O	DQOs identified in GPO Work Plan have been achieved	Continue with GPO until DQOs are achieved.
GPO Report	Project Manager, Project Geophysicist	Verify recommendations in GPO Report for Digital Geophysical Mapping (DGM) system and associated DQOs have been approved.	PP/IP	O	Recommendations for DGM equipment and associated DQOs are approved by USACE.	Do not proceed with DGM field activities until recommendations of GPO Report are approved.
Field Operations						
Site preparation (Mobilization)	Project Manager	Verify local agencies are coordinated.	PP/IP	O	Local agencies are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	Project Manager	Verify equipment has been inspected and tested.	PP/IP	E	Equipment passes inspection and testing.	Proceed only with activities for which equipment has passed inspection and testing.
Site preparation (Mobilization)	Project Manager	Verify communications and other logistical support are coordinated.	PP/IP	O	Communications and other logistical support are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	Project Manager	Verify emergency services have been coordinated.	PP/IP	O	Emergency services are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	MEC QCS, Project Manager	Verify site-specific training is performed and acknowledged.	PP/IP	O	Site-specific training is performed and acknowledged	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	MEC QCS, Project Manager	Hold pre-mobilization meeting and Operations Readiness Review (ORR) with the project team.	PP/IP	O	Project plans are reviewed and acknowledged by team members.	Do not proceed with field activities until criterion is passed.
Site preparation (Site Survey)	Project Manager	Verify surveyor qualifications.	PP/IP	O	Surveyor's qualifications are up to date and acceptable.	Ensure surveyor provides the qualifications prior to starting work or change surveyor.
Site Preparation (Site Survey)	Project Manager	Verify benchmarks for survey have been established and documented.	PP/IP	O	Benchmarks for survey have been established and documented.	Ensure benchmarks for survey are established and documented prior to performing survey.

TABLE B-2
DGM Definable Features of Work Auditing Procedures
Expanded Range Assessment/Phase II Site Inspection
Former VNTR, Vieques, Puerto Rico

Definable Feature of Work with Auditable Function	Responsible Person(s) ¹	Audit Procedure ²	QC Phase ³	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
Site Preparation (Site Survey)	Project Manager	Verify site boundaries and grids have been established.	PP/IP	O	Site boundaries and grids have been established.	Do not proceed with dependent field activities until criterion is passed.
Site Preparation (Vegetation Removal)	Project Manager	Verify personnel qualifications and training.	PP/IP	O	Personnel qualifications and training are appropriate.	Ensure subcontractor provides appropriately trained and qualified personnel or replace with properly trained personnel.
Site Preparation (Vegetation Removal)	Project Manager	Verify environmental controls are correct and functional.	IP/FP	O	Environmental controls are correct and functional.	Ensure that appropriate environmental controls are in place prior to proceeding with vegetation removal.
Site Preparation (Vegetation Removal)	Project Manager, MEC QCS	Verify vegetation removal is conducted IAW the Geophysical Investigation Plan	FP	D	Vegetation removal is conducted IAW the Geophysical Investigation Plan	Stop vegetation removal activities until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary.
Site Preparation (Surface MEC identification)	MEC QCS	Verify equipment testing is performed per Quality Control Plan	IP/FP	O/D	Equipment passes daily function test in equipment check area.	Repair or replace instrument.
Site Preparation (Surface MEC identification)	MEC QCS	Verify area/boundary.	PP/IP	O	Area/boundary is marked.	Stop activities until area/boundary can be verified.
Site preparation (Surface MEC identification)	MEC QCS, Project Geophysicist	Verify work methods are conducted IAW the Geophysical Investigation Plan and Health and Safety Plan. Survey/Sweeps MEC Surface Sweeps	IP/FP	D	Work methods are being performed IAW the Work Plan and SOPs.	Stop activities until Work Plan and SOPs are being followed and any activities not performed within compliance are re-evaluated and re-performed if necessary.
Site Preparation (Surface MEC identification)	MEC QCS	Verify team separation distance IAW the Geophysical Investigation Plan (Section 3.3 of Work Plan).	IP/FP	D	Team separation distance is appropriate for work being performed and the site munitions with the greatest fragmentation distance	Stop activities until appropriate separation distance is being followed.
DGM Survey	Project Geophysicist	Confirm that geophysical investigation plan blind seeding procedures are being followed.	IP	O	Blind seeding program requirements of Geophysical Investigation Plan of this document are being met.	Do not proceed with field activities until criterion is passed.
DGM Survey	Project Geophysicist	Verify DGM Survey conducted IAW Geophysical Investigation Plan and DGM SOPs	IP/FP	O/D	DGM Survey conducted IAW Geophysical Investigation Plan and DGM SOPs.	Stop activity until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary.
DGM Survey	Project Geophysicist	Check results of QC tests performed as specified in QCP and DGM SOPs	FP	E	QC tests must pass IAW standards determined during the GPO and referenced SOPs.	If a QC test does not pass, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
DGM Survey	Project Geophysicist	Confirm that DGM survey DQOs established during GPO are being met.	FP	E	DGM survey DQOs are being met.	If the DQOs are not being met, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
DGM Survey	Project Geophysicist	QC of field forms	IP	O	QC has been done on field forms, and 1) Appropriate fields have been completed, 2) Field entries are appropriate for work performed, 3) Data required for geophysical data processors have been entered, and 4) Work passes minimum requirements for general editorial review (spelling, dates, etc.).	Do not proceed with field activities until criterion is passed.
DGM Survey	Project Geophysicist	Check results of QC field audits performed by MEC QCS to ensure that no MEC missed from DGM surveys.	FP	E	No MEC or metallic item equal or greater in mass to a 20mm projectile.	If the item was found within the depth criteria established during the GPO, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
DGM Survey	Project Geophysicist	QC of preprocessing.	IP	O	1) Data have been translated from local coordinates into the UTM system, 2) Coordinates are correct (grids fall in correct locations when loaded into GIS), 3) Line gaps have been accounted for, 4) Background geophysical noise is acceptable, 5) Cross track distance between lines is acceptable, 6) Down line data density is acceptable, 7) Appropriate file headers are attached, and 8) Files contain the appropriate grids.	Fix failed criteria, and resurvey.
DGM Survey	Project Geophysicist	QC of processing.	IP	O	1) Latency/lag correction is appropriate, 2) De-spiking is appropriate, 3) Leveling is appropriate, 4) Filtering performed is appropriate, 5) Line breaking is appropriate, 6) Anomaly selection is appropriate.	Fix criteria and reprocess.

TABLE B-2
 DGM Definable Features of Work Auditing Procedures
 Expanded Range Assessment/Phase II Site Inspection
 Former VNTR, Vieques, Puerto Rico

Definable Feature of Work with Auditable Function	Responsible Person(s) ¹	Audit Procedure ²	QC Phase ³	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
DGM Data Processing	Project Geophysicist	Verify data checks specified in this Geophysical Investigation Plan are being met.	FP	E	Data checks must pass in accordance with standards determined during the GPO and referenced SOPs.	If a QC test does not pass, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
Demobilization	Project Manager	Verify facilities-support infrastructures are dismantled and shipped to appropriate location and area is returned to original condition.	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						
Site Specific Final Report preparation and approval	Project Manager, Project Geophysicist	Verify tabulations of all MEC, MD, and other material recovered during the removal actions are accurate and complete.	IP	O	Tabulations of all MEC, MD, and other material recovered during the removal actions are accurate and complete.	Ensure tabulation of all MEC, MD, and other material recovered during the removal actions are accurate and complete
Site Specific Final Report preparation and approval	Project Manager, Project Geophysicist	Verify all dig sheets where geophysical mapping and investigation performed are accurate and complete.	FP	O	All dig sheets where geophysical mapping and investigation performed are accurate and complete.	Ensure all dig sheets where geophysical mapping and investigation performed are accurate and complete
MEC Response Completion Acceptance	Project Manager	Verify Final Report has been approved.	IP	O	Final Report has been approved.	Take appropriate actions to ensure Report gets approved
Archiving	GIS Manager	Verify data back-up systems are in place.	IP	O	Data back-up systems are in place	Ensure data back-up systems are in place
Project Closeout	Project Manager	Verify purchase orders have been closed out.	IP	O	Purchase orders have been closed out	Ensure purchase orders are closed out
Project Closeout	Project Manager	Verify invoices completed and approved.	IP	O	Invoices completed and approved	Ensure invoices are completed and approved

Notes:
 IAW = in accordance with

<u>QC Phase</u>	<u>Frequency</u>
PP = Preparatory Phase	O = Once
IP = Initial Phase	D = Daily
FP = Follow-up Phase	W = Weekly
	E = Each occurrence

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

² Where appropriate, a reference has been included referring the reader to a more detailed description of the procedures being audited.

³ Documentation to be in accordance with the three-phase control process as outlined in the Quality Control Plan.

Final

**Geophysical Prove-Out Work Plan
Former Vieques Naval Training Range (VNTR)**

Contract Task Order 0047

November 2006

Prepared for
**Department of the Navy
Naval Facilities Engineering Command
Atlantic Division**

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Prepared by



Virginia Beach, Virginia

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1 Acronyms and Abbreviations

2	CD	Compact Disk
3	Cm	centimeters
4	DGM	Digital Geophysical Mapping
5	DGPS	Differential Global Positioning System
6	DID	Data Item Description
7	DQO	Data Quality Objective
8	FAR	False Alarm Rate
9	GPO	Geophysical Prove-Out
10	GPS	Global Positioning System
11	Mb	megabytes
12	MEC	Munitions and Explosives of Concern
13	QC	Quality Control
14	RLS	Registered Land Surveyor
15	RTK	Real-Time Kinematic
16	RTS	Robotic Total Station
17	SOP	Standard Operating Procedure
18	TDEM	Time Domain Electromagnetic
19	USACE	U.S. Army Corps of Engineers

1 1.0 Purpose

2 This Geophysical Prove-Out (GPO) Work Plan for the Former Vieques Naval Training Range
3 (VNTR)¹ has been prepared by CH2M HILL for the Naval Facilities Engineering Command
4 (NAVFAC) Atlantic Division (LANTDIV) under Navy Contract N62470-02-D-3052, Navy
5 Comprehensive Long-Term Environmental Action Navy (CLEAN), District III, Contract Task
6 Order 0047. The GPO Work Plan documents GPO activities to be performed as part of the
7 process for selecting the digital geophysical mapping (DGM) system to be utilized during the
8 Expanded Range Assessment/Phase II Site Inspection.

9 The primary objective of the GPO is to demonstrate and document the site-specific capabilities
10 of a DGM system to operate as an integrated system capable of meeting project data quality
11 objectives (DQOs). For the purposes of this work, a system is considered to include the survey
12 platform, sensors, navigation equipment, data analysis and management, and associated
13 equipment and personnel. Additional objectives of the GPO include:

- 14 • Document the consideration given to various geophysical detection instruments, the criteria
15 used to identify geophysical instruments for consideration, and the causes for their
16 respective selection or rejection.
- 17 • Document the capabilities and limitations of the geophysical detection instrument selected
18 for consideration.
- 19 • Confirm the achievable percent detection with respect to the specific items, orientations and
20 depths seeded in the GPO to support decision-making at the site.
- 21 • Observe the geophysical detection instrument operating in the DGM subcontractor's
22 configuration, using their personnel and methodologies.
- 23 • Evaluate the DGM subcontractor's data collection, data transfer quality and data QC
24 method(s).
- 25 • Evaluate the DGM subcontractor's method(s) of data analysis and evaluation.
- 26 • Establish anomaly selection criteria.
- 27 • Evaluate estimated field production rates and estimated false positive ratios, as related to
28 project cost.
- 29 • Document system reliability.

30 The GPO objectives will be attained through evaluation of the achievement of the DQOs
31 (discussed below) and observation of the GPO activities by the CH2M HILL Project
32 Geophysicist. A full discussion of the evaluation will be provided in the Geophysical Prove-Out
33 Report (see Section 9.0 for topics to be discussed).

¹ In many documents written before 2004, VNTR was referred to as the Atlantic Fleet Weapons Training Facility (AFWTF).

1 2.0 Project Data Quality Objectives

2 DGM operations performed in the GPO area will demonstrate the ability of the tested systems
 3 to achieve specific project DQOs. The project DQOs, measurement performance criteria, and
 4 test method to be used during the GPO are discussed in the following sub-sections and
 5 summarized in Table 1.

TABLE 1
 Project Data Quality Objectives

Data Quality Objective	Measurement Performance Criteria	Test Method During GPO
General System Functioning		
Accurate coordinates are being obtained from DGM positioning systems.	Positional error at known monuments will not exceed ± 20 cm.	Results of QC Test #2 (Record Sensor Positions) (see Section 6.0) will be evaluated to ensure compliance.
Repeatable data are being obtained from DGM system.	Response to standardized item will not vary more than $\pm 20\%$.	Results of QC Test #5 (Static Background and Static Spike) (see Section 6.0) will be evaluated to ensure compliance.
DGM Surveys		
DGM survey system can detect all MEC to the depths specified by the following equation: Estimated Detection Depth (meters) = $11 * \text{diameter (mm)} / 1000$ (Depth is to top of the item.)	Sensor to identify 100% of all MEC items (or their surrogates in the GPO) at depths fitting within the detection depth equation.	Verify that: All of the seed items fitting within the detection depth equation have anomalies selected from the DGM surveys within 1 meter of a point on the surface above the item.
Downline data density is sufficient to detect MEC items.	Over 98% of possible sensor readings are captured along a transect. In addition, any transect containing a data gap of 2 ft or greater does not meet the DQO.	Results of DGM surveys with various systems and configurations will be evaluated to ensure compliance.
Coverage over survey area is sufficient to detect MEC items.	Search transect spacing to vary no more than $\pm 20\%$ of spacing specified in sampling design.	Results of DGM surveys with various systems will be evaluated to ensure compliance.
Positioning of detected anomalies is accurate.	95% of all anomaly locations (as shown on the dig sheets) lie within a 1-meter radius of a point on the ground surface directly above the source of the anomaly.	Anomalies selected will be compared with known seed item locations to ensure compliance.
Data Handling		
All data must be delivered in a timely manner and in a useable format.	Data packages (see Section 8) are completed and delivered to the CH2M HILL Project Geophysicist within 1 working day of data collection.	Evaluate based on actual delivery of data

1 2.1 General Geophysical Systems Functioning

2 2.1.1 DGM Systems Positioning

3 The DQO for DGM systems positioning is that the coordinates being obtained from the
4 positioning systems are at a sufficient enough accuracy to allow for appropriate relocation of
5 munitions and explosives of concern (MEC) items for intrusive investigation. The measurement
6 performance criterion for this is that the positional error at known monuments will not exceed
7 ± 20 cm. This will be evaluated during the GPO by ensuring that, on a daily basis, the
8 positioning system in use passes QC Test #2 (Record Sensor Positions), as outlined in Section
9 6.0.

10 2.1.2 DGM Systems Data Repeatability

11 The DQO for DGM systems data repeatability is that the systems respond consistently from the
12 beginning to the end of an operation. The measurement performance criterion for this is that the
13 response to a standardized item will not vary more than $\pm 20\%$. This will be evaluated during
14 the GPO by ensuring that, on a daily basis, the geophysical system being used passes QC Test #
15 5 (Static Background and Static Spike) and QC Test #7 (Repeat Data), as outlined in Section 6.0.

16 2.2 DGM Surveys

17 2.2.1 MEC Detection

18 The DQO for MEC detection is to detect all MEC to their maximum detectable depths.
19 However, actual maximum detectable depths may vary based on site-specific and munitions-
20 specific parameters, such as: 1) item orientation, 2) site background/noise levels, 3) masking
21 effects from adjacent metallic items, 4) item shape, 5) magnetic conductivity of item materials,
22 and 6) weathering effects on the magnetic conductivity of item materials.

23 An equation has been developed based on empirical data that describes typical detection depths
24 for most MEC items (USACE DID MR-005-05):

$$25 \quad \text{Estimated Detection Depth (meters)} = 11 * \text{diameter (mm)} / 1000$$

26 (Depth is to top of the item.)

27 This relationship reflects the fact that MEC detection capability is reduced with greater item
28 depth and/or decreased item size. The equation assumes worst-case orientations for ordnance
29 items, a ratio of length to width of at least 2:1, and that the item is not thin-walled. Because of
30 these assumptions, though the formula is to be a DQO, a more accurate actual detection depth
31 will be determined during the GPO. The geophysical system and process will be tested to see if
32 they can meet the above DQO. If the system cannot meet the DQO, the system and/or process
33 will be modified to try to meet the DQO. If these changes still don't allow the system and
34 processes to meet the DQO requirement, then a discussion will commence about modifying this
35 DQO. .

36 Because there is a wide array of potential MEC in the survey areas, a representative sample of
37 MEC sizes will be buried at various depths and orientations (horizontal and vertical) to evaluate
38 the tested system's detection capabilities. In other words, for logistical reason, not every MEC
39 item that could possibly be found at VNTR will be included. The measurement performance
40 criterion for this is that the system tested must identify 100 percent of all MEC items in the GPO

1 at depths fitting within the detection depth equation. This will be evaluated by verifying that all
2 of the seed items in this category have anomalies selected from the DGM surveys within 1
3 meter of a point on the surface above the item.

4 The actual project detection depth will be determined during the GPO based on the depth and
5 orientation that the item was detectable (using the signal-to-noise ratio, shape of the anomaly,
6 and width of the anomaly for anomaly selection) without causing an unreasonable false alarm
7 rate (FAR) using the same anomaly selection criteria. It should be noted that there is no absolute
8 rule to determine an acceptable FAR. A high FAR may increase the possibility that the target
9 items will be detected; however, the inefficiencies associated with a high FAR increase field
10 efforts, data processing and handling, and the likelihood of errors; and may decrease the overall
11 quality of the GPO and project fieldwork results.

12 2.2.2 Downline Data Density

13 The DQO for downline (along the survey transect) data density is to have sufficient data
14 collected along each transect to detect MEC items. The measurement performance criterion for
15 this is that at least 98 percent of possible sensor readings are captured along each transect. In
16 addition, any transect containing a data gap of 2 feet or greater does not meet the DQO. This
17 will be evaluated during the GPO by verifying that all of the DGM data collected and used for
18 anomaly selection meets this standard.

19 2.2.3 Survey Coverage (Lane Spacing)

20 The DQO for lane spacing is to maintain appropriate lane spacing to provide 100 percent coverage
21 of the survey area at sufficient density to detect all detectable MEC items. The measurement
22 performance criterion for this is that the lane spacing varies no more than ± 20 percent of spacing
23 specified in the sampling design. This will be evaluated during the GPO by verifying that all of the
24 DGM data collected and used for anomaly selection meets this standard.

25 2.2.4 Positioning Accuracy

26 The DQO for horizontal positioning accuracy is that positioning of detected anomalies is
27 accurate enough to allow for effective reacquisition of the anomaly. The measurement
28 performance criterion for this is that 95 percent of all anomaly locations (as shown on the dig
29 sheets) lie within a 1-meter radius of a point on the ground surface directly above the source of
30 the anomaly. Any anomaly that is selected (coordinates shown on the dig sheets) outside of 1
31 meter from a point directly above the item will not be considered to be a detection of that item.
32 This will be evaluated during the GPO by verifying that all anomalies selected are within this
33 standard or can be otherwise explained.

34 2.3 Data Handling

35 The DQO for data handling is that all data must be delivered in a timely manner and in a
36 useable format. Because of the need for rapid feedback during GPO operations to effectively test
37 potential DGM systems, the measurement performance criterion for data handling during GPO
38 activities will require that data packages of raw data for the GPO (see Section 8) be completed
39 and delivered to the CH2M HILL Project Geophysicist **within 1 working day of data collection.**
40 Final processed data for the GPO shall be delivered to the CH2M HILL Project Geophysicist
41 within 3 working days of data collection. During production surveys, the measurement
42 performance criterion for data handling will require that "draft" (raw) data packages be

1 completed and delivered to the CH2M HILL Project Geophysicist within 3 working days of data
2 collection and the final data packages within 5 working days of data collection. This will be
3 evaluated based on the actual delivery of data during the GPO.

4 3.0 Personnel and Qualifications

5 All personnel involved in performance of the GPO and the production geophysical surveys will
6 meet the following qualifications:

- 7 • **Project Geophysicist:** will have a degree in geophysics, geology, geological engineering, or
8 a closely related field, and have a minimum of 7 years of directly related geophysical
9 experience. This individual will be capable of managing a geophysical data collection and
10 processing project/program including several task orders/sites and will have at least one
11 year of experience in managing geophysical operations on an MEC site.
- 12 • **Site Geophysicist:** will have a degree in geophysics, geology, geological engineering, or a
13 closely related field, and have a minimum of 5 years of directly related geophysical
14 experience. This individual will be capable of competently managing personnel, equipment
15 and data on projects requiring multiple (three or more) geophysical field teams and
16 geophysical data processors and will have at least one year of experience in performing
17 geophysical operations on an MEC site.
- 18 • **Geophysical Data Processor:** will have a degree in geophysics, geology, geological
19 engineering, or a closely related field, and will have at least 6 months experience in
20 processing geophysical data related to MEC projects.
- 21 • **Field Geophysicist:** will have a degree in geophysics, geology, geological engineering, or a
22 closely related field, will have a minimum of 2 years of directly related geophysical
23 experience and will have at least 1 year of experience in performing geophysical operations
24 on an MEC site.
- 25 • **Geophysical Technician:** will have at least 6 months of experience in geophysical data
26 collection on MEC related projects.

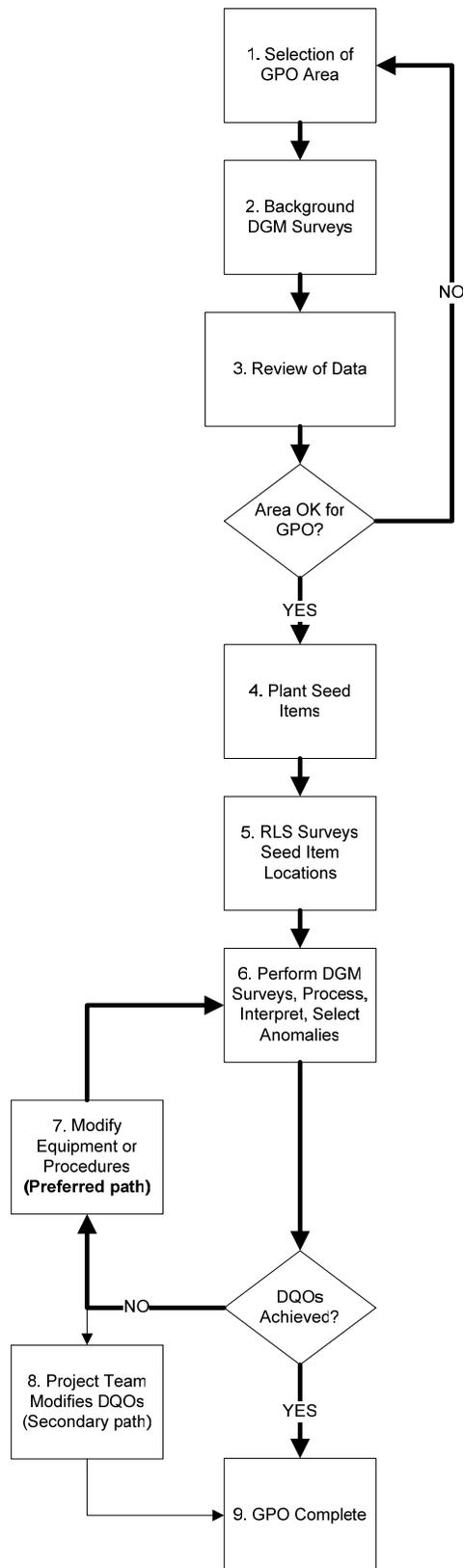
27 The following individuals will be involved in the GPO.

- 28 • CH2M HILL Project Geophysicist
- 29 • UXO Technician II (or higher)
- 30 • DGM subcontractor's Site Geophysicist
- 31 • DGM subcontractor's Field Geophysicist/Data Processor
- 32 • DGM subcontractor's Geophysical Technician

33 4.0 Procedures

34 A qualified and experienced MEC DGM operations geophysical team (see Section 3.0) will
35 separately employ each system to be tested on the GPO plot. Figure 1 illustrates the GPO
36 process and the procedures to be employed (numbered in accordance with the steps shown on
37 Figure 1) during site work.

FIGURE 1
GPO Process



- 1 1. A GPO area will be selected based on:
 - 2 (a) Terrain, geology and vegetation similar to that of a majority of the project site.
 - 3 (b) Geophysical noise conditions similar to those expected across the survey area.
 - 4 (c) Large enough site to accommodate all necessary GPO tests and equipment and for
5 adequate spacing of the seed items to avoid ambiguities in data evaluation.
 - 6 (d) Readily accessible to project personnel.
 - 7 (e) Close proximity to the actual survey site.
- 8 2. A “background” DGM survey will be performed by the DGM subcontractor with the
9 instrument to be tested in the GPO. This step will allow background geophysical conditions
10 to be recorded, will help determine the appropriateness of the location (i.e., few existing
11 anomalies), and will verify that items are not seeded near existing anomalies. The data will
12 be post-processed (i.e., filtered and positions attached to the geophysical data) but the DGM
13 subcontractor will not view the results apart from this.
- 14 3. The data will be provided to the CH2M HILL Project Geophysicist for evaluation.
- 15 4. A sufficient number of seed items (to be determined in conjunction with the Navy prior to
16 mobilization to the site) will be buried at a range of depths and orientations to document
17 detection limits within the GPO grid. The targets will include items intended to represent
18 variably sized MEC at the site. The actual items will depend on the types of inert items
19 available for use from scrap collected during other work at VNTR, but initial plans are to
20 use inert (practice) 20mm, 60mm, 81mm and 155mm projectiles and 2.75-inch rockets.
21 Simulated items will be used if the number and size distribution of inert items is not
22 sufficient.
23
24 CH2M HILL personnel will construct the GPO using shovels and, if necessary, a mechanical
25 auger or backhoe to dig the holes to the appropriate depths for burial of the seed items. The
26 seed items will be painted blue and tagged with a non-biodegradable label identifying the
27 items as inert and providing a contract reference, a point of contact address, phone number,
28 and a target identifier. The background survey data and anomaly avoidance techniques will
29 be used to ensure that corner stakes and seed items are not placed on top of or near existing
30 anomalies. Personnel will emplace each seed item and record the emplacement data (depth,
31 orientation, and azimuth). All seed items will be photographed prior to burial.
- 32 5. A Registered Land Surveyor (RLS) will use a Real-Time Kinematic (RTK) Differential Global
33 Positioning System (DGPS) or conventional Total Station survey equipment to record seed
34 item locations to a horizontal accuracy of 3 centimeters (cm) and a vertical accuracy of 5 cm,
35 providing an Easting and Northing (in NAD83 UTM 20, meters) for the center and each end
36 (where applicable) of the targets. The location of the four corners of the grid will also be
37 recorded (in UTM meters). All target markings in the GPO grid will be removed and the
38 grid will be returned as near as possible to its natural condition. Information on the seeded
39 target’s location will not be released to the DGM subcontractor.
- 40 6. DGM surveys will be performed by the DGM subcontractor using the system
41 configurations, shown in Table 2, to be tested. The data will be processed and interpreted by

- 1 the DGM subcontractor and anomaly selections made. "Draft-Final" data packages will be
2 provided to the CH2M HILL Project Geophysicist for evaluation.
- 3 7. If the initial DQOs have not been met, the CH2M HILL Project Geophysicist will meet with
4 the DGM subcontractor to discuss whether modifications (e.g., sensor spacing) or
5 procedures (e.g., lane spacing) can be made to the DGM system in order to meet the DQOs.
- 6 8. If the DQOs cannot be met by the DGM subcontractor, the CH2M HILL Project Geophysicist
7 will meet with the NAVFAC RPM to discuss a resolution (i.e., modification of a DQO) prior
8 to completing the GPO.
- 9 9. Once the surveys have been performed and at least one of the configurations has been
10 determined capable of meeting the initial (or modified) DQOs, the GPO will be complete.

11 5.0 Additional GPO Considerations

12 Additional topics taken into consideration for the design of the GPO include plot location, size,
13 and shape; quantities of seeded items; and geophysical and positioning instruments and
14 technologies.

15 5.1 GPO Plot Location

16 The location of the GPO will be determined on the basis of field conditions at the time the GPO
17 is conducted. The plot will be located in an area where the geology, vegetation, and terrain area
18 as similar as possible to the actual site conditions. Because the majority of the work to be
19 performed is along the roadways (as opposed to the beaches), initial plans are to use a section of
20 roadway that is infrequently used and reasonably free of anomalies (as determined through a
21 background DGM survey). Figure 2 is a generalized geologic map of the survey area with the
22 locations of the roadways and beaches to be surveyed overlain.

23 5.2 Validation Strips

24 Because of the variable geology across the area to be geophysically surveyed, it is not possible
25 to select a single GPO area that will be representative of the entire site. One or more validation
26 strips will be emplaced in areas of the site that do not have similar geology to the GPO plot.
27 Three items similar to items seeded in the GPO plot will be emplaced in the validation strip(s)
28 at the same depths and orientations as their comparable items in the GPO. The selected survey
29 equipment will be operated over those items to ensure that response over the items is not
30 significantly different. Because of the variability in response of items resulting from small
31 changes in shape, degradation and depth emplaced, an acceptable response will be considered
32 to be a maximum amplitude response of at least 75% of the comparable item in the GPO plot.
33 Any variation from this will be brought to the attention of the Site Manager and the Project
34 Manager and a determination will be made by the Project Manager and the Project Geophysicist
35 as to a path forward.



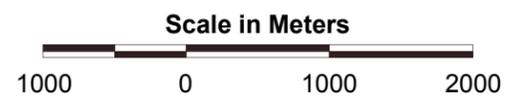
GEOLOGY LEGEND

Quaternary
Qa - Alluvial Deposits, Sand, Silt, Clay, Gravel Flood Plain, Terrace Deposits, and Piedmont Fan Deposits
Qb - Beach and Dune Desposits, Largely Calcite, Quartz and Volcanic Rocks, and Fragment Sand with Local Magnetite

Tertiary
Tl - Marine Sedimentary Rocks, Undivided

Cretaceous
Kv Sandstone, Siltstone, Conglomerate, Lava, Tuff, and Tuffaceous Breccia. Largely Deposited in Marine Environment. Extensive Deep Weathering. Some Limestone.
KTd- Plutonic Rocks, Largely Grandiorite, and Quartz Diorite, Locally Deeply Weathered (from Torres-Gonzalez, 1989)

Base imagery is comprised of 1994 1-meter USGS Digital Ortho-imagery quarter quadrangles (DOQQs).



**Figure 2
 Geologic Map**
 Former Vieques Naval Training Range, Vieques, Puerto Rico

1 Table 2

2 Geophysical Equipment Tests to be Performed during GPO

Test	Instrument	Positioning System	Approximate Sensor Height Above Ground Surface (m)	Lane Width (m)	Data Collection Rate (per second)	Approximate Survey Speed (m/s)
1	Cesium Vapor Magnetometer	RTK GPS	0.41	0.75	10	1
2	Cesium Vapor Magnetometer	Fiducial	0.41	0.75	10	1
3	*Cesium Vapor Magnetometer Array	RTK GPS	TBD*	TBD*	TBD*	TBD*
4	EM61-MK2 Single Coil	RTK GPS	0.41	0.75	10	1
5	EM61-MK2 Single Coil	Fiducial	0.41	0.75	10	1
6	*EM61-MK2 Array	RTK GPS	TBD*	TBD*	TBD*	TBD*

3 Note that some of the data elements are subject to modification based on proposals from potential DGM subcontractors and evaluation in the field.

4 *Based on proposals from DGM subcontractor. (To be updated prior to final Work Plan submittal.)

5

1 5.3 GPO Size and Shape

2 The intended dimensions of the GPO plot are 100 ft x 100 ft but may be modified based on site
3 conditions.

4 5.4 Number and Types of Geophysical Instruments and Technologies 5 Selected for Testing

6 The two primary techniques used in the industry, cesium vapor magnetics and time domain
7 electromagnetics (TDEM) will be tested during the GPO process.

8 A complete description of the systems to be tested will be provided in the instrument-specific
9 Standard Operating Procedures (SOPs) to be provided in the Final GPO Work Plan (after DGM
10 subcontractor selection).

11 5.5 Number and Types of Positioning Instruments and Technologies 12 Selected for Testing

13 Both RTK GPS (sub-centimeter) and a fiducial positioning method will be tested for positioning
14 of the geophysical data. The intent is to utilize RTK GPS for positioning the geophysical data;
15 however, in areas of the site where vegetation cover precludes the use of GPS, an alternative
16 positioning method will need to be employed.

17 6.0 Quality Control

18 All systems will be field tested by the DGM subcontractor to ensure that they are operating
19 properly. Several basic quality control (QC) tests will be performed in addition to instrument
20 specific tests. The instrument specific tests are described in the instrument operation SOPs that
21 will be provided by the geophysical services subcontractor. A description of each basic QC test,
22 its acceptance criteria and test frequency is provided below and summarized in Table 3.

- 23 1. **Equipment Warm-up.** This is an instrument specific activity (although standard warm-up
24 time is 5 minutes). Some geophysical systems require more warm-up time than others. Each
25 system specific SOP (attached in Attachment A) defines the equipment-specific warm-up
26 time. Equipment warm-up will be performed each time the instrument is first turned on for
27 the day or has been turned off for a sufficient amount of time for the specific instrument to
28 cool down.
- 29 2. **Record Sensor Positions.** Positioning accuracy of the final processed data will be
30 demonstrated by operating the equipment over one or more known points. It is important
31 that the positioning system be tested in exactly the same manner in which it is to be used
32 during the actual surveys. The accuracy of the data positioning will be assessed by
33 calculating the difference between the location where the track-plots cross each other on the
34 map and the actual location of the known point(s). Presumably, the actual track-plots will
35 cross exactly over the known point when the data was collected, and the difference, if any,
36 observed on the final track-plot map is a direct measure of the positioning system's
37 accuracy. The sensor position test will be conducted at the beginning of the survey
38 operations for each work day.

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

8 TABLE 3
 9 Geophysical Instrument Standardization Tests and Acceptance Criteria

Test	Test Description	Acceptance Criteria	Power on	Beginning of Day	Beginning and End of Day	1st Time Instrument Used	2% of Total Area Surveyed
1	Equipment Warm-up	Equipment specific (typically 5 min)	X				
2	Record Sensor Positions	+/- 4 inch (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	Azimuthal Test *	Sensor orientation that minimizes drop-outs				X	
7	Six Line Test	Repeatability of response amplitude +/-20%, Positional Accuracy +/- 20 cm				X	
8	Repeat Data	Repeatability of response amplitude +/-20%, Positional Accuracy +/- 20 cm					X

10

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

- 1 5. **Static Background and Static Spike.** Static tests will be performed by positioning the
2 survey equipment within or near the survey boundaries in an area free of metallic contacts,
3 and collecting data for a minimum period of three minutes. During this time, the instrument
4 will be held in a fixed position without a spike (known standard) and then with a spike. The
5 purpose of the static test is to determine whether unusual levels of instrument or ambient
6 noise exist. The static background and static spike test will be conducted at the beginning
7 and end of each survey operation.
- 8 6. **Azimuthal Test.** This test will be performed to ensure that a system's sensors are oriented in
9 such a manner that minimizes data drop-outs and maximizes instrument response. This test
10 will only be performed for magnetometer systems and will be conducted the first time the
11 system is used at the site.
- 12 7. **Six Line Test.** The Six Line test is a standard response test consisting of a predetermined
13 route (survey line) established on or near the site in an area free of metallic contacts. The
14 beginning, midpoint, and end of the line will be marked, and data will be collected along
15 the line. The line will be traversed a total of six times as follows: 1) *normal* data collection
16 speed *without* a spike at the centerpoint; 2) *normal* data collection speed *without* a spike at the
17 centerpoint; 3) *normal* data collection speed *with* a spike at the centerpoint; 4) *normal* data
18 collection speed *with* a spike at the centerpoint; 5) *fast* data collection speed *with* a spike at
19 the centerpoint; 6) *slow* data collection speed *with* a "pike at the centerpoint. (Speed of data
20 collection will also be evaluated as part of the GPO evaluation process.) The Six Line test
21 will be conducted the first time a system is used at the site.
- 22 8. **Repeat Data.** This test is performed to ensure repeatability of the data and will be
23 performed after the initial survey over an area.
- 24 9. **Octant Test (Heading Error Test):** This test is done to document "heading" error associated
25 with magnetometer systems so that the error can be corrected during data processing. This
26 test is conducted the first time a system is used at the site.

27 7.0 Records Management

28 The MRP Enterprise (described in Section 3) will be used to capture and record all field
29 and processing notes.

30 8.0 Data Delivery

31 The DGM data delivery requirements include the following:

- 32 • All sensor data will be correlated with navigational data based upon a local "third order"
33 (1:5,000) monument or survey marker. If a suitable point is not available, CH2M HILL will
34 have a professional land surveyor establish a point.
- 35 • All sensor data will be preprocessed for sensor offsets, diurnal magnetic variations, latency
36 corrections, drift corrections, etc., and correlated with navigation data.
- 37 • Diurnal magnetic variations measured at a base-station must be collected at a minimum of
38 once per minute.

-
- 1 • The DGM system will digitally capture the instrument readings into a file coincident with
2 the grid coordinates.
 - 3 • All raw and final processed data will be delivered corrected and processed in ASCII files.
 - 4 • Corrections such as for navigation, instrument bias, and diurnal magnetic shift will be
5 applied.
 - 6 • All corrections will be documented (see Table 4).
 - 7 • Data will be presented in delineated fields as x, y, z, v1, v2, etc., where x and y are NAD83
8 UTM Grid Plane Coordinates in Easting (meters) and Northing (meters) directions, z
9 (elevation is an optional field in meters), and v1, v2, v3, etc., are the instrument readings.
 - 10 • The last data field should be a time stamp.
 - 11 • Each data field will be separated by a comma or tab.
 - 12 • No individual file may be more than 100 megabytes (Mb) in size and no more than
13 600,000 lines long.
 - 14 • Each grid (or set) of data will be logically and sequentially named so that the file name can
15 easily be correlated with the grid name used by other project personnel.
 - 16 • Within three working day after collection, the DGM subcontractor will furnish draft data
17 packages for each system's survey via internet using FTP, E-mail attachment for small files
18 under 5 Mb, digital compact disk (CD) or other approved method. Final data packages will
19 be sent similarly within 5 days of field data collection. Final data packages must include the
20 following:
 - 21 – Dig sheets (anomaly selections) in Microsoft Excel formats
 - 22 – PDF file(s) of color contoured geophysical results with anomaly selections shown and
23 labeled at a readable scale
 - 24 – Geosoft format GDB files and packed maps
 - 25 – Raw data files
 - 26 – Final processed data files
 - 27 – All quality control data files associated with the survey files
 - 28 – PDF of report from MRP Enterprise documenting the field activities associated with the
29 data, and the processing performed (see Table 4)
 - 30 – Digital planimetric map, in Geosoft and ArcView format, and coincident with the
31 location of the geophysical survey

TABLE 4
Processing Documentation Requirements

Information Type	Final Data Delivery	Must be in File Headers
Site ID	X	X
Geophysical instrument type used	X	
Positioning method used	X	
Instrument serial numbers (geophysical and positioning)	X	
Coordinate system and unit of measure	X	
Grid ID (or other identifier of surveyed area)	X	X
Date of data collection	X	X
Raw data file names associated with delivery	X	
Processed data file names associated with delivery	X	
Name of Project Geophysicist	X	
Name of Site Geophysicist	X	
Name of data processor	X	
Data processing software used	X	
Despiking method and details	X	
Sensor drift removal and details	X	
Latency correction and details	X	
Heading correction and details	X	
Sensor bias, background leveling and/or standardization adjustment method and details	X	
Diurnal correction (magnetic data)	X	
Geophysical noise identification and removal (spatial, temporal, motional, terrain induced) and details	X	
Other filtering/processing performed and details	X	
Gridding method	X	
Anomaly selection and decision criteria details	X	
Other processing comments	X	
Date data processing is completed	X	
Data delivery date	X	
Scanned copy of field notes and field PDA notes (if applicable)	X	

1 9.0 Reporting

2 CH2M HILL will prepare a GPO Report that will include the following elements:

- 3 • As-built drawing of the GPO plot
- 4 • Pictures of the seed items
- 5 • Color maps of the geophysical data
- 6 • Summary of the GPO results
- 7 • Geophysical equipment, techniques, and methodologies selected for the production survey
- 8 • Sufficient supporting information to justify selection

1 APPENDIX A

2 **DGM Subcontractor Standard Operating**
3 **Procedures**

DGM Subcontractor SOP No	Version	Title

4

Final

**First, Second and Third Responses to Comments on the Draft
Expanded Range Assessment and Phase II Site Inspection
Work Plan**

Former Vieques Naval Training Range (VNTR)

Vieques, Puerto Rico

Contract Task Order 0047

November 2006

Prepared for

**Department of the Navy
Naval Facilities Engineering Command
Atlantic Division**

Under the

**LANTDIV CLEAN III Program
Contract No. N62470-02-D-3052**

Prepared by



Virginia Beach, Virginia

Response to Comments Draft Expanded Range Assessment and Phase II Site Inspection Work Plan Former Vieques Naval Training Range (VNTR) Vieques, Puerto Rico April 2006

EPA General Comments

1. The details of the process to be used to inspect the Munitions Response Sites (MRSs), the Photo Identified (PI) sites, the Potential Areas of Concern (PAOC) sites, and the two Areas of Interest (AOIs) under investigation are unclear as to the proposed location and spacing of the transects in the areas where a less than 100 percent inspection is being performed. It would assist the reader in understanding exactly what is proposed if a graphic representation similar to that provided in the *Draft Expanded Range Assessment/Phase I Site Inspection Work Plan*, dated July 2004, (Figures 3-4 through 3-9) was provided for each of these areas. Please revise the Draft ERA & Phase II SI Work Plan to provide these graphics.

Response: Figures similar to those in the ERA/Phase I SI Work Plan will be included in the Final Expanded Range Assessment and Phase II Site Inspection Work Plan to show example locations of transects. Actual transects may vary significantly based on field conditions such as rough terrain, threatened or endangered plants or animals, wetlands, or other conditions that prevent access to specific points.

2. The investigation procedures proposed for the areas that are being inspected using analog geophysical instruments have instructions that require the recording of the location of all "MEC items that are visually observed" using a Global Positioning System (GPS) receiver. However, this is not done for any large subsurface anomalies noted by the analog instruments. Please provide written justification for this omission or revise the cited procedure to provide for the recording of the location of any large subsurface anomalies discovered during the investigation.

Response: The work plan will be revised to clarify that the GPS location of any large subsurface anomalies identified during the magnetometer assisted visual survey will be documented.

3. The Draft ERA & Phase II SI Work Plan often uses the term "UXO personnel" in instances where it is unclear as to the exact qualifications of the personnel so described. DoD Explosives Safety Board (DDESB) TP 18 (Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel) contains two definitions of terms that could be described as "UXO personnel." These are:

UXO-Qualified Personnel.

Personnel who have performed successfully in military EOD positions, or are qualified to perform in the following Department of Labor, Service Contract Act, Directory of Occupations, contractor positions: UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist or Senior UXO Supervisor.

UXO Technician.

Personnel who are qualified for and filling Department of Labor, Service Contract Act, Directory of Occupations contractor positions of UXO Technician I, UXO Technician II, and UXO Technician III.

Of primary interest and concern is that the use of the term “UXO personnel” leaves in doubt whether or not UXO Technician I level personnel are included in the situation under discussion. Please replace the term “UXO personnel” where used in the Draft ERA & Phase II SI Work Plan with one of the two terms defined in DDESB TP 18.

Response: All references to UXO personnel will be replaced with “UXO Technician”, per DDESB TP-18, Table 4-1.

EPA Specific Comments

1. Acronyms and Abbreviations, page ix: The acronym “EOD” is defined here as “Explosive Ordnance Detachment.” The definition of “EOD” provided in NAVSEA OP5 (U.S. Naval Sea Systems Command Ammunition and Explosives Safety Ashore, Regulations for Handling, Storing, Production, Renovation and Shipping) is “Explosive Ordnance Disposal.” Please correct this definition.

Response: The table of Acronyms and Abbreviations will be revised to include Explosive Ordnance Disposal.

2. Acronyms and Abbreviations, page ix: The acronym “LAWS” is defined here as “Light Anticraft Weapons.” However, the acronym “LAWS” is defined as “light anti-craft weapons” on page 2-2 of the Eastern Maneuver Area subsection of Section 2.2, Munitions Area Description. The *Hazard Classification of United States Military Munitions*, Revision 12, February 2004, U.S. Army Defense Ammunition Center, defines the term “LAW” as “Light Antitank Weapon.” There is a group of weapons listed as “Light Antiarmor Weapons” (no acronym listed) in FM-23-25 (*Light Antiarmor Weapons*), 17 August 1994. This group consists of the AT-4 rocket and the 66mm M72 Light Antitank Weapon (LAW). That manual also lists the acronym “LAW” as referring to the Light Antitank Weapon. No reference was located during the review that defined the acronyms “LAWS” or “LAWS” as “Light Anticraft Weapons.” Please review this acronym and either change its definition to “Light Antitank Weapon(s)” or provide a citable reference that lists the definition found in the Draft ERA & Phase II SI Work Plan.

Response: According to Jane’s Information Group (authoritative source regarding military systems as defined by the U.S. military and corporations producing those systems, the inclusive term of LAW is “Light Anti-Armor/Anti-Tank Weapon”. The citation on page 2-2 and the table of acronyms and abbreviations will be revised.

3. Section 2.2, Munitions Response Area Description, page 2-2: Lines 10 and 11 on the cited page reads, “Range 3: Rifle Grenade Range (40mm) and small arms [identified in

aerial photo analysis as Range 4 and hereforth identified as Range 4].” This again raises the issue of the 40mm projectile being identified with the term “rifle grenade,” which is incorrect nomenclature. The weapons that fire 40mm projectiles that are also identified in military publications as “grenades” include the M79 grenade launcher, the M203 Grenade launcher (which is attached to the underside of the M16 series rifle), and a number of weapons identified as “Grenade Machine Guns.” A search of the available references finds the complete 40mm munitions referred to as “40mm cartridges” or “40mm rounds.” The term “40mm Rifle Grenade” was not found in any of the reference documents available for review. A check with the Army Technical Center for Explosives Safety determined that the appropriate nomenclature did not include the word “rifle.” Please disassociate these 40mm projectiles (sometimes referred to as “grenades”) from the term “rifle” to avoid confusion as to the munitions item intended. If it is necessary to indicate that the range was used for firing 40mm grenade launchers and rifle grenades, please refer to the range as the “Rifle Grenade/40mm Grenade Launcher Range,” or similar verbiage to ensure that the potential confusion is eliminated. Please make this change throughout the Draft ERA & Phase II SI Work Plan.

Response: It is noted that the size “40mm” is never associated with “rifle grenade” per Department of the Army Technical Manuals, but is referred to as a “40mm cartridge”. Also, “rifle grenades”, strictly speaking, by Army standards, are “fin stabilized”, propelled from specially designed adapters that normally affix to the end of the rifle, and are propelled by specially designed cartridges (as opposed to the M209 rifle grenade launcher which affixes to under the rifle barrel). Furthermore, “rifle grenade cartridges”, by Army definition, are “specially designed, bullet-less cartridges use for launching rifle grenades from rifles”. The 40mm items found on the range are typically the projectile portion of the whole cartridge, or round. In the future, reference to 40mm grenade projectiles found in the grid will be categorized as 40mm grenade projectiles, or 40mm grenade cartridges if found as whole rounds.

4. Section 3.1, Rationale and Approach for Phase II Site Inspection, page 3-1: In the first paragraph of this section, lines 7 through 9 contain a sentence which reads, “In addition to the MRSs to be investigated two areas of interest (AOIs) identified from the LiDAR survey and will be investigated during the ERA/Phase II SI.” As currently constructed, this sentence is unclear as to its meaning. Please revise the cited sentence to correct its construction and punctuation to make its intent clear.

Response: The sentence has been corrected to: *In addition to the EMA-MRSs noted above, two areas of interest (AOIs) identified during the LIDAR survey will be investigated during the ERA/Phase II SI. These AOIs are located within the boundaries of EMA-MRS 43 (Figure 3-1).*

5. Section 3.1, Rationale and Approach for Phase II Site Inspection, page 3-1: In the fifth paragraph of this section, lines 35 through 38 read, “The approach to the vegetation evaluation prior to clearing will be fully described when the biological assessment is complete; however, it is anticipated that areas will be surveyed by a qualified biologist prior to any clearing to avoid impacts to threatened/endangered plant or animal species.” While this anticipated approach is commendable, it is unclear as to what other approaches will be considered if the anticipated process is not employed. Please revise the cited paragraph to provide additional wording that fully describes the potential alternatives that will be

considered to ensure that impacts to threatened/endangered plant or animal species are avoided.

Response: *The above referenced sentence has been changed to: "The Navy is currently expanding the approach to minimizing impacts to threatened and endangered species during vegetation clearance and other investigation and response activities developed for the LIA to the other MRAs. When this approach is finalized, it will be incorporated into the work plan."*

6. Section 3.2, Investigation Procedure, page 3-5: The third paragraph of this section reads, "Verification Level (VL) III will be the initial VL for all QC inspections of sites being evaluated at 100 percent: a lot will consist of 4 grids (80 total lanes), which total 1 acre and the failure to identify 5 UXO items greater than or equal to 20mm in size for any grid will result in grid failure and the grid will be re-investigated. Verification Level (VL) VII will be the initial VL for all QC inspections of sites being evaluated using a transect approach: 2,400 linear meters of transect will equate to a lot with each meter being a sample unit, the failure to identify 20 UXO items greater than 20mm in size for any lot will result in lot failure and the lot will be re-investigated."

It is unclear as to why the same basic quality criteria (5 UXO items greater than or equal to 20mm in size for any grid) is not being applied to the areas being evaluated using the transect approach. From a quality evaluation approach, 20 items in the equivalent area of four grids is not the same as 5 items in the equivalent area of one grid. For example, it would be possible to have 19 of the 20mm items found in a one grid equivalent and none in the remaining three, allowing all four grid equivalents to pass inspection because less than 20 items were found in the entire lot. Also, it is unclear why grids (areas being 100 percent inspected) are initially being quality inspected at a Verification Level of III, whereas the areas inspected by transects are being evaluated at Verification Level VII.

Please revise the quality process for the areas being evaluated by transects to bring it into line statistically with that used for the areas being inspected using a grid system. Also, please expand the cited section to explain the basis for the different Verification Levels for grids and transects.

Response: **The QC program will be implemented according to Table 9-1, which is presented in the Draft Master MEC Work Plan, Revision 1 (CH2M HILL, September 2005). The applicable definable features of work presented in Table 9-1 will be evaluated during the appropriate phases (preparatory, initial, and follow-up), which are indicated in Table 9-1.**

The third paragraph of Section 3.5, page 3-2 will be replaced with: "Quality control of all investigation activities will be conducted in accordance with Section 9 of the Draft Master MEC Work Plan, Revision 1 (CH2M HILL, September 2005). Specifically, the applicable defineable features of work identified in Table 9-1 will be evaluated during the appropriate assessment phases (preparatory, initial, and follow-up), which are given in Table 9-1. Additionally, a minimum of 10% of the areas (either transect or grid, whichever is being used) will be re-evaluated to insure proper MEC location and identification is being accomplished."

7. Appendix A, Health and Safety Plan, Table A-1 Hazard Analysis, pages 3 and 4: Under the subsection entitled “Transportation of Explosive Materials,” a discussion is provided of the qualifications for drivers that transport explosives cargo outside of the boundaries of federal installations. No corresponding discussion of the qualifications for transporting the same cargo inside of these boundaries is provided. As this transportation scenario is the one most likely to involve project personnel in a transportation accident, please include a discussion of the qualifications for transporting explosives inside the boundaries of the installation.

Response: The sentence will be changed to: *“Drivers will be licensed in accordance with federal, state, and local regulations.”*

8. Appendix A, Health and Safety Plan, Table A-1 Hazard Analysis, page 5: This page contains a subsection entitled “Inspection/certification of ORS*.” No definition of the acronym “ORS” is provided. Please correct this omission.

Response: ORS, or “ordnance related scrap” is an outdated term originally defined by the USA Corps of Engineers Ordinance and Explosives. The currently approved term is MD or “munitions debris”. ORS will be replaced by MD, with the appropriate entry under the acronym listing.

9. Appendix A, Health and Safety Plan, Table A-1 Hazard Analysis, page 6: This page contains a subsection entitled “Anomaly Reacquisition.” In that subsection it is noted that “Non-UXO Personnel” represent a hazard during MEC operations. It then states that the contractor will “Stop all MEC operations when non-UXO-qualified personnel are within the EZ.” The term UXO-Qualified, as defined in DoD Explosives Safety Board TP 18 (Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel), excludes UXO Technician I personnel from the definition of “UXO-Qualified” personnel. In addition, authorized visitors who are not “UXO-Qualified” are now allowed inside the EZ during MEC operations when approved by the appropriate authorities. Please revise this section of the noted table to eliminate the cited discrepancies.

Response: The following will be added as a footnote to Table A-1. *“By USACE regulations, sweep personnel are not permitted within the EZ while “MEC operations” (intrusive and explosive operations such as demolition) are being performed; UXOT Is can only be in the EZ, under the same circumstances, if under the supervision of UXOT IIs or IIIs. Non-UXO Technician personnel can be designated as Essential Personnel to observe MEC operations if they have a letter authorizing them from the appropriate federal agency, a risk analysis has been performed, and they have been briefed on safety and are escorted by UXOT II or higher. No more than two authorized visitors, can enter the EZ at one time”.*

Table A-1 will be modified to state *“Non-UXO technician personnel as below.”* and *“Stop all MEC operations when non-UXO-technician personnel are within the EZ as below.”*

10. Appendix A, Health and Safety Plan, Section A.4.3.20, Radiological Hazards and Controls, page 20: This section contains a sentence that states, “An intensive range sweep was initiated at that time and many of the DU rounds were recovered.” As a 25mm PGU-20 round consists of a cartridge case, propellant, a primer, and a projectile, it is very unlikely that complete rounds were actually recovered. Please revise the cited sentence to replace the term “rounds” with the term “projectiles” to make it technically correct.

Response: The term “round” will be replaced with the term “projectile” in the cited sentence, and everywhere else appropriate.

11. Appendix A, Health and Safety Plan, Attachment 2, A.14 Standard of Practice HSE&Q-610, page unnumbered: The title sheet for this attachment reads “Standard of Practice HSE&Q-610.” However, the document enclosed is entitled “Standard of Practice HSE-610.” Please correct this as necessary.

Response: The reference to HSE-610 will be replaced with HSE&Q-610, the currently approved CH2M HILL Munitions Response SOP.

12. Appendix A, Health and Safety Plan, Attachment 2, A.14 Standard of Practice HSE&Q-610, Section 2.2.3, MEC Removal, page 3: This section defines the UXOQCS as the “UXO Quality Control Supervisor.” However, on page 11 the same acronym is defined as “UXO Quality Control Specialist.” Does the contractor have both a UXO Quality Control Supervisor and a UXO Quality Control Specialist on-site, or are these two different terms used to describe the same position? Also, does the acronym apply to both definitions? If so, how does the reader determine which is intended? Please review the cited uses of these acronyms and terms and revise the cited portions of the document (and any other occurrences) as necessary to eliminate this situation.

Response: The proper term is “UXO Quality Control Specialist”, which will replace any reference to “UXO Quality Control Supervisor”.

13. Appendix A, Health and Safety Plan, Attachment 2, A.14 Standard of Practice HSE&Q-610, Attachment 1, Definitions, page 10: The definition of Munitions and Explosives of Concern (MEC) provided in this attachment is technically correct. However, the reference citations for the sub elements of the definition should be revised: The citation for Unexploded Ordnance (UXO) should read 10 U.S.C. 101(e)(5). The citation for Discarded Military Munitions (DMM) should read 10 U.S.C. 2710(e)(2). The citation for Munitions Constituents (MC) should read 10 U.S.C. 2710(e)(3). Please make these corrections.

Response: The references from Title 10 U.S.C. will be changed to the correct citation.

EQB Comments

1. Pg 2-2, Sec 2.2, Lines 8-17, Pg 2-3, Sec 2.2, Lines 2-17, Pg. 3-1, Sec 3.1, Lines 4-9. Some of the descriptions of the various sites are getting confusing. There are many sites and they are called by various names. For example, on these lines we have Ranges 1 through 6 which are also referred to as other range numbers:

- Range 3 “here forth identified as Range 4”
- Range 4 “here forth identified as Range 4B”
- Range 5 “here forth identified as Range 3”

Note that the bullet on line 37 at the bottom of page 2-2 contradicts the text on lines 8 through 17. The text says that here forth the ranges will be referred to as Range 1, 2, 3, 4, 4B, and 6. The bullet on Line 37 refers to Ranges 3, 4, 4A, 4B, and 5. There is no mention of Range 4A in the text on lines 8 – 17, so which range is actually Range 4A? There is also the

discrepancy between the references to Range 6 in the text and Range 5 in the bullet. It is not possible to understand which range is which EMA MRS by the description provided here.

Add to that the fact that the Phase I ERA/SI Report refers to Ranges 3, 4, 4A, 4B, and 6. There is no mention of Range 4A in lines 8 – 17 and we still have the discrepancy between Ranges 5 and 6.

Also, Figure 2-4 shows nine ranges along the north road, not six.

By the time one gets to page 2-3 a score card is needed to attempt to understand the sites. This text discusses MRS numbers, Range numbers, PIs, PAOCs, and then AOIs are added to the mix in Chapter 3 (see Figure 3-1). Add this to the fact that the MRS numbers are duplicated between the EMA, SIA, LIA, and ECA and the result is an inability for the reader to understand which site is being discussed.

Then, there are two new AOIs listed as being subjects for this work. Since they are not designated, how are they going to be discussed? “AOI North” and “AOI South”? Please explain.

A final example of the confusing nature of the site designations used in this document is the text on page 3-1, lines 4 – 9 which reads: “Based on the results of the ERA/Phase I SI the following MRSs will be investigated during the Phase II SI: the entire MRA-ECA; the MRA-Beach Area within the EMA, SIA and LIA; a total of 9 MRSs, including one PI site, and one PAOC site in the MRA-SIA; and a total of 22 MRSs within the EMA, including five PI sites, and three PAOC sites. In addition to the MRSs to be investigated two areas of interest (AOIs) identified from the LiDAR survey and will be investigated during the ERA/Phase II SI. The AOIs are within the boundary of MRS 43.” It is very difficult to understand the meaning of these three sentences.

Some method is needed to allow the reader to understand which site is being discussed. A scorecard, such as is provided in Table 3-1 may be the answer. Modifying this table (note that it only refers to EMA Ranges 3, 4, 4A, 4B, and 5 and that there is no mention of Ranges 1, 2, and 6) and putting it in the front of the document may be the answer. This issue of numbering and designating sites may deserve a separate chapter because there is little hope of achieving group and public understanding of the project if we can't efficiently refer to sites when they are being discussed.

Response: Nomenclature: The site nomenclature is a combination of standard Department of Defense (DoD) and standard US Environmental Protection Agency site descriptors. DoD breaks the site down into five munition response areas (MRAs) (see Figure 2-2), the Eastern Maneuver Area (EMA), the Surface Impact Area (SIA), the Live Impact Area (LIA), the Eastern Conservation Area (ECA), and the Beach MRA. These MRAs are in turn broken down into munition response sites (MRSs). It has, to date, not been necessary to subdivide the Beach MRA into MRSs. Note that the MRSs are numbered incrementally for each MRA, and that the MRS numbers do not signify priority. Because the MRS numbers are duplicated across MRAs, where MRS numbers are cited in the text, if there is any question as to in which MRA that particular MRS resides, the MRA should be cited as well.

Note that the EMA-MRS 43 includes all land area within the EMA which is covered by artillery safety fans, excluding areas designated as other MRSs (Figure 2-4 shows artillery

safety fans). EMA-MRS 44 includes all land area within the EMA which is outside the area covered by artillery safety fans, excluding areas designated as other MRSs. SIA-MRS 7 includes all land area within the SIA which is covered by artillery safety fans, excluding areas designated as other MRSs. Figure 2-2 will be revised, replacing in the notes range fan(s) with artillery safety fan(s).

Ranges: The discussion of range numbering will be clarified in the Expanded Range Assessment and Phase II Site Inspection Work Plan. In addition to the six EMA ranges mentioned in the draft document on page 2-2 lines 8-17, page 2-2 lines 18-22 discuss what were originally classified as nine ranges within the EMA. These ranges are ranges 1, 2, 3, 4, 5, 6, 7, 8, and 9. In historical documents, ranges 4, 4A, and 4B were considered one range, currently they are considered separate ranges. Thus, there are actually 11 ranges in the EMA (Figure 2-3). The text on page 2-2, lines 18-22 will be changed to: *“An aerial photograph analysis of the EMA and SIA (ERI, 2002) indicates that as many as 9 ranges (11 ranges now that range 4 has been subdivided into 3 discrete ranges, 4, 4A, and 4B) and up to 30 gun emplacements and positions may have existed historically at the EMA (Figure 2-5). These ranges are currently identified as ranges 1, 2, 3, 4, 4A, 4B, 5, 6, 7, 8, and 9. Additionally the aerial photograph analysis identified up to nine gun positions and eight observation posts within the SIA (identified on Figure 2-5 as GP for gun position, OP for observation post, or PI for photo-identified site, if the photo-identified site use could not be confirmed). These SIA sites may have been used for mortar or artillery gun training.”*

As discussed in the 6/1/06 CTC meeting Table 3-1, MRS 30 will be changed to include range 8. Also, items evaluated during the ERA Phase I SI will be removed from the table.

Page 3-1, lines 4-9 will be changed to:

“Based on the results of the ERA/Phase I SI, the following MRSs will be investigated during the Phase II SI:

- *MRA-ECA: The entire MRA-ECA.*
- *MRA Beach Area: The beaches in the EMA, SIA, LIA and ECA.*
- *MRA-SIA: A total of 7 MRSs, and one PI site, and one PAOC site.*
- *MRA-EMA: A total of 22 MRSs including five PI sites and three PAOC sites.*

In addition to the EMA-MRSs, PI sites, and PAOC sites noted above, two areas of interest (AOIs) identified during the LIDAR survey will be investigated during the ERA/Phase II SI. These AOIs are located within the boundaries of EMA-MRS 43 (Figure 3-1).”

Figure 3-1 will be revised to identify the northern AOI as AOI-1, and the southern AOI as AOI-2. If munitions response actions are determined to be warranted, the AOIs will become new MRSs.

2. Pg 2-2 to 2-3, Sec 2.2, Line 26 to 2. This section says that there are no impacts or potential environmental releases observed at PI 9. However, it is known that the shore area of PI 9 is heavily contaminated with MC and possibly MEC. It is recommended that this near-shore contamination be investigated and that PI 9 not be referred to as being documented to have no potential environmental releases. This same comment was made to the Phase I ERA/SI Report.

Response: The section states that no impacts of any potential environmental releases were observed (at PI 9 and others). MRSs are defined as ending at the low tide line. Items below the low tide line, in the near shore zone, will be addressed as warranted following the investigation and remedial actions for inland areas. The types of items found at EMA MRS 12 consisted of small arms and expended items. A number of sub surface anomalies were identified in EMA MRS 12, and a subsurface evaluation was recommended. An investigation of environmental contamination from MC will be conducted, for this site as with all other munitions response sites, after the munitions response action(s) is/are completed.

3. Pg 2-3, Sec 2-2, Lines 18-29. These lines describe recommendations from the Phase I ERA/SI Report. It should be noted that EQB has comments on these recommendations as reflected in our comment numbers 27 through 30 in our comments to the Phase I ERA/SI Report. It is recommended that the comments on the recommendations contained in the Phase I ERA/SI Report be resolved first and then this section of the Phase II Work Plan can be revised accordingly.

Response: As discussed in the responses to comments numbers 27 through 30 of the ERA and Phase I SI Report, the explosive hazard severity for EMA MRS 6 and EMA MRS 12 have been revised to follow the Site Prioritization Protocol's Table 1 classification within the EHE module munitions type. The explosive safety hazard screening category for EMA MRS 6 is moderate-high. The explosive safety hazard screening category for EMA MRS 12 is high. Because there is evidence that these sites have been impacted the recommendation is for further investigation; however, because all of the items found were expended, relative to some of the other sites they have a lower priority. The recommendations contained in the above mentioned section of the Phase II Work Plan are unchanged.

With respect to EMA MRS 12, MEC debris in near-shore water is outside the scope of this work, and not part of EMA MRS 12. Only MD was found in this MRS.

4. Pg 2-4, Sec 2.2, Line 3-17. This section singles out SIA MRS 1 for a detailed description of its history and hazard screening. However, this is the only site receiving this type of narrative treatment in this chapter of the report. According to page ES-V, SIA MRS 1, 2, 3, 4, 5, 6, 7, other PI and PAOC sites in the SIA are going to be inspected during this SI. Please explain why SIA MRS 1 receives additional narrative treatment in this section over and above what is given to the other sites. Is SIA MRS 1 especially important for some reason?

Response: SIA MRS 1 is the only MRS in the SIA that was investigated during the Expanded Range Assessment and Phase I Site Inspection. The explanation of its history, and hazard screening is included to help support the rationale for additional investigation of all MRSs in the SIA (MRSs 1-7), and PI 1 and 17, and PAOC Y. The paragraph starting on line three will be changed to "*MRS 1 was the only MRS surveyed in the SIA during the Phase I Site Inspection. MRS 1 was a marine artillery target area for marine artillery gunfire from the gun positions within the EMA.*" The paragraph starting on line 7 will be removed.

5. Pg 3-2, Sec 3.1, Lines 10-12, and Fig. 3-2. The beach areas to be investigated are shown on Figure 3-2. It would be appropriate to reference Figure 3-2 in this section.

Also, the legend on Figure 3-2 should be enlarged to make it consistent with the other figures throughout the plan.

Response: Figure 3-2 will be referenced in the above mentioned section. The legend on Figure 3-2 will be enlarged.

6. Pg 3-2, Sec 3.1, Lines 30-35 and 37-39. These sections describing the approach for the investigation in the SIA and EMA don't say what is going to be done. Note that the description of the investigation for the ECA says the investigation will be a "surface MEC evaluation using a transect approach". It is recommended that similar information be added to the section on the SIA and EMA.

Response: The following will be inserted after the first sentence which begins on Line 30: "Transects totaling an area of approximately 10 percent of SIA MRSs 1-7 and 100 percent coverage of PI 1, PI 17, and PAOC Y will be used to evaluate surface MEC". The following will be inserted at the end of the last paragraph on page 3-2: "Transects will be used to evaluate surface MEC."

7. Pg 3-5, Sec 3.2, Lines 9-16. The amount of acceptable failures described in this section on QC criteria appears to be inadequate. The allowable failure rate (the number of UXO allowed to be missed) is excessive. It also requires that only UXO be considered to be failures, not ordnance-like objects or even MEC. The allowable number of missed UXO specified is five in each quarter acre or twenty per acre. This is a very large number of allowable failures and is likely unprecedented.

It is recommended to:

1. Change the requirement for a failure to be a UXO (note, functioned BDU-33 practice bombs, large pieces of frag, etc, are not UXO but should be found by the geophysics) to being any metal object larger than 20-mm.
2. Please provide further explanation for how MIL-STD-1916 is being used to arrive at the amount of QC inspection and the allowable failure rate of 20/acre.
3. Explain how many square feet equal a lot for the transect survey. The only number given is 2,400 linear feet and, since the transect width is unknown, the overall size of a lot cannot be determined.
4. Revise the acceptable failure rate to a lower and more reasonable number.

Response: See response to EPA specific comment 6.

8. Pg 3-6, Sec 3.2.1, Lines 9-11. This section says that rocky areas near beaches will not be mapped. While it is agreed that geophysical mapping of rocky areas is not productive, numerous MEC can be easily observed on these rocky areas between beaches. It is recommended that these areas be walked and visually inspected during the Phase II ERA/SI. This can easily and quickly be done and identifying these surface MEC for disposal will help to further decrease the MEC hazard in the area.

Response: These areas will be cleared as part of the upcoming EE/CA. Any effort as part of the Phase II ERA/SI would be duplicative.

9. **Pg 3-6, Sec 3.2.2, Line 28.** There is an important typo in this section. This line should refer to “roads” not “beach areas”.

Response: The sentence will be changed to refer to road areas.

10. **Pg 3-6, Sec 3.2.3, Line 36.** This line says the ECA has been added to the TCRA “that is currently completed in the LIA” (note: this is assumed to mean the TCRA “that is currently being completed in the LIA”). If this is the case, and the ECA is part of the TCRA, that would mean that the ECA is going to receive 100% surface clearance. In that case, why bother with the description in this section of clearing 5-ft. wide transects and inspecting them? Isn’t this all going to be done anyway during the TCRA as stated on line 36? It is stated on page 3-7, line 4 and 5 that the inspection is being done to “gather information to design the Time Critical Removal Action to be completed for this area.” But, is this necessary. If it is part of the TCRA why not just do the surface clearance? What additional information is necessary, beside possibly acquiring some ecological data?

Response: The text has been revised to: “...Time Critical Removal Action that is currently being conducted in the LIA.” The 10 percent inspection will be used to determine the types and densities of MEC in the ECA for purposes of accurately scoping and developing final cost estimates and approaches for the future time critical removal action.

11. **Pg 3-10, Sec 3.4.** There is no mention of photos as part of the data management system. The need for a photo record of the project that is managed as part of the overall data management system was discussed during the last CTC meeting and it was said that CH2M Hill agreed that management of photos as part of the data management system was a needed improvement. They said they were working on it and that it should be completed soon. If this has been accomplished please add management of photos to this section.

Response: An eighth bullet will be added to section 3.4: “Photo Log (project photos with notes from photographer)”

12. **Fig. 3-3.** This figure contains a new position, “CH2M Hill Field Superintendent”. This position isn’t described in the Master Work Plan and is not included in the organization chart (Figure 2-1) in the MWP. How does this position relate to the organization established in the MWP? What are the qualifications and duties of this position?

Response: The position title will be changed to Site Manager, as described in the Master Workplan.

13. **Figs 3-4 and 3-5.** This figure is very confusing. It is not a decision flow diagram because there are very few decision points identified and what decision needs to be made is not identified. For example, refer to the left side of this diagram:

1. MEC is found. Then the “CH2M Hill Safety/QC Supervisor Cliff Walden” is brought into the loop.
2. He then goes to two entities, the “UXO Subcontractor Team” and the “CH2M Hill Superintendent Heather Blackwell”. But, it is assumed the “UXO Subcontractor Team” found the UXO in the first place, so what are they supposed to do at this point in the flow chart?

3. The chart then seems to ask if it is safe to move.
4. If safe to move it goes to removal which sends it to “CH2M Hill MRP George Overby”, who sends it to Stacin Martin who sends it to Carlton Finley/Madeline Rivera. What is being done by these persons? Are they just notifying each other or are they taking some action? When this chain dead-ends at “Carlton Finley/Madeline Rivera”, what happens now?

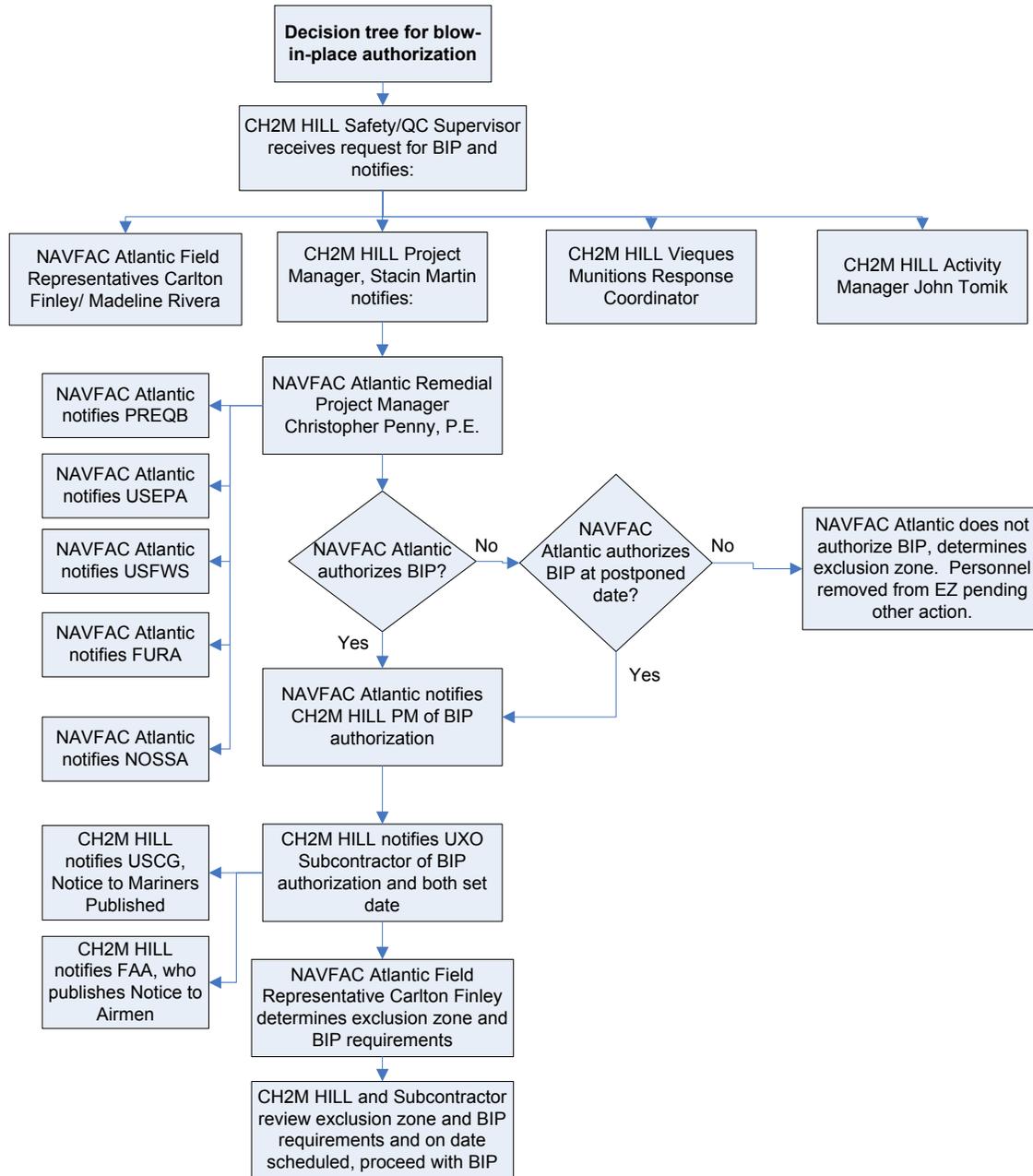
As another example, this process may or may not go through “CH2M Hill Superintendent Heather Blackwell”. What is the difference in the situation that determines whether she is or is not in this loop?

There are many more examples of questions that are unanswered by the figure and the same can be said of Figure 3-5. There are no decisions represented on Figure 3-5 and only a few instances where one organization notifies another.

It is recommended that true decision trees be developed for these functional areas.

Response: Figure 3-4 and section 3.5.1 will be deleted as unnecessary. The original Figure 3-5 (the Blow In Place Decision Tree), which now becomes Figure 3-4, has been revised, and is attached to these comments.

Figure 3-4 Blow-in-Place (BIP)
Decision Tree,
Former VNTR, Vieques, Puerto Rico



14. Pg 5-1, Sec 5.2, Line 18-28. This section references the hazard evaluation and site prioritization performed as part of the Phase I ERA/SI. However, EQB had several comments (comment numbers 25 – 30) on the hazard evaluation and site prioritization in the Phase I ERA/SI which have not been resolved. It is recommended that EQB’s comments on the hazard evaluation and site prioritization in the Phase I ERA/SI be discussed and

resolved before the results of that evaluation and screening process are implemented in this work plan.

Response: The explosive hazard categories have been revised to include the 11 categories given in the DoD Site Prioritization Protocol. The “Riot Control” category has been retained for consistency with the DoD protocol. See response to comments 25 through 30 of the ERA and Phase I SI Report.

The categories are:

Classification	Description	Score
Sensitive	<ul style="list-style-type: none"> • All UXO that are considered likely to function upon any interaction with exposed persons (e.g., submunitions, 40mm high-explosive[HE] grenade projectiles, white phosphorus [WP] munitions, high-explosive antitank [HEAT] munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions). • All hand grenades containing energetic filler • Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazard. 	30
High explosive (used or damaged)	<ul style="list-style-type: none"> • All UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered “sensitive” • All DMM containing a high-explosive filler that have: <ul style="list-style-type: none"> -Been damaged by burning or detonation -Deteriorated to the point of instability. 	25
Pyrotechnics (used or damaged)	<ul style="list-style-type: none"> • All UXO containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades). • All DMM containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades) that have: <ul style="list-style-type: none"> -Been damaged by burning or detonation -Deteriorated to the point of instability. 	20
High explosive (unused)	<ul style="list-style-type: none"> • All DMM containing a high explosive filler that: <ul style="list-style-type: none"> -Have not been damaged by burning or detonation -Are not deteriorated to the point of instability. 	15
Propellant	<ul style="list-style-type: none"> • All UXO containing mostly single-, double-, or triple-based propellant, or composite propellants(e.g., rocket motor). • All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants(e.g., rocket motor) that are: <ul style="list-style-type: none"> -Damaged by burning or detonation -Deteriorated to the point of instability. 	15
Bulk secondary high	<ul style="list-style-type: none"> • All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants(e.g., rocket motor), that are deteriorated 	10

explosives, pyrotechnics, or propellant	<ul style="list-style-type: none"> • Bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard. 	
Pyrotechnic (not used or damaged)	<ul style="list-style-type: none"> • All DMM containing pyrotechnic fillers (i.e., red phosphorous), other than white phosphorous filler that: <ul style="list-style-type: none"> -Have not been damaged by burning or detonation -Are not deteriorated to the point of instability. 	10
Practice	<ul style="list-style-type: none"> • All UXO that are practice munitions that are not associated with a sensitive fuse. • All DMM that are practice munitions that are not associated with a sensitive fuse and that have not: <ul style="list-style-type: none"> -Been damaged by burning or detonation -Deteriorated to the point of instability. 	5
Riot control	<ul style="list-style-type: none"> • All UXO or DMM containing a riot control agent filler (e.g., tear gas). 	3
Small arms	<ul style="list-style-type: none"> • All used munitions or DMM that are categorized as small arms ammunition. [Physical evidence or historical evidence that no other types of munitions (e.g., grenades, subcaliber training rockets, demolition charges) were used or are present on the MRS is required for selection of this category.] 	2
Evidence of no munitions	Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0

Notes:

- *Former* (as in “former military range”) means the MRS is a location that was (1) closed by a former decision made by the Component with administrative control over the location, or (2) put to a use incompatible with the presence of UXO, DMM, or MC.
- *Historical evidence* means the investigation: (1) found written documents or records, (2) documented interviews of persons with a knowledge of site conditions, or (3) found and verified other forms of information.
- *Physical Evidence* means: (1) recorded observations from on-site investigations, such as finding intact UXO or DMM, or munitions debris (e.g., fragments, penetrators, projectiles, shell casings, links, fins); (2) the results of field or laboratory sampling and analysis procedures; or (3) the results of geophysical investigations.
- *Practice munitions* means munitions that contain an inert filler (e.g., wax, sand, concrete), a spotting charge (i.e., a small charge of red phosphorous, photoflash powder, or black powder used to indicate the point of impact), and a fuze.
- The term *small arms ammunition* means ammunition, without projectiles that contain explosives (other than tracers), that is .50 caliber or smaller, or for shotguns.

15. Pg C-1 through C-14, Sec Appendix B. The page numbering in this appendix is confusing. First, Appendix B is numbered C-1 through C-14. Then, the attachment (the GPO Plan) is number 1 – 18. Please revise the numbering on these pages to make it easier to identify specific passages.

Also, this appendix doesn't use line numbers as have been used, and were very helpful, throughout the rest of the document. Use of line numbers is recommended on all draft documents.

Response: Appendix B will be renumbered B-1 through B-14. The GPO plan numbers will be C1-C18. Line numbers will be added to appendices.

16. Pg C-4, Sec B.17, and Pg C-4, Sec B.18, and App B, Pg. 2, Table 1, and App B, Pg. 3, Sec. 2.2.1, and App B, Pg. 4, Sec 2.2.1. These sections all have a similar theme: that a "site-specific GPO will be used to finalize project DQOs". This is not technically correct. All guidance on this issue (EPA UXO Handbook, ITRC guidance, etc.) require the DQOs to be established first. Then, the GPO either achieves or doesn't achieve the DQOs. If the DQOs are achieved everything can proceed as planned. If they are not achieved then an evaluation should be performed to see if modifications to the process (use of alternate sensors, changes to procedures, etc.) can be implemented to meet the DQOs. If not, then the impact of modifying the DQOs can be considered. The procedure outlined in the Phase II ERA/SI Work Plan is backwards and requires establishment of the DQOs to meet the capabilities of the geophysical system after performance of the GPO.

The intent of the documents is to state that the DGM systems are to be tested against the DQOs established in the work plans and if a particular DQO cannot be met, the system or process will be modified to attempt to meet the DQO and if the DQO still cannot be met then discussion regarding a modification to the DQO will ensue. {You may want to add something here regarding any text changes you will make to clarify the intent.}

The procedure outlined here is also not in compliance with Bullet #9 of Appendix F of the Master Work Plan (no page number is provided, this bullet is on the fifth page of text in this appendix) which states, "If the DQOs cannot be met by The DGM Contractor, the Title 2 Services Contractor QA Geophysicist will meet with the U.S. Navy to discuss a resolution (i.e. modification of a DQO) prior to completing the GPO." Note that this bullet doesn't say that the DQO will be established after the GPO to comply with the results of the GPO. This is because the DQO is established prior to performance of the GPO.

Also note that the procedure outlined in the text is not consistent with the process shown in Figure 1 which clearly identifies modifying the DQOs (Step 8) as the "Secondary path". The figure is consistent with the intent.

Response: The DQOs for the geophysical prove out and survey will be added to the work plan. The Draft ERA SI and Phase II SI WP sections cited above in the comment will be revised to reflect the following: After establishing DQOs, the system and processes will be tested to see if they can meet the DQOs. If the system cannot meet DQOs, the system and/or the process will be modified to try to meet the DQOs. If these changes still don't allow the system and processes to meet DQO requirements, then and only then will a discussion start about modifying the DQOs.

17. Table B2 and Pg C-13, Sec B.25, unnamed figure. This is a very useful table. However, there appear to be a few important issues associated with it:

1. There is no requirement listed in this table for the blind seeding program that is required by Section B.23 of this appendix. It is recommended that this QC requirement be added to Table B-2.
2. There is an audit requiring checking to “Verify data checks specified in the QCP and SOPs”. In order to ensure that this is accomplished it is necessary to list these checks and who is responsible for performing them. This is because these checks are contained in several places and in some cases the guidance conflicts.

The unnamed figure on Page C-13 contains some QC checks that should be added to Table B-2 (QC review performed on field forms, QC review performed on pre-processing, QC review performed on processing).

Response: 1) The blind seeding program requirements will be added to Table B-2:

Definable features of work with auditable function- DGM Survey

Responsible Person(s)- Project geophysicist

Audit Procedure – Confirm that geophysical investigation plan blind seeding procedures are being followed.

QC Phase – IP

Freq. of Audit O

Pass/Fail Criteria-Blind seeding program requirements of Geophysical Investigation Plan of this document are being met.

Action if failure occurs. Do not proceed with field activities until criterion is passed.

2) Change audit requirement to “Verify data checks specified in this Geophysical Investigation Plan are being met.”

Definable features of work with auditable function- DGM Survey

Responsible Person(s)- Project geophysicist

Audit Procedure –QC of field forms

QC Phase – IP

Freq. of Audit O

Pass/Fail Criteria- QC has been done on field forms, and 1) Appropriate fields have been completed, 2) Field entries are appropriate for work performed, 3) Data required for geophysical data processors have been entered, and 4) Work passes minimum requirements for general editorial review (spelling, dates, etc.).

Action if failure occurs. Do not proceed with field activities until criterion is passed.

Definable features of work with auditable function- DGM Survey

Responsible Person(s)- Project geophysicist

Audit Procedure – QC of preprocessing.

QC Phase – IP

Freq. of Audit O

Pass/Fail Criteria: 1) Data have been translated from local coordinates into the UTM system, 2) Coordinates are correct (grids fall in correct locations when loaded into GIS), 3) Line gaps have been accounted for, 4) Background geophysical noise is acceptable, 5)

Crosstrack distance between lines is acceptable, 6) Downline data density is acceptable, 7) Appropriate file headers are attached, and 8) Files contain appropriate grids.

Action if failure occurs. Fix failed criteria, and resurvey.

Definable features of work with auditable function- DGM Survey

Responsible Person(s)- Project geophysicist

Audit Procedure - QC of processing

QC Phase - IP

Freq. of Audit 0

Pass/Fail Criteria- 1) Latency/Lag correction is appropriate, 2) Despiking is appropriate, 3) Leveling is appropriate, 4) Filtering performed is appropriate, 5) Line breaking is appropriate, 6) Anomaly selection is appropriate.

Action if failure occurs. Fix criteria and reprocess.

18. Pg C-12, Sec B.24. This section lists in three places some of the QC checks that are performed (“The following items are among the QC checks performed”). Since Table B-2 is designed to list all of the required QC checks, it is recommended that this section be deleted because it can only cause confusion and conflict with Table B-2. It is recommended that any QC checks in this section that are not included in Table B-2 be added to Table B-2 and that this section be removed from the plan to prevent conflict with the definitive requirements of Table B-2.

Response: Section B.24 will be replaced with a reference to the specific DFOWs in Table B-2, and the bulleted items inserted in Table B-2. See response to EQB comment 17 above.

19. App B Attachment and Table 1. Much of the Attachment to Appendix B (the GPO Plan) repeats the requirements of Appendix F to the Master Work Plan. Inclusion of this information only serves to cause confusion where the Appendix B Attachment doesn’t agree with Appendix F to the MWP.

For example, both documents contain an introductory section on “Purpose.” However, the attachment to Appendix B excludes two of the requirements contained in Appendix F to the MWP: “Document system reliability” and “Evaluate estimated field production rates and estimated false positive ratios, as related to project cost”. Is the deletion of these requirements a formal modification to the MWP which means that documentation of system reliability and field production rates is not part of the function of the GPO? If so, why? Why was it included as part of the purpose in the MWP and not in the Phase II ERA/SI? And why repeat all of the other requirements verbatim if they are unchanged?

It is recommended that the attachment to Appendix B be scrubbed to eliminate all text that is duplicative to the existing requirements of the MWP because this duplication with only minor changes causes confusion.

Also, the section on DQOs is slightly different than that contained in the MWP. For example, the requirement for “Downline Data Density” is not in the MWP and the text for “Survey Coverage (Lane Spacing)” is different than that in the MWP. Are these formal changes which should be reflected in the next version of the MWP or are they errors in the attachment to Appendix B?

Also, Table 1 on “Project Data Quality Objectives” contains numerous conflicts with the text in the work plan and the MWP. Project DQOs are contained in several places in this document and the MWP so it is inevitable that there will be contradictions. For example, Table 1 says that the DQO for transect spacing is for no more than a 2-ft. gap. Is this the same as the MWP requirement for “Lane Spacing (Sensor Separation)” contained in the MWP? They appear to be different (the MWP contains a 2% requirement and a 1-ft. radius requirement). Another difference is the Table 1 requirement for “Search transect spacing to vary no more than + or - 20% of spacing specified in sampling design.” This appears to be different than the 98% coverage requirement in the MWP Appendix F.

Also, Table 1 doesn’t have any DQO for reacquisition accuracy as does the MWP Appendix F. Why is this DQO missing?

Response: The Master Work Plan is intended to be a general overarching guidance document. Where site specific projects vary from the general guidance, site specific work plans are written to document the changes. This Draft Expanded Range Assessment Site Investigation Phase II Work Plan is such a document, providing modifications to the general guidance for this specific project. The geophysical investigation plan in this document is a later edition, and reflects updates that will be made to the Master Work Plan when it is next revised.

20. Pg 3, Sec 2.2.1, Line Attachment to App B. This says the GPO seed items will be “a representative sample of MEC sizes ... buried at various depths and orientations”. It is recommended that the plan be more specific and indicate how many of what size MEC will be used and to what depths they will be buried in order to meet the requirement for representativeness.

Response: This table of sizes of GPO seed items and the depths, locations and orientations at which they will be buried, will be provided to stakeholders as per discussion and agreement in a timely manner prior to construction of the GPO. The information will not be included in this plan to ensure blind GPO testing of subcontractors’ processes and equipment.

21. Pg 4, Sec 2.2.1, Line Attachment to App B. The discussion of FAR is confusing. If there is “... no absolute rule to determine an acceptable FAR”, then how will an acceptable FAR be determined? Can any criteria be established? The MWP Appendix F says the criteria is for FAR to be no greater than 15%. Is this requirement no longer valid?

Response: The requirement for less than 15 percent FAR will be removed from the next version of the MWP. No absolute FAR will be determined. It is of more value to look at FAR as the project progresses, and evaluate the FAR against the anomaly selection criteria and other metrics, than to set a fixed limit for FAR.

22. Pg 4, Sec 2.2.2 and 2.2.3, Line Attachment to Appendix B. The requirements here for “Downline Data Density” and “Survey Coverage” are not contained in the MWP. Should they be added to the MWP or are these criteria only valid to this one project?

Response: Downline Data Density and Survey Coverage will be added as potential DQOs in the MWP. The requirements of site-specific geophysical work plans differ, depending on scope, These two requirements are applicable to this plan and potentially future ones.

23. Pgs 4,5, Sec 2.3, Line Attachment to Appendix B. This section contains two requirements for delivery of data packages: “within 1 working day of data collection” and “within 3 working days of data collection”. Which is correct?

Response: The requirements are: **one working day for raw data for GPO, and three working days for final processed data for the GPO. The DQO for the project data is 3 days for raw field data and 5 days for final project data. The paragraph will be revised: “...the measurement performance criterion for data handling during GPO activities will require that data packages of raw data for the GPO (see Section 8) be completed and delivered to the CH2M HILL Project Geophysicist within 1 working day of data collection. Final processed data for the GPO shall be delivered to the CH2M HILL Project Geophysicist within 3 working day of data collection. ”**

Page 15, Section 8, last bullet will be revised with the correct data submittal time requirement.

24. Pg 7, Sec 4.0, Line Attachment to Appendix B, Comment 24, Pg 10, Sec 5.1, Line Attachment to Appendix B. This section says the GPO area will be selected in the future. It is recommended that it be selected and identified during the planning stage of the project and included in this GPO plan. Selecting the GPO area now would be consistent with guidance documents on the subject including the EPA UXO Handbook and the ITRC “GPOs for MR Projects”.

Response: **Appropriate project personnel will pre-scout potential locations. The project geophysicist will screen sites when he arrives to set up the GPO site. As discussed, an interim deliverable will be issued with the location of the GPO and specifications of seed items size, number, orientation and depth.**

This section also says that the number, type, and depth of burial of seed items will be determined later. The same comment as above applies to this. It is recommended that the GPO be planned and that the plan be included in this planning document to comply with best practices as described in the referenced documents.

Response: See response above.

25. Pg 9, Table 3, Attachment to Appendix B. Table 3 shows that the GPO will be performed on a lane width of 0.75-ft. (8-in.). This is an extremely narrow lane width. It is only appropriate to perform the GPO at this lane width if the production field work is also going to be performed at this narrow lane width. Please confirm that the production lane width will also be 8-in.

Response: **The lane width is actually in meters, the table will be revised.**

26. Pg 10, Sec 5.1, Attachment to Appendix B. It is a sound technical plan to use a portion of a road for the GPO. This is especially valid for the road survey. It is possible that the roads have been resurfaced with gravel that includes geophysical noise that was imported onto the roads. Therefore, EQB supports using a representative section of road (representative defined as having a surface or various surfaces that are similar to other sections of road to be surveyed) as the GPO.

Response: **Noted.**

27. Pg 10, Sec 5.2, Attachment to Appendix B. The concept of having one GPO and then “validation strips” in other locations may be technically sound if it is adequately implemented. However, if the GPO is constructed on a section of road, as described in Section 5.1, it is likely that a validation strip consisting of three targets will not be adequate for the beaches because the geological conditions (no imported gravel, different geology) will be much different than those at the road GPO. It is recommended that an evaluation of the number of targets emplaced on the beach validation strip be performed to determine if three are adequate or whether additional targets are required to establish that the DQOs are being met on the beaches.

Response: The road is anticipated to be the most difficult environment for the geophysical instruments, because of the anticipated heterogeneity of the fill materials over native materials. The GPO constructed on a section of road should suffice for geophysical work done along roadways. Beach sand is generally the easiest environment for geophysics because of the lack of imported materials, the lack of significant quantities of ferrous minerals in the material, and the homogeneity of the material. A test strip in the beach environment should suffice to confirm and measure the geophysical instruments and procedural responses.

28. Pg 12-13, Sec 6.0, Attachment to Appendix B. This section on QC almost completely repeats the text of the MWP, but not quite. What is the significance of the fact that the MWP contains an “Octant Test” and that this has been replaced by a “Repeat Data” test in the attachment to Appendix B? Is this requirement for the “Octant Test” in the MWP no longer valid?

Response: The octant test will be required, and will be re-inserted in the text. The repeat data test will be included also.

Response to Second Comments Draft Expanded Range Assessment and Phase II Site Inspection Work Plan Former Vieques Naval Training Range (VNTR) Vieques, Puerto Rico October 2006

EPA Comments

EPA September 2006 comment:

The responses to the EPA comments on the *Draft ERA & Phase II SI Work Plan* are sufficient as written, provided it is implemented in the succeeding version of the *Expanded Range Assessment/Phase II Site Inspection Work Plan* in the manner stated in the Navy responses. However, responses to Specific Comments 5, 8, and 9 requires additional action.

EPA APRIL 2006 SPECIFIC COMMENT:

- 5. Section 3.1, Rationale and Approach for Phase II Site Inspection, page 3-1:** In the fifth paragraph of this section, lines 35 through 38 read, 'The approach to the vegetation evaluation prior to clearing will be fully described when the biological assessment is complete; however, it is anticipated that areas will be surveyed by a qualified biologist prior to any clearing to avoid impacts to threatened/endangered plant or animal species.' While this anticipated approach is commendable, it is unclear as to what other approaches will be considered if the anticipated process is not employed. Please revise the cited paragraph to provide additional wording that fully describes the potential alternatives that will be considered to ensure that impacts to threatened/endangered plant or animal species are avoided.

The Navy response to this comment reads as follows:

"The above referenced sentence has been changed to: 'The Navy is currently expanding the approach to minimizing impacts to threatened and endangered species during vegetation clearance and other investigation and response activities developed for the LIA to the other MRAs. When this approach is finalized, it will be incorporated into the work plan.' "

EPA September 2006 response:

The Navy response is sufficient if it is implemented in the succeeding version of the *Expanded Range Assessment/Phase II Site Inspection Work Plan* in the manner stated above. However, the EPA would like to review the expanded approach prior to its inclusion in the final version of the work plan. Please provide the EPA with a copy of the expanded approach for review prior to its inclusion in the final version of the work plan.

Response: EPA will be provided a copy of the expanded approach to minimizing impacts to threatened and endangered species during vegetation clearance and other investigation

and response activities for review prior to its inclusion in the final version of the work plan.

EPA APRIL 2006 SPECIFIC COMMENT:

8. **Appendix A, Health and Safety Plan, Table A-1 Hazard Analysis, page 5:** This page contains a subsection entitled 'Inspection/certification of ORS*.' No definition of the acronym 'ORS' is provided. Please correct this omission.

The Navy response to this comment reads as follows:

"ORS, or 'ordnance related scrap' is an outdated term originally defined by the USA Corps of Engineers Ordnance and Explosives. The currently approved term is MD or 'munitions debris'. ORS will be replaced by MD, with the appropriate entry under the acronym listing."

EPA September 2006 response:

The Navy response is sufficient if it is implemented in the succeeding version of the *Expanded Range Assessment/Phase II Site Inspection Work Plan* in the manner stated above. However the word "Ordnance" is misspelled as "Ordinance" in the response.

Response: The spelling will be corrected.

EPA APRIL 2006 SPECIFIC COMMENT:

9. **Appendix A, Health and Safety Plan, Table A-1 Hazard Analysis, page 6:** This page contains a subsection entitled 'Anomaly Reacquisition.' In that subsection it is noted that 'Non-UXO Personnel' represent a hazard during MEC operations. It then states that the contractor will 'Stop all MEC operations when non-UXO-qualified personnel are within the EZ.'" The term UXO-Qualified, as defined in DoD Explosives Safety Board TP 18 (Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel), excludes UXO Technician I personnel from the definition of 'UXO-Qualified' personnel. In addition, authorized visitors who are not 'UXO-Qualified' are now allowed inside the EZ during MEC operations when approved by the appropriate authorities. Please revise this section of the noted table to eliminate the cited discrepancies.

The Navy response to this comment reads as follows:

"The following will be added as a footnote to Table A-1. 'By USACE regulations, sweep personnel are not permitted within the EZ while "MEC operations" (intrusive and explosive operations such as demolition) are being performed; UXOT Is can only be in the EZ, under the same circumstances, if under the supervision of UXOT IIs or IIIs. Non-UXO Technician personnel can be designated as Essential Personnel to observe MEC operations if they have a letter authorizing them from the appropriate federal agency, a risk analysis has been performed, and they have been briefed on safety and are escorted by UXOT II or higher. No more than two authorized visitors, can enter the EZ at one time'.

Table A-1 will be modified to state 'Non-UXO technician personnel as below.' and 'Stop all MEC operations when non-UXO-technician personnel are within the EZ as below'."

EPA September 2006 response:

The Navy response is questionable due to the last listed modification of Table A-1 which reads, "Table A-1 will be modified to state 'Non-UXO technician personnel as below.' and 'Stop all MEC operations when non-UXO-technician personnel are within the EZ as below'." If the last revised statement is added to the table, it will preclude EPA personnel that are not "UXO-technician personnel" from observing in-process MEC operations. This is unacceptable to the EPA. Please revise the table to read in a manner that does not preclude personnel that are authorized to enter the EZ, yet are "non UXO-technician personnel," from observing in-process MEC operations.

Response: The intent was to allow authorized "Essential Personnel" visitors as stated in the footnote, while stopping work when non-UXO-technicians are present who have not been designated as Essential Personnel as noted in the footnote. The footnote will be broken into numbered footnotes to clarify:

1) By USACE regulations, sweep personnel are not permitted within the EZ while "MEC operations"(intrusive and explosive operations such as demolition) are being performed; UXOT Is can only be in the EZ, under the same circumstances, if under the supervision of UXOT IIs or IIIs.

2) Non-UXO Technician personnel can be designated as Essential Personnel to observe MEC operations if they have a letter authorizing them from the appropriate federal agency, a risk analysis has been performed, and they have been briefed on safety and are escorted by UXOT II or higher. No more than two authorized visitors, can enter the EZ at one time'.

The modifications to Table A-1 will be changed to: "Stop all MEC operations when non-UXO-technician personnel are within the EZ^{1,2}" and "Non-UXO technician personnel^{1,2}"

EQB comments

EQB April 2006 comment:

1. Pg 2-2, Sec 2.2, Lines 8-17, Pg 2-3, Sec 2.2, Lines 2-17, Pg. 3-1, Sec 3.1, Lines 4-9. Some of the descriptions of the various sites are getting confusing. There are many sites and they are called by various names. For example, on these lines we have Ranges 1 through 6, which are also referred to as other range numbers:

- Range 3 "here forth identified as Range 4"
- Range 4 "here forth identified as Range 4B"
- Range 5 "here forth identified as Range 3"

Note that the bullet on line 37 at the bottom of page 2-2 contradicts the text on lines 8 through 17. The text says that here forth the ranges will be referred to as Range 1, 2, 3, 4, 4B, and 6. The bullet on Line 37 refers to Ranges 3, 4, 4A, 4B, and 5. There is no mention of Range 4A in the text on lines 8 - 17, so which range is actually Range 4A?

There is also the discrepancy between the references to Range 6 in the text and Range 5 in the bullet. It is not possible to understand which range is which EMA MRS by the description provided here. Add to that the fact that the Phase I ERA/SI Report refers to

Ranges 3, 4, 4A, 4B, and 6. There is no mention of Range 4A in lines 8 - 17 and we still have the discrepancy between Ranges 5 and 6.

Also, Figure 2-4 shows nine ranges along the north road, not six.

By the time one gets to page 2-3 a score card is needed to attempt to understand the sites. This text discusses MRS numbers, Range numbers, PIs, PAOCs, and then AOIs are added to the mix in Chapter 3 (see Figure 3-1). Add this to the fact that the MRS numbers are duplicated between the EMA, SIA, LIA, and ECA and the result is an inability for the reader to understand which site is being discussed.

Then, there are two new AOIs listed as being subjects for this work. Since they are not designated, how are they going to be discussed? "AOI North" and "AOI South"? Please explain.

A final example of the confusing nature of the site designations used in this document is the text on page 3-1, lines 4 - 9 which reads: "Based on the results of the ERA/Phase I SI the following MRSs will be investigated during the Phase II SI: the entire MRA-ECA; the MRA Beach Area within the EMA, SIA and LIA; a total of 9 MRSs, including one PI site, and one PAOC site in the MRA-SIA; and a total of 22 MRSs within the EMA, including five PI sites, and three PAOC sites. In addition to the MRSs to be investigated two areas of interest (AOIs) identified from the LiDAR survey and will be investigated during the ERA/Phase II SI. The AOIs are within the boundary of MRS 43." It is very difficult to understand the meaning of these three sentences.

Some method is needed to allow the reader to understand which site is being discussed. A scorecard, such as is provided in Table 3-1 may be the answer. Modifying this table (note that it only refers to EMA Ranges 3, 4, 4A, 4B, and 5 and that there is no mention of Ranges 1, 2, and 6) and putting it in the front of the document may be the answer. This issue of numbering and designating sites may deserve a separate chapter because there is little hope of achieving group and public understanding of the project if we can't efficiently refer to sites when they are being discussed.

The Navy response to this comment reads as follows:

Nomenclature: The site nomenclature is a combination of standard Department of Defense (DoD) and standard US Environmental Protection Agency site descriptors. DoD breaks the site down into five munition response areas (MRAs) (see Figure 2-2), the Eastern Maneuver Area (EMA), the Surface Impact Area (SIA), the Live Impact Area (LIA), the Eastern Conservation Area (ECA), and the Beach MRA. These MRAs are in turn broken down into munition response sites (MRSs). It has, to date, not been necessary to subdivide the Beach MRA into MRSs. Note that the MRSs are numbered incrementally for each MRA, and that the MRS numbers do not signify priority. Because the MRS numbers are duplicated across MRAs, where MRS numbers are cited in the text, if there is any question as to in which MRA that particular MRS resides, the MRA should be cited as well.

Note that the EMA-MRS 43 includes all land area within the EMA which is covered by

artillery safety fans, excluding areas designated as other MRSs (Figure 2-4 shows artillery safety fans). EMA-MRS 44 includes all land area within the EMA which is outside the area covered by artillery safety fans, excluding areas designated as other MRSs. SIA-MRS 7 includes all land area within the SIA which is covered by artillery safety fans, excluding areas designated as other MRSs. Figure 2-2 will be revised, replacing in the notes range fan(s) with artillery safety fan(s).

Ranges: The discussion of range numbering will be clarified in the Expanded Range Assessment and Phase II Site Inspection Work Plan. In addition to the six EMA ranges mentioned in the draft document on page 2-2 lines 8-17, page 2-2 lines 18-22 discuss what were originally classified as nine ranges within the EMA. These ranges are ranges 1, 2, 3, 4, 5, 6, 7, 8, and 9. In historical documents, ranges 4, 4A, and 4B were considered one range, currently they are considered separate ranges. Thus, there are actually 11 ranges in the EMA (Figure 2-3). The text on page 2-2, lines 18-22 will be changed to: *“An aerial photograph analysis of the EMA and SIA (ERI, 2002) indicates that as many as 9 ranges (11 ranges now that range 4 has been subdivided into 3 discrete ranges, 4, 4A, and 4B) and up to 30 gun emplacements and positions may have existed historically at the EMA (Figure 2-5). These ranges are currently identified as ranges 1, 2, 3, 4, 4A, 4B, 5, 6, 7, 8, and 9. Additionally the aerial photograph analysis identified up to nine gun positions and eight observation posts within the SIA (identified on Figure 2-5 as GP for gun position, OP for observation post, or PI for photo-identified site, if the photo-identified site use could not be confirmed). These SIA sites may have been used for mortar or artillery gun training.”*

As discussed in the 6/1/06 CTC meeting Table 3-1, MRS 30 will be changed to include range 8. Also, items evaluated during the ERA Phase I SI will be removed from the table.

Page 3-1, lines 4-9 will be changed to:

“Based on the results of the ERA/Phase I SI, the following MRSs will be investigated during the Phase II SI:

- *MRA-ECA: The entire MRA-ECA.*
- *MRA Beach Area: The beaches in the EMA, SIA, LIA and ECA.*
- *MRA-SIA: A total of 7 MRSs, and one PI site, and one PAOC site.*
- *MRA-EMA: A total of 22 MRSs including five PI sites and three PAOC sites.*

In addition to the EMA-MRSs, PI sites, and PAOC sites noted above, two areas of interest (AOIs) identified during the LIDAR survey will be investigated during the ERA/Phase II SI. These AOIs are located within the boundaries of EMA-MRS 43 (Figure 3-1).”

Figure 3-1 will be revised to identify the northern AOI as AOI-1, and the southern AOI as AOI-2. If munitions response actions are determined to be warranted, the AOIs will become new MRSs.

EQB August 2006 comment:

EQB agrees that the changes to the document proposed by the Navy are appropriate and should help correct some of the confusion that was created by the original discussion of the various sites discussed in the document. However, it is recommended that the Navy and

CH2M Hill examine the numbering system and evaluate whether or not it is likely to provide an efficient system for identifying the various sites. It should be remembered that the public and multiple agencies will be involved in discussing these sites in the future and many of these persons are not native English speakers. Developing a more simplified site naming system may simplify communication. For example:

- it is not necessary to start the numbering of MRSs with the number 1 in each MRA. It may be advantageous to use a consecutive numbering system so that there is only one MRS 12.
- The suggestion for a “scorecard” was a serious one. Producing a table that shows the MRS designation and linking this current designation to other previous or associated names for the site (for example, the previously used Range numbers) may be a very helpful reference for reviewers of the document.

Response: As discussed in the MR Subcommittee meeting of September 19th, the site numbering system will be retained.

EQB April 2006 comment:

2. Pg 2-2 to 2-3, Sec 2.2, Line 26 to 2. This section says that there are no impacts or potential environmental releases observed at PI 9. However, it is known that the shore area of PI 9 is heavily contaminated with MC and possibly MEC. It is recommended that this near-shore contamination be investigated and that PI 9 not be referred to as being documented to have no potential environmental releases. This same comment was made to the Phase I ERA/SI Report.

The Navy response to this comment reads as follows:

The section states that no impacts of any potential environmental releases were observed (at PI 9 and others). MRSs are defined as ending at the low tide line. Items below the low tide line, in the near shore zone, will be addressed as warranted following the investigation and remedial actions for inland areas. The types of items found at EMA MRS 12 consisted of small arms and expended items. A number of subsurface anomalies were identified in EMA MRS 12, and a subsurface evaluation was recommended. An investigation of environmental contamination from MC will be conducted, for this site as with all other munitions response sites, after the munitions response action(s) is/are completed.

EQB August 2006 comment:

It is EQB's understanding that ordnance debris projects out of the water at PI 9/EMA MRS 12. This makes it at least debatable whether or not this contamination should be considered a subsurface anomaly. This site has not been visited by EQB in some time, and it is recommended that a visit to examine this contamination be performed in the near future. But, the main point of the comment is to question the statement that there are no impacts of environmental releases at PI 9/EMA MRS 12. It is not known what level of effort was made to support this determination. A case could be made that MC projecting above the waterline (if this is the case) is evidence of an environmental release. It also hasn't been established that this pile of ordnance scrap consists of only MC since it hasn't been investigated yet.

EQB is concerned with the safety residents and visitors to Vieques. Having an ordnance scrap dump accessible to anyone with a boat is a concern because it is possible that this site, potentially containing hazardous ordnance or MC can be disturbed by trespassers at any time.

Because of this EQB recommends that the description of this site be modified to recognize these potential hazards.

Response: As discussed during the MR Subcommittee meeting of September 19th 2006, EMA MRS-46 has been expanded to include the area south of EMA MRS-12 including Puerto Ferro (see attached revised Figure 2-2). The locations where the items are visible at low tide will be evaluated to identify munitions related materials.

EQB April 2006 comment:

3. Pg 2-3, Sec 2-2, Lines 18-29. These lines describe recommendations from the Phase I ERA/SI Report. It should be noted that EQB has comments on these recommendations as reflected in our comment numbers 27 through 30 in our comments to the Phase I ERA/SI Report. It is recommended that the comments on the recommendations contained in the Phase I ERA/SI Report be resolved first and then this section of the Phase II Work Plan can be revised accordingly.

The Navy response to this comment reads as follows:

As discussed in the responses to comments numbers 27 through 30 of the ERA and Phase I SI Report, the explosive hazard severity for EMA MRS 6 and EMA MRS 12 have been revised to follow the Site Prioritization Protocol's Table 1 classification within the EHE module munitions type. The explosive safety hazard screening category for EMA MRS 6 is moderate-high. The explosive safety hazard screening category for EMA MRS 12 is high. Because there is evidence that these sites have been impacted the recommendation is for further investigation; however, because all of the items found were expended, relative to some of the other sites they have a lower priority. The recommendations contained in the above mentioned section of the Phase II Work Plan are unchanged.

With respect to EMA MRS 12, MEC debris in near-shore water is outside the scope of this work, and not part of EMA MRS 12. Only MD was found in this MRS.

EQB August 2006 comment:

This comment deals with the hazard assessment protocol used in this document. The response describes revisions to the hazard assessments for these MRS that are contained in the Navy's responses to EQB's comments on the Phase I ERA SI Report. The Navy is correct that these changes were made in the Navy's responses to that report. However, the responses to EQB comments on the ERA SI Phase I Report are dated March 2006. Since that time, the Navy as agreed to revise the hazard assessment protocol at the last MR Committee meeting held in San Juan on May 31, 2006. As recorded in UXO Pro's report to EQB on that meeting:

- "The hazard assessment section of this document [note: "this document" is the Phase I ERA SI Report] was discussed at length. Jim Pastorick made the point that the current hazard assessment protocol is not useful to the project because it doesn't discriminate explosive hazards very well and it also doesn't accurately represent the

ranking procedure of the Site Prioritization Protocol on which it is based. **It was decided that CH2M Hill would review the hazard ranking procedure and revise it within three weeks. Chris Penny said that the hazard assessment protocol should be a recurring topic of discussion for the MR Committee until it is resolved.”**

To date no revisions to the hazard ranking protocol have been discussed with EQB or received by EQB. Therefore, EQB considers this comment to be still unresolved and open for discussion and future resolution.

EQB August 2006 comment part 2:

With respect to the second paragraph of the Navy response “With respect to EMA MRS 12, MEC debris in near-shore water is outside the scope of this work, and not part of EMA MRS 12. Only MD was found in this MRS”, please see the Additional EQB Comment #2 above.

Response to part 1: The hazard assessment protocol was discussed in the September 19 2006 MR Subcommittee meeting. As discussed in the meeting, no changes will be made to this document on the hazard assessment protocol. However, the hazard assessment protocol will continue to be evaluated by the MR Subcommittee.

Response to part 2: As discussed above in the most recent Navy response to EQB April 2006 comment 2. Pg 2-2 to 2-3, Sec 2.2, Line 26 to 2, the locations where the items are visible at low tide will be evaluated to identify munitions related materials.

EQB April 2006 comment:

14. Pg 5-1, Sec 5.2, Line 18-28. This section references the hazard evaluation and site prioritization performed as part of the Phase I ERA/SI. However, EQB had several comments (comment numbers 25 – 30) on the hazard evaluation and site prioritization in the Phase I ERA/SI which have not been resolved. It is recommended that EQB’s comments on the hazard evaluation and site prioritization in the Phase I ERA/SI be discussed and resolved before the results of that evaluation and screening process are implemented in this work plan.

The Navy response to this comment reads as follows:

The explosive hazard categories have been revised to include the 11 categories given in the DoD Site Prioritization Protocol. The “Riot Control” category has been retained for consistency with the DoD protocol. See response to comments 25 through 30 of the ERA and Phase I SI Report.

The categories are:

Classification	Description	Score
Sensitive	<ul style="list-style-type: none"> • All UXO that are considered likely to function upon any interaction with exposed persons (e.g., submunitions, 40mm high-explosive[HE] grenade projectiles, white phosphorus [WP] munitions, high-explosive antitank [HEAT] munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions). • All hand grenades containing energetic filler • Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an 	30

	explosive hazard.	
High explosive (used or damaged)	<ul style="list-style-type: none"> • All UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered “sensitive” • All DMM containing a high-explosive filler that have: <ul style="list-style-type: none"> -Been damaged by burning or detonation -Deteriorated to the point of instability. 	25
Pyrotechnics (used or damaged)	<ul style="list-style-type: none"> • All UXO containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades). • All DMM containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades) that have: <ul style="list-style-type: none"> -Been damaged by burning or detonation -Deteriorated to the point of instability. 	20
High explosive (unused)	<ul style="list-style-type: none"> • All DMM containing a high explosive filler that: <ul style="list-style-type: none"> -Have not been damaged by burning or detonation -Are not deteriorated to the point of instability. 	15
Propellant	<ul style="list-style-type: none"> • All UXO containing mostly single-, double-, or triple-based propellant, or composite propellants(e.g., rocket motor). • All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants(e.g., rocket motor) that are: <ul style="list-style-type: none"> -Damaged by burning or detonation -Deteriorated to the point of instability. 	15
Bulk secondary high explosives, pyrotechnics, or propellant	<ul style="list-style-type: none"> • All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants(e.g., rocket motor), that are deteriorated • Bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard. 	10
Pyrotechnic (not used or damaged)	<ul style="list-style-type: none"> • All DMM containing pyrotechnic fillers (i.e., red phosphorous), other than white phosphorous filler that: <ul style="list-style-type: none"> -Have not been damaged by burning or detonation -Are not deteriorated to the point of instability. 	10
Practice	<ul style="list-style-type: none"> • All UXO that are practice munitions that are not associated with a sensitive fuse. • All DMM that are practice munitions that are not associated with a sensitive fuse and that have not: <ul style="list-style-type: none"> -Been damaged by burning or detonation -Deteriorated to the point of instability. 	5
Riot control	<ul style="list-style-type: none"> • All UXO or DMM containing a riot control agent filler (e.g., tear gas). 	3
Small arms	<ul style="list-style-type: none"> • All used munitions or DMM that are categorized as small arms ammunition. [Physical evidence or 	2

	historical evidence that no other types of munitions (e.g., grenades, subcaliber training rockets, demolition charges) were used or are present on the MRS is required for selection of this category.]	
Evidence of no munitions	Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
<p>Notes:</p> <ul style="list-style-type: none"> • Former (as in “former military range”) means the MRS is a location that was (1) closed by a former decision made by the Component with administrative control over the location, or (2) put to a use incompatible with the presence of UXO, DMM, or MC. • Historical evidence means the investigation: (1) found written documents or records, (2) documented interviews of persons with a knowledge of site conditions, or (3) found and verified other forms of information. • Physical Evidence means: (1) recorded observations from on-site investigations, such as finding intact UXO or DMM, or munitions debris (e.g., fragments, penetrators, projectiles, shell casings, links, fins); (2) the results of field or laboratory sampling and analysis procedures; or (3) the results of geophysical investigations. • Practice munitions means munitions that contain an inert filler (e.g., wax, sand, concrete), a spotting charge (i.e., a small charge of red phosphorous, photoflash powder, or black powder used to indicate the point of impact), and a fuze. • The term small arms ammunition means ammunition, without projectiles that contain explosives (other than tracers), that is .50 caliber or smaller, or for shotguns. 		

EQB August 2006 comment:

Please see the Additional EQB Comment on #3 above. In addition, the Navy’s response merely cuts and pastes Table 1 from the Site Prioritization Protocol. There is no explanation for why this is an appropriate hazard ranking method for the Vieques Phase II SI. As is documented in the Additional EQB Comment on #3 above, “It was decided that CH2M Hill would review the hazard ranking procedure and revise it within three weeks. Chris Penny said that the hazard assessment protocol should be a recurring topic of discussion for the MR Committee until it is resolved.” However, it has not been resolved and, in fact, there have not been any additional meetings or discussion on this topic. EQB considers this comment to be not resolved and open for discussion.

Response: The hazard assessment protocol was discussed in the September 19 2006 MR Subcommittee meeting. As discussed in the meeting, no changes will be made to this document on the hazard assessment protocol. However, the hazard assessment protocol will continue to be evaluated by the MR Subcommittee.

EQB April 2006 comment:

19. App B Attachment and Table 1. Much of the Attachment to Appendix B (the GPO

Plan) repeats the requirements of Appendix F to the Master Work Plan. Inclusion of this information only serves to cause confusion where the Appendix B Attachment doesn't agree with Appendix F to the MWP.

For example, both documents contain an introductory section on "Purpose." However, the attachment to Appendix B excludes two of the requirements contained in Appendix F to the MWP: "Document system reliability" and "Evaluate estimated field production rates and estimated false positive ratios, as related to project cost". Is the deletion of these requirements a formal modification to the MWP which means that documentation of system reliability and field production rates is not part of the function of the GPO? If so, why? Why was it included as part of the purpose in the MWP and not in the Phase II ERA/SI? And why repeat all of the other requirements verbatim if they are unchanged?

It is recommended that the attachment to Appendix B be scrubbed to eliminate all text that is duplicative to the existing requirements of the MWP because this duplication with only minor changes causes confusion.

Also, the section on DQOs is slightly different than that contained in the MWP. For example, the requirement for "Downline Data Density" is not in the MWP and the text for "Survey Coverage (Lane Spacing)" is different than that in the MWP. Are these formal changes which should be reflected in the next version of the MWP or are they errors in the attachment to Appendix B?

Also, Table 1 on "Project Data Quality Objectives" contains numerous conflicts with the text in the work plan and the MWP. Project DQOs are contained in several places in this document and the MWP so it is inevitable that there will be contradictions. For example, Table 1 says that the DQO for transect spacing is for no more than a 2-ft. gap. Is this the same as the MWP requirement for "Lane Spacing (Sensor Separation)" contained in the MWP? They appear to be different (the MWP contains a 2% requirement and a 1-ft. radius requirement). Another difference is the Table 1 requirement for "Search transect spacing to vary no more than + or - 20% of spacing specified in sampling design." This appears to be different than the 98% coverage requirement in the MWP Appendix F.

Also, Table 1 doesn't have any DQO for reacquisition accuracy as does the MWP Appendix F. Why is this DQO missing?

The Navy response to this comment reads as follows:

The Master Work Plan is intended to be a general overarching guidance document. Where site specific projects vary from the general guidance, site specific work plans are written to document the changes. This Draft Expanded Range Assessment Site Investigation Phase II Work Plan is such a document, providing modifications to the general guidance for this specific project. The geophysical investigation plan in this document is a later edition, and reflects updates that will be made to the Master Work Plan when it is next revised.

EQB August 2006 comment:

Based on the Navy's response these changes represent significant changes to the MWP. However, by merely including these changes in the site-specific work plan without discussion the Navy puts EQB in the position of having to spend a significant amount of time comparing the two documents, looking for variations, and evaluating those variations.

For example, since the response says that the text in the site-specific work plan takes precedent, EQB assumes that there is not DWP for reacquisition accuracy (since it is not referenced in the site-specific work plan). Or, does the original reacquisition accuracy DQO from the MWP still apply?

Figuring this out which changes apply to the MWP and which portions of the MWP are still valid is nearly impossible under these circumstances. It is highly recommended that the Navy list these important changes to the GPO plan contained in the MWP, that has already been agreed upon, so these changes can be recognized and understood by all agencies and reviewers involved. Submitting a change notice to the MWP would be an appropriate format for implementing these changes.

Response: To clarify the original comment: The Master Work Plan is the general overarching guidance document. Where site specific work plans specifically call out changes, those changes apply for the specific project only. If the site specific work plan does not contain a requirement in the Master Work Plan, that requirement is still valid for the site specific project. The geophysical investigation plan in this document is a later edition, and reflects updates that will be made to the Master Work Plan when it is next revised. Specifically:

- **The requirements to "Document system reliability" and "Evaluate estimated field production rates and estimated false positive ratios, as related to project cost" will be added to the purpose section of the Geophysical Prove-Out Work Plan in the Expanded Range Assessment and Phase II Site Inspection Work Plan**
- **The requirements for "Downline Data Density" and the revised text for "Survey Coverage (Lane Spacing)" will be added to the Master Work Plan when it is next revised.**
- **In response to the original April comment that states "Table 1 says that the DQO for transect spacing is for no more than a 2-ft. gap. Is this the same as the MWP requirement for Lane Spacing (Sensor Separation) contained in the MWP?" The DQO quoted is for downline data density (data density along the line of travel in the geophysical survey), which is different than lane spacing (the distance between individual geophysical survey lines). The requirements are correct as written in the documents.**
- **The requirement in the site specific Geophysical Prove-Out Work Plan for "Search transect spacing to vary no more than + or - 20% of spacing specified in sampling design" is an update to standard requirements and will be revised in the Master Work Plan Appendix F.**
- **The site specific work plan does not contain the DQO for reacquisition accuracy provided in the Master Work Plan. The DQO for reacquisition accuracy was written for the case where an anomaly is identified and flagged, and another geophysical team/technique is used to try to more accurately identify the location. This type of work is not planned in the Expanded Range Assessment and Phase II**

Site Inspection, only geophysical mapping will be conducted. Reacquisition and anomaly investigation will be carried out as part of future removal actions.

With respect to the most recent August 2006 comment: If there is no changed requirement established in the site specific work plan, then the requirements of the Master Work Plan stand. The original DQO for reacquisition in the MWP still applies, though reacquisition is not planned for this phase of work. The Master Work Plan will be modified to reflect the changes stated in the responses to comments.

APPENDIX D

Response to Third Comments On the Expanded Range Assessment and Phase II Site Inspection Work Plan Former Vieques Naval Training Range (VNTR), Vieques, Puerto Rico, October 2006

EQB comments**EQB April 2006 comment:**

1. Pg 2-2, Sec 2.2, Lines 8-17, Pg 2-3, Sec 2.2, Lines 2-17, Pg. 3-1, Sec 3.1, Lines 4-9. Some of the descriptions of the various sites are getting confusing. There are many sites and they are called by various names. For example, on these lines we have Ranges 1 through 6, which are also referred to as other range numbers:

- Range 3 “here forth identified as Range 4”
- Range 4 “here forth identified as Range 4B”
- Range 5 “here forth identified as Range 3”

Note that the bullet on line 37 at the bottom of page 2-2 contradicts the text on lines 8 through 17. The text says that here forth the ranges will be referred to as Range 1, 2, 3, 4, 4B, and 6. The bullet on Line 37 refers to Ranges 3, 4, 4A, 4B, and 5. There is no mention of Range 4A in the text on lines 8 - 17, so which range is actually Range 4A?

There is also the discrepancy between the references to Range 6 in the text and Range 5 in the bullet. It is not possible to understand which range is which EMA MRS by the description provided here. Add to that the fact that the Phase I ERA/SI Report refers to Ranges 3, 4, 4A, 4B, and 6. There is no mention of Range 4A in lines 8 - 17 and we still have the discrepancy between Ranges 5 and 6.

Also, Figure 2-4 shows nine ranges along the north road, not six.

By the time one gets to page 2-3 a score card is needed to attempt to understand the sites.

This text discusses MRS numbers, Range numbers, PIs, PAOCs, and then AOIs are added to the mix in Chapter 3 (see Figure 3-1). Add this to the fact that the MRS numbers are duplicated between the EMA, SIA, LIA, and ECA and the result is an inability for the reader to understand which site is being discussed.

Then, there are two new AOIs listed as being subjects for this work. Since they are not designated, how are they going to be discussed? “AOI North” and “AOI South”? Please explain.

A final example of the confusing nature of the site designations used in this document is the text on page 3-1, lines 4 – 9 which reads: “Based on the results of the ERA/Phase I SI the following MRSs will be investigated during the Phase II SI: the entire MRA-ECA; the MRA Beach Area within the EMA, SIA and LIA; a total of 9 MRSs, including one PI site, and one PAOC site in the MRA-SIA; and a total of 22 MRSs within the EMA, including five PI sites, and three PAOC sites. In addition to the MRSs to be investigated two areas of interest (AOIs) identified from the LiDAR survey and will be investigated during the ERA/Phase II SI. The AOIs are within the boundary of MRS 43.” It is very difficult to understand the meaning of these three sentences.

Some method is needed to allow the reader to understand which site is being discussed.

A

scorecard, such as is provided in Table 3-1 may be the answer. Modifying this table (note that it only refers to EMA Ranges 3, 4, 4A, 4B, and 5 and that there is no mention of Ranges 1, 2, and 6) and putting it in the front of the document may be the answer. This issue of numbering and designating sites may deserve a separate chapter because there is little hope of achieving group and public understanding of the project if we can't efficiently refer to sites when they are being discussed.

The Navy response to this comment reads as follows:

Nomenclature: The site nomenclature is a combination of standard Department of Defense (DoD) and standard US Environmental Protection Agency site descriptors. DoD breaks the site down into five munition response areas (MRAs) (see Figure 2-2), the Eastern Maneuver Area (EMA), the Surface Impact Area (SIA), the Live Impact Area (LIA), the Eastern Conservation Area (ECA), and the Beach MRA. These MRAs are in turn broken down into munition response sites (MRSs). It has, to date, not been necessary to subdivide the Beach MRA into MRSs. Note that the MRSs are numbered incrementally for each MRA, and that the MRS numbers do not signify priority. Because the MRS numbers are duplicated across MRAs, where MRS numbers are cited in the text, if there is any question as to in which MRA that particular MRS resides, the MRA should be cited as well.

Note that the EMA-MRS 43 includes all land area within the EMA which is covered by artillery safety fans, excluding areas designated as other MRSs (Figure 2-4 shows artillery safety fans). EMA-MRS 44 includes all land area within the EMA which is outside the area covered by artillery safety fans, excluding areas designated as other MRSs. SIA-MRS 7 includes all land area within the SIA which is covered by artillery safety fans, excluding areas designated as other MRSs. Figure 2-2 will be revised, replacing in the notes range fan(s) with artillery safety fan(s).

Ranges: The discussion of range numbering will be clarified in the Expanded Range Assessment and Phase II Site Inspection Work Plan. In addition to the six EMA ranges mentioned in the draft document on page 2-2 lines 8-17, page 2-2 lines 18-22 discuss what were originally classified as nine ranges within the EMA. These ranges are ranges 1, 2, 3, 4, 5, 6, 7, 8, and 9. In historical documents, ranges 4, 4A, and 4B were considered one range, currently they are considered separate ranges. Thus, there are actually 11

ranges in the EMA (Figure 2-3). The text on page 2-2, lines 18-22 will be changed to: *“An aerial photograph analysis of the EMA and SIA (ERI, 2002) indicates that as many as 9 ranges (11 ranges now that range 4 has been subdivided into 3 discrete ranges, 4, 4A, and 4B) and up to 30 gun emplacements and positions may have existed historically at the EMA (Figure 2-5). These ranges are currently identified as ranges 1, 2, 3, 4, 4A, 4B, 5, 6, 7, 8, and 9. Additionally the aerial photograph analysis identified up to nine gun positions and eight observation posts within the SIA (identified on Figure 2-5 as GP for gun position, OP for observation post, or PI for photo-identified site, if the photo-identified site use could not be confirmed). These SIA sites may have been used for mortar or artillery gun training.”*

As discussed in the 6/1/06 CTC meeting Table 3-1, MRS 30 will be changed to include range 8. Also, items evaluated during the ERA Phase I SI will be removed from the table.

Page 3-1, lines 4-9 will be changed to:

“Based on the results of the ERA/Phase I SI, the following MRSs will be investigated during the Phase II SI:

- *MRA-ECA: The entire MRA-ECA.*
- *MRA Beach Area: The beaches in the EMA, SIA, LIA and ECA.*
- *MRA-SIA: A total of 7 MRSs, and one PI site, and one PAOC site.*
- *MRA-EMA: A total of 22 MRSs including five PI sites and three PAOC sites.*

In addition to the EMA-MRSs, PI sites, and PAOC sites noted above, two areas of interest (AOIs) identified during the LIDAR survey will be investigated during the ERA/Phase II SI. These AOIs are located within the boundaries of EMA-MRS 43 (Figure 3-1).”

Figure 3-1 will be revised to identify the northern AOI as AOI-1, and the southern AOI as AOI-2. If munitions response actions are determined to be warranted, the AOIs will become new MRSs.

EQB August 2006 comment:

EQB agrees that the changes to the document proposed by the Navy are appropriate and should help correct some of the confusion that was created by the original discussion of the various sites discussed in the document. However, it is recommended that the Navy and CH2M Hill examine the numbering system and evaluate whether or not it is likely to provide an efficient system for identifying the various sites. It should be remembered that the public and multiple agencies will be involved in discussing these sites in the future and many of these persons are not native English speakers.

Developing a more simplified site naming system may simplify communication. For example:

- it is not necessary to start the numbering of MRSs with the number 1 in each MRA. It may be advantageous to use a consecutive numbering system so that there is only one MRS 12.
- The suggestion for a “scorecard” was a serious one. Producing a table that shows the MRS designation and linking this current designation to other previous or associated names for the site (for example, the previously used

Range numbers) may be a very helpful reference for reviewers of the document.

Navy response to August 2006 comment reads as follows:

As discussed in the MR Subcommittee meeting of September 19th, the site numbering system will be retained.

EQB October 2006 comment:

It doesn't appear to be possible for EQB to convince the Navy that the complexity designed into the current site numbering system should be corrected to make the site numbering system more user-friendly. However, EQB would like to make the following two points:

1. EQB doesn't agree with the Navy response above indicating that it was agreed and understood that the existing site numbering system will be retained. Our notes from the last MR Committee meeting (September 19, 2006) only reference discussion of comments 2, 3, 14, and 19. It is possible that this comment was discussed and not recorded by EQB during the meeting. This is another example of why it would be advisable to spend a short amount of time at the end of each MR Committee meeting to review agreements and action items and develop a consensus list of agreements, conclusions and action items.
2. Recent E-mails with USFWS indicate that they are having difficulty understanding which sites on VNTR are being discussed. In these informal discussions EPA has indicated similar concern. This is another indication that the current numbering system is creating confusion among members of the Vieques Project Team.

This problem is only going to worsen over time unless action is taken to simplify the site numbering system. EQB again recommends that the site numbering system be updated and simplified to allow efficient communication concerning specific project sites on the VNTR.

Navy Response:

The Navy is proposing to make clarifications to the current numbering system. It is our understanding that the primary concerns with the current system fall into two categories:

1) The concern that munition response site (MRS) numbers are non-unique, and can be confused when the munition response area (MRA) is not cited as well. In response to this concern we propose that whenever a site is discussed in text or in verbal discussion, the MRA identifier (EMA, SIA, LIA, and ECA) be used as well as the MRS number. This has the additional advantage of giving the reader/listener a cue that narrows down the area in which the MRS lies, making it easier to find on a map or mentally remember where it is located.

2) The concern that there are so many different descriptors for sites; MRAs and MRSs, potential areas of concern (PAOCs), photo identified (PI) sites, areas of concern (AOCs), gun positions, ranges, open burn/open detonation (OB/OD) sites, and solid waste management units (SWMUs). There are many different site descriptors in use on the Vieques Munitions Response Program (MRP). It is important to remember however, that they have different uses. MRAs and MRSs subdivide the areas

currently under investigation in the MRP into large and small subdivisions. AOCs are numbered sequentially regardless of MRA. They are new areas to be investigated to determine if they need to be renamed as MRSs for further investigation, based on the findings from the Site Inspection. The remainder of the nomenclature consists of historical site use areas (gun positions, ranges, OB/OD sites) and historical nomenclature for areas that were investigated or of some interest (PIs, PAOCs, and SWMUs). These historical sites use names and area of investigation names often overlap boundaries of MRSs, and as such have little connection with MRS identifiers. Changing this historical site use nomenclature would confuse the reader when the historical documents are reviewed.

In order to allow easy cross referencing of historical site names with MRSs we have created a MRA, MRS, and historical site use/name matrix table (Table 3-1), similar to the score card proposed in EQB’s comment. Table 3-1 was revised to include all known historical sites. The site names of sites to be investigated as part of Phase II are identified in bold, the names of sites previously investigated in Phase I are shaded and cross referenced to MRAs, MRSs, and historical site use/names. It has been our experience that renaming sites to a new nomenclature would create much confusion among readers. One would have to take into account the date at which a document was written in order to determine which site is which. Referencing the MRA with the MRS should resolve any MRA/MRS confusion, and the cross-referencing in Table 3-1 should clarify any questions as to historical site names.

TABLE 3-1
Parcel, MRA, MRS, and Historical Site Use/Name Matrix
Former VNTR, Vieques, Puerto Rico

MRA	MRS Number	Historical Site Use/Name
MRA-Beach Area*		Differentiated based on associated MRA and MRS
MRA-LIA	MRS 1	SAM West/Air-to-Ground (ATG) Target
	MRS 2	ATG Target
	MRS 3	Strafing Run/ATG Target
	MRS 4, 5, 6, 7, 8*, 9*, 10*	ATG Target
	MRS 11*	Convoy Target/ATG Target
	MRS 12*	ATG Target
	MRS 13*	Mock Runway/ATG Target
	MRS 14*, 15*, 16, 17, 18*, 19*, 20*, 21*, 22*	ATG Target
	MRS 23*	SAM EAST/ATG Target
	MRS 24*, 25*, 26*, 27*, 28	ATG Target
	MRS 29*	OB/OD?ATG Target
	MRS 30, 31*	ATG Target, EOD range (SWMU 3)
MRA-SIA	MRS 1*	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas, Observation Point 5, 12, 13, 14, Gun Position GP 5.

TABLE 3-1
 Parcel, MRA, MRS, and Historical Site Use/Name Matrix
 Former VNTR, Vieques, Puerto Rico

MRA	MRS Number	Historical Site Use/Name
MRA-SIA continued		PIs 22, 35.
	MRS 2	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas Gun Position 21. PIs-1, 22.
	MRS 3	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas
	MRS 4	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas PI-34, Observation Point 1, Gun Position GP 1. SWMUs 5, 8, 12. AOC-A
	MRS 5	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas
	MRS 6	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas PI-17
	MRS 7	Non-Explosive Ordnance Firing Range (SWMU 11) Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas, PIs-32, 33. PAOC Y.
MRA-EMA	MRS 1*	Range 3 – Hand Grenade Range
	MRS 2*	Range 4 – 40mm Rifle Grenade Range PAOC CC
	MRS 3*	Range 4A – Rocket Range
	MRS 4*	Range 4B – Rocket Range PAOC DD
	MRS 5*	Range 5 – Hand Grenade Range
	MRS 6*	Artillery shortfall area, Target area, Observation Points 9, 10, 11, Gun Positions 22, 25, GP 7, GP 9., PIs-15, 16.
	MRS 7*	
	MRS 8*	
	MRS 9*	PI-Gun Position 17
	MRS 10*	PI-Gun Position 18
	MRS 11*	PI-Gun Position 19
	MRS 12*	PI-9
	MRS 13	Observation point/bunker
	MRS 14	PI-3
	MRS 15	Gun Position 14, 15, 16
	MRS 16	Gun Position 9
	MRS 17	Gun Positions 3, 4, 5, 24; PI-27 and PI-28
	MRS 18	Gun Positions 2, 6, 12 and 13
	MRS 19	Area adjacent to Range 6
	MRS 20	Range 6 - Demolition and small arms range
	MRS 21	Gun Position 26
	MRS 22	Gun Position 1
	MRS 23	Gun Position 32
	MRS 24	Gun Position 33
	MRS 25	Gun Position 20

TABLE 3-1
Parcel, MRA, MRS, and Historical Site Use/Name Matrix
Former VNTR, Vieques, Puerto Rico

MRA	MRS Number	Historical Site Use/Name
MRA-EMA continued	MRS 26	Gun Position 34
	MRS 27	Gun Position 28;
	MRS 28	Gun Position 35, Artillery shortfall area. PI-30
	MRS 29	PI-29, 31. Artillery shortfall area, Gun Position GP-9, Observation Point 7. PAOC Z.
	MRS 30	Part of Range 8 Gun Position 8
	MRS 31	Gun Position 29
	MRS 32	Range 9 and Gun Position 7
	MRS 33	PI-12 and Gun Position 11
	MRS 34	Gun Position 10, part of Range 4a
	MRS 35	Gun Position 27
	MRS 36	Range 2 – Small Arms Range using pistols and shotguns, PI-23, PAOC AA
	MRS 37	Range 1 – Small arms range using service rifles, pistols, and machine guns, Gun position 23
	MRS 38	Range 7 with impact areas PAOC BB
	MRS 39	Area of Interest
	MRS 40	PIs-10, 19
	MRS 41	PI-14
	MRS 42	Area of Interest
MRS 43	Area of Interest, PIs-24, 25, 26, C-3 Bunker/OP, Gun positions 20, 30, 31, 36. AOs 1, 2.	
MRS 44	PIs-2, 4, 5, 6, 7, 10, 11, 18, 20, 21. PAOCs U, V, W, X, FF, EE. SWMUs 1, 2, 4, 6, 7, 10, AOCs F, G Camp Garcia Gun positions 8, 9. Part of Range 8	
MRS 45		
MRS 46	PI-13	
MRS 47	PI-8	
MRA-ECA	MRS 1	Impacts due to adjacent target areas

* Shaded were evaluated during ERA/Phase I SI
Bold to be evaluated during the ERA/Phase II SI.

EQB April 2006 comment:

2. Pg 2-2 to 2-3, Sec 2.2, Line 26 to 2. This section says that there are no impacts or potential environmental releases observed at PI 9. However, it is known that the shore area of PI 9 is heavily contaminated with MC and possibly MEC. It is recommended that this near-shore contamination be investigated and that PI 9 not be referred to as being documented to have no potential environmental releases. This same comment was made to the Phase I ERA/SI Report.

The Navy response to April 2006 comment reads as follows:

The section states that no impacts of any potential environmental releases were observed (at PI 9 and others). MRSs are defined as ending at the low tide line. Items below the low tide line, in the near shore zone, will be addressed as warranted following the investigation and remedial actions for inland areas. The types of items found at EMA MRS 12 consisted of small arms and expended items. A number of sub surface anomalies were identified in EMA MRS 12, and a subsurface evaluation was recommended. An investigation of environmental contamination from MC will be conducted, for this site as with all other munitions response sites, after the munitions response action(s) is/are completed.

EQB August 2006 comment:

It is EQB's understanding that ordnance debris projects out of the water at PI 9/EMA MRS 12. This makes it at least debatable whether or not this contamination should be considered a subsurface anomaly. This site has not been visited by EQB in some time, and it is recommended that a visit to examine this contamination be performed in the near future.

But, the main point of the comment is to question the statement that there are no impacts of environmental releases at PI 9/EMA MRS 12. It is not know what level of effort was made to support this determination. A case could be made that MC projecting above the waterline (if this is the case) is evidence of an environmental release. It also hasn't been established that this pile of ordnance scrap consists of only MC since it hasn't been investigated yet.

EQB is concerned with the safety residents and visitors to Vieques. Having an ordnance scrap dump accessible to anyone with a boat is a concern because it is possible that this site, potentially containing hazardous ordnance or MC can be disturbed by trespassers at any time.

Because of this EQB recommends that the description of this site be modified to recognize these potential hazards.

Navy response to August 2006 comment reads as follows:

As discussed during the MR Subcommittee meeting of September 19th 2006, EMA MRS-46 has been expanded to include the area south of EMA MRS-12 including Puerto Ferro (see attached revised Figure 2-2). The locations where the items are visible at low tide will be evaluated to identify munitions related materials.

EQB October 2006 Comment:

Figure 2-2 was not attached to this document so it was not reviewed. In general, EQB agrees that the Navy response captures the discussion on this site during the last MR Committee meeting (expanding EMA MRS-12 and scheduling the MC that protrudes from the water at low tide for evaluation). However, one additional agreement was documented in EQB's meeting notes: "It was agreed that small piles of MEC discovered by Felix on land will be investigated during the Phase II ERA/SI." Including investigation of the MEC discovered by Felix in the Phase II ERA/SI would complete this response.

Navy response:

The small piles of MEC items discovered by Felix Lopez of FWS are mostly within the area of EMA MRS-46 and all will be evaluated to identify munitions related materials during the Phase II ERA/SI.

EQB April 2006 comment:

3. Pg 2-3, Sec 2-2, Lines 18-29. These lines describe recommendations from the Phase I ERA/SI Report. It should be noted that EQB has comments on these recommendations as

reflected in our comment numbers 27 through 30 in our comments to the Phase I ERA/SI

Report. It is recommended that the comments on the recommendations contained in the Phase I ERA/SI Report be resolved first and then this section of the Phase II Work Plan can be revised accordingly.

The Navy response to April 2006 comment reads as follows:

As discussed in the responses to comments numbers 27 through 30 of the ERA and Phase I SI Report, the explosive hazard severity for EMA MRS 6 and EMA MRS 12 have been revised to follow the Site Prioritization Protocol's Table 1 classification within the EHE module munitions type. The explosive safety hazard screening category for EMA MRS 6 is moderate-high. The explosive safety hazard screening category for EMA MRS 12 is high. Because there is evidence that these sites have been impacted the recommendation is for further investigation; however, because all of the items found were expended, relative to some of the other sites they have a lower priority. The recommendations contained in the above mentioned section of the Phase II Work Plan are unchanged.

With respect to EMA MRS 12, MEC debris in near-shore water is outside the scope of this work, and not part of EMA MRS 12. Only MD was found in this MRS.

EQB August 2006 comment:

This comment deals with the hazard assessment protocol used in this document. The response describes revisions to the hazard assessments for these MRS that are contained in the Navy's responses to EQB's comments on the Phase I ERA SI Report. The Navy is correct that these changes were made in the Navy's responses to that report. However, the responses to EQB comments on the ERA SI Phase I Report are dated March 2006. Since that time, the Navy as agreed to revise the hazard assessment protocol at the last MR Committee meeting held in San Juan on May 31, 2006. As recorded in UXO Pro's report to EQB on that meeting:

- "The hazard assessment section of this document [note: "this document" is the Phase I ERA SI Report] was discussed at length. Jim Pastorick made the point that the current hazard assessment protocol is not useful to the project because it doesn't discriminate explosive hazards very well and it also doesn't accurately represent the ranking procedure of the Site Prioritization Protocol on which it is based. **It was decided that CH2M Hill would review the hazard ranking procedure and revise it within three weeks. Chris Penny said that the hazard assessment protocol should be a recurring topic of discussion for the MR**

Committee until it is resolved.”

To date no revisions to the hazard ranking protocol have been discussed with EQB or received by EQB. Therefore, EQB considers this comment to be still unresolved and open for discussion and future resolution.

EQB August 2006 comment part 2:

With respect to the second paragraph of the Navy response “With respect to EMA MRS 12, MEC debris in near-shore water is outside the scope of this work, and not part of EMA MRS 12. Only MD was found in this MRS”, please see the Additional EQB Comment #2 above.

Navy response to August 2006 comment reads as follows:

Response to part 1:

The hazard assessment protocol was discussed in the September 19 2006 MR Subcommittee meeting. As discussed in the meeting, no changes will be made to this document on the hazard assessment protocol. However, the hazard assessment protocol will continue to be evaluated by the MR Subcommittee.

Response to part 2:

As discussed above in the most recent Navy response to EQB April 2006 comment 2. Pg 2-2 to 2-3, Sec 2.2, Line 26 to 2, the locations where the items are visible at low tide will be evaluated to identify munitions related materials.

EQB October 2006 Comment:

EQB doesn't agree that Part I was resolved at the September MR Committee meeting and that agreement was reached that no changes will be made to the hazard assessment protocol presented in the Phase II ERA/SI Work Plan. As noted in the previous comments issued by EQB on this subject, the Navy has previously committed to revising the hazard assessment protocol within three weeks of May 31, 2006 and the Navy also committed to discussing this subject within the MR Committee. Neither of these things has occurred. Also, EQB's notes describing the discussion of this comment at the last MR Committee meeting says, “Discussion of this comment was not completed and was postponed until later”, indicating that continued discussion of this topic was, once again, scheduled but not implemented.

EQB's position is, in summary, that there are two hazard analyses that need to be accomplished:

1. The Navy is required to develop the Site Prioritization Protocol (SPP) for all MRS on the VNTR. It is EQB's understanding that this is an internal DoD requirement and that the Navy is required to implement the SPP exactly as published in the Federal Register to comply with this comment.
2. Separate from the requirement described in #1 above, the Navy needs to perform an assessment of the hazard of MEC on the MRS in the VNTR for the purpose of determining a.) if a future response action is required (basically a preliminary screen with possible outcomes of “no further action”, “forward to RI/FS”, or “accelerated response”) and b.) if a response is required by the results of a.) what is the appropriate response action.

It is EQB's understanding that the two hazard analyses listed above require three actual screening processes:

1. The SPP as published in the Federal Register.
2. A preliminary screening protocol performed prior to the Remedial Investigation.
3. A detailed hazard analysis protocol performed during the Feasibility Study.

The SPP exists as published in the Federal Register (screen #1 above). The EPA is developing the MEC Hazard Analysis (MEC HA) which is designed to be used for the hazard analysis described in #3 above. We are currently dealing with the requirement for the preliminary screen described in #2 above and a successful screening protocol for this purpose has not yet been developed.

It is EQB's understanding that the SPP is intended to prioritize sites for future attention on a nation-wide basis. It is EQB's understanding that it is not designed to be used as a risk assessment tool for determining future remedial actions at specific MRS and this is where EQB disagrees with the Navy's use of the SPP in this document.

EQB recommends that the previous agreement to discuss this issue in detail within the MR Committee be implemented. EQB stands ready to support this effort and further recommends that Doug Maddox, an original member of the MR Committee from EPA, be included in these discussions since he has intimate knowledge of the various MEC hazard analysis processes including the MEC HA.

Navy response:

The SPP will be used as designed to provide a relative priority of the MRSs based on explosive and environmental hazards at the former VNTR. Additionally, other MRS factors will be considered as described in the "Sequencing" section of the SPP. These other factors and the sequencing process will be considered and conducted with the stakeholder's input.

EQB April 2006 comment:

14. Pg 5-1, Sec 5.2, Line 18-28. This section references the hazard evaluation and site prioritization performed as part of the Phase I ERA/SI. However, EQB had several comments (comment numbers 25 - 30) on the hazard evaluation and site prioritization in

the Phase I ERA/SI which have not been resolved. It is recommended that EQB's comments on the hazard evaluation and site prioritization in the Phase I ERA/SI be discussed and resolved before the results of that evaluation and screening process are implemented in this work plan.

The Navy response to April 2006 comment reads as follows:

The explosive hazard categories have been revised to include the 11 categories given in the DoD Site Prioritization Protocol. The "Riot Control" category has been retained for consistency with the DoD protocol. See response to comments 25 through 30 of the ERA and Phase I SI Report.

The categories are:

Classification	Description	Score
Sensitive	<ul style="list-style-type: none"> • All UXO that are considered likely to function upon any interaction with exposed persons (e.g., submunitions, 40mm high-explosive[HE] grenade projectiles, white phosphorus [WP] munitions, high-explosive antitank [HEAT] munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions). • All hand grenades containing energetic filler • Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazard. 	30
High explosive (used or damaged)	<ul style="list-style-type: none"> • All UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered “sensitive” • All DMM containing a high-explosive filler that have: <ul style="list-style-type: none"> -Been damaged by burning or detonation -Deteriorated to the point of instability. 	25
Pyrotechnics (used or damaged)	<ul style="list-style-type: none"> • All UXO containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades). • All DMM containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades) that have: <ul style="list-style-type: none"> -Been damaged by burning or detonation -Deteriorated to the point of instability. 	20
High explosive (unused)	<ul style="list-style-type: none"> • All DMM containing a high explosive filler that: <ul style="list-style-type: none"> -Have not been damaged by burning or detonation -Are not deteriorated to the point of instability. 	15
Propellant	<ul style="list-style-type: none"> • All UXO containing mostly single-, double-, or triple-based propellant, or composite propellants(e.g., rocket motor). • All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants(e.g., rocket motor) that are: <ul style="list-style-type: none"> -Damaged by burning or detonation -Deteriorated to the point of instability. 	15
Bulk secondary high explosives, pyrotechnics, or propellant	<ul style="list-style-type: none"> • All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants(e.g., rocket motor), that are deteriorated • Bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard. 	10
Pyrotechnic (not used or damaged)	<ul style="list-style-type: none"> • All DMM containing pyrotechnic fillers (i.e., red phosphorous), other than white phosphorous filler that: <ul style="list-style-type: none"> -Have not been damaged by burning or detonation -Are not deteriorated to the point of instability. 	10

Practice	<ul style="list-style-type: none"> • All UXO that are practice munitions that are not associated with a sensitive fuse. • All DMM that are practice munitions that are not associated with a sensitive fuse and that have not: <ul style="list-style-type: none"> -Been damaged by burning or detonation -Deteriorated to the point of instability. 	5
Riot control	<ul style="list-style-type: none"> • All UXO or DMM containing a riot control agent filler (e.g., tear gas). 	3
Small arms	<ul style="list-style-type: none"> • All used munitions or DMM that are categorized as small arms ammunition. [Physical evidence or historical evidence that no other types of munitions (e.g., grenades, subcaliber training rockets, demolition charges) were used or are present on the MRS is required for selection of this category.] 	2
Evidence of no munitions	Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0

Notes:

- *Former* (as in “former military range”) means the MRS is a location that was (1) closed by a former decision made by the Component with administrative control over the location, or (2) put to a use incompatible with the presence of UXO, DMM, or MC.
- *Historical evidence* means the investigation: (1) found written documents or records, (2) documented interviews of persons with a knowledge of site conditions, or (3) found and verified other forms of information.
- *Physical Evidence* means: (1) recorded observations from on-site investigations, such as finding intact UXO or DMM, or munitions debris (e.g., fragments, penetrators, projectiles, shell casings, links, fins); (2) the results of field or laboratory sampling and analysis procedures; or (3) the results of geophysical investigations.
- *Practice munitions* means munitions that contain an inert filler (e.g., wax, sand, concrete), a spotting charge (i.e., a small charge of red phosphorous, photoflash powder, or black powder used to indicate the point of impact), and a fuze.
- The term *small arms ammunition* means ammunition, without projectiles that contain explosives (other than tracers), that is .50 caliber or smaller, or for shotguns.

EQB August 2006 comment:

Please see the Additional EQB Comment on #3 above. In addition, the Navy’s response merely cuts and pastes Table 1 from the Site Prioritization Protocol. There is no explanation for why this is an appropriate hazard ranking method for the Vieques Phase II SI. As is documented in the Additional EQB Comment on #3 above, “It was decided that CH2M Hill would review the hazard ranking procedure and revise it within three weeks. Chris Penny said that the hazard assessment protocol should be a recurring topic of discussion for the MR Committee until it is resolved.” However, it has not been

resolved and, in fact, there have not been any additional meetings or discussion on this topic. EQB considers this comment to be not resolved and open for discussion.

Navy response to August 2006 comment:

The hazard assessment protocol was discussed in the September 19 2006 MR Subcommittee meeting. As discussed in the meeting, no changes will be made to this document on the hazard assessment protocol. However, the hazard assessment protocol will continue to be evaluated by the MR Subcommittee.

EQB October 2006 Comment:

Please see EQB's response to the previous comment #3 for a more detailed description of EQB's understanding of the various hazard assessment requirements. Note that EQB disagrees that it was decided that no changes will be made to this document concerning the hazard assessment protocol at the last MR Committee meeting.

It is also noted that there is little purpose in continuing to evaluate this issue if there is no possibility that changes will be made to the hazard evaluation process in this document. Under those conditions it is likely that EQB will decline to participate in discussions since it has been predetermined that they will not result in any changes.

Please see comment #3 above for a thorough summary of EQB's understanding of the hazard assessment requirements of this project and for EQB's recommendation for a path forward.

Navy response:

See responses to comment # 3 above. The Phase II SI work plan will be implemented to collect crucial data that can be input into the hazard assessment.

EQB April 2006 comment:

19. App B Attachment and Table 1. Much of the Attachment to Appendix B (the GPO Plan) repeats the requirements of Appendix F to the Master Work Plan. Inclusion of this information only serves to cause confusion where the Appendix B Attachment doesn't agree with Appendix F to the MWP.

For example, both documents contain an introductory section on "Purpose." However, the attachment to Appendix B excludes two of the requirements contained in Appendix F to the MWP: "Document system reliability" and "Evaluate estimated field production rates and estimated false positive ratios, as related to project cost". Is the deletion of these

requirements a formal modification to the MWP which means that documentation of system reliability and field production rates is not part of the function of the GPO? If so, why? Why was it included as part of the purpose in the MWP and not in the Phase II ERA/SI? And why repeat all of the other requirements verbatim if they are unchanged?

It is recommended that the attachment to Appendix B be scrubbed to eliminate all text that is duplicative to the existing requirements of the MWP because this duplication with only minor changes causes confusion.

Also, the section on DQOs is slightly different that that contained in the MWP. For

example, the requirement for “Downline Data Density” is not in the MWP and the text for “Survey Coverage (Lane Spacing)” is different than that in the MWP. Are these formal changes which should be reflected in the next version of the MWP or are they errors in the attachment to Appendix B?

Also, Table 1 on “Project Data Quality Objectives” contains numerous conflicts with the text in the work plan and the MWP. Project DQOs are contained in several places in this document and the MWP so it is inevitable that there will be contradictions. For example, Table 1 says that the DQO for transect spacing is for no more than a 2-ft. gap. Is this the same as the MWP requirement for “Lane Spacing (Sensor Separation)” contained in the MWP? They appear to be different (the MWP contains a 2% requirement and a 1-ft. radius requirement). Another difference is the Table 1 requirement for “Search transect spacing to vary no more than + or - 20% of spacing specified in sampling design.” This appears to be different than the 98% coverage requirement in the MWP Appendix F.

Also, Table 1 doesn't have any DQO for reacquisition accuracy as does the MWP Appendix F. Why is this DQO missing?

The Navy response to the April 2006 comment reads as follows:

The Master Work Plan is intended to be a general overarching guidance document. Where site specific projects vary from the general guidance, site specific work plans are written to document the changes. This Draft Expanded Range Assessment Site Investigation Phase II Work Plan is such a document, providing modifications to the general guidance for this specific project. The geophysical investigation plan in this document is a later edition, and reflects updates that will be made to the Master Work Plan when it is next revised.

EQB August 2006 comment:

Based on the Navy's response these changes represent significant changes to the MWP. However, by merely including these changes in the site-specific work plan without discussion the Navy puts EQB in the position of having to spend a significant amount of time comparing the two documents, looking for variations, and evaluating those variations.

For example, since the response says that the text in the site-specific work plan takes precedent, EQB assumes that there is not DWP for reacquisition accuracy (since it is not referenced in the site-specific work plan). Or, does the original reacquisition accuracy DQO from the MWP still apply?

Figuring this out which changes apply to the MWP and which portions of the MWP are still valid is nearly impossible under these circumstances. It is highly recommended that the Navy list these important changes to the GPO plan contained in the MWP, that has already been agreed upon, so these changes can be recognized and understood by all agencies and reviewers involved. Submitting a change notice to the MWP would be an appropriate format for implementing these changes.

Navy response to the August 2006 comment reads as follows:

To clarify the original comment: The Master Work Plan is the general overarching guidance document. Where site specific work plans specifically call out changes, those changes apply for the specific project only. If the site specific work plan does not contain a requirement in the Master Work Plan, that requirement is still valid for the site specific project. The geophysical investigation plan in this document is a later edition, and reflects updates that will be made to the Master Work Plan when it is next revised.

Specifically:

- The requirements to “Document system reliability” and “Evaluate estimated field production rates and estimated false positive ratios, as related to project cost” will be added to the purpose section of the Geophysical Prove-Out Work Plan in the Expanded Range Assessment and Phase II Site Inspection Work Plan
- The requirements for “Downline Data Density” and the revised text for “Survey Coverage (Lane Spacing)” will be added to the Master Work Plan when it is next revised.
- In response to the original April comment that states “Table 1 says that the DQO for transect spacing is for no more than a 2-ft. gap. Is this the same as the MWP requirement for Lane Spacing (Sensor Separation) contained in the MWP?” The DQO quoted is for downline data density (data density along the line of travel in the geophysical survey), which is different than lane spacing (the distance between individual geophysical survey lines). The requirements are correct as written in the documents.
- The requirement in the site specific Geophysical Prove-Out Work Plan for “Search transect spacing to vary no more than + or - 20% of spacing specified in sampling design” is an update to standard requirements and will be revised in the Master Work Plan Appendix F.
- The site specific work plan does not contain the DQO for reacquisition accuracy provided in the Master Work Plan. The DQO for reacquisition accuracy was written for the case where an anomaly is identified and flagged, and another geophysical team/technique is used to try to more accurately identify the location. This type of work is not planned in the Expanded Range Assessment and Phase II Site Inspection, only geophysical mapping will be conducted. Reacquisition and anomaly investigation will be carried out as part of future removal action.

With respect to the most recent August 2006 comment: If there is no changed requirement established in the site specific work plan, then the requirements of the Master Work Plan stand. The original DQO for reacquisition in the MWP still applies, though reacquisition is not planned for this phase of work. The Master Work Plan will be modified to reflect the changes stated in the responses to comments.

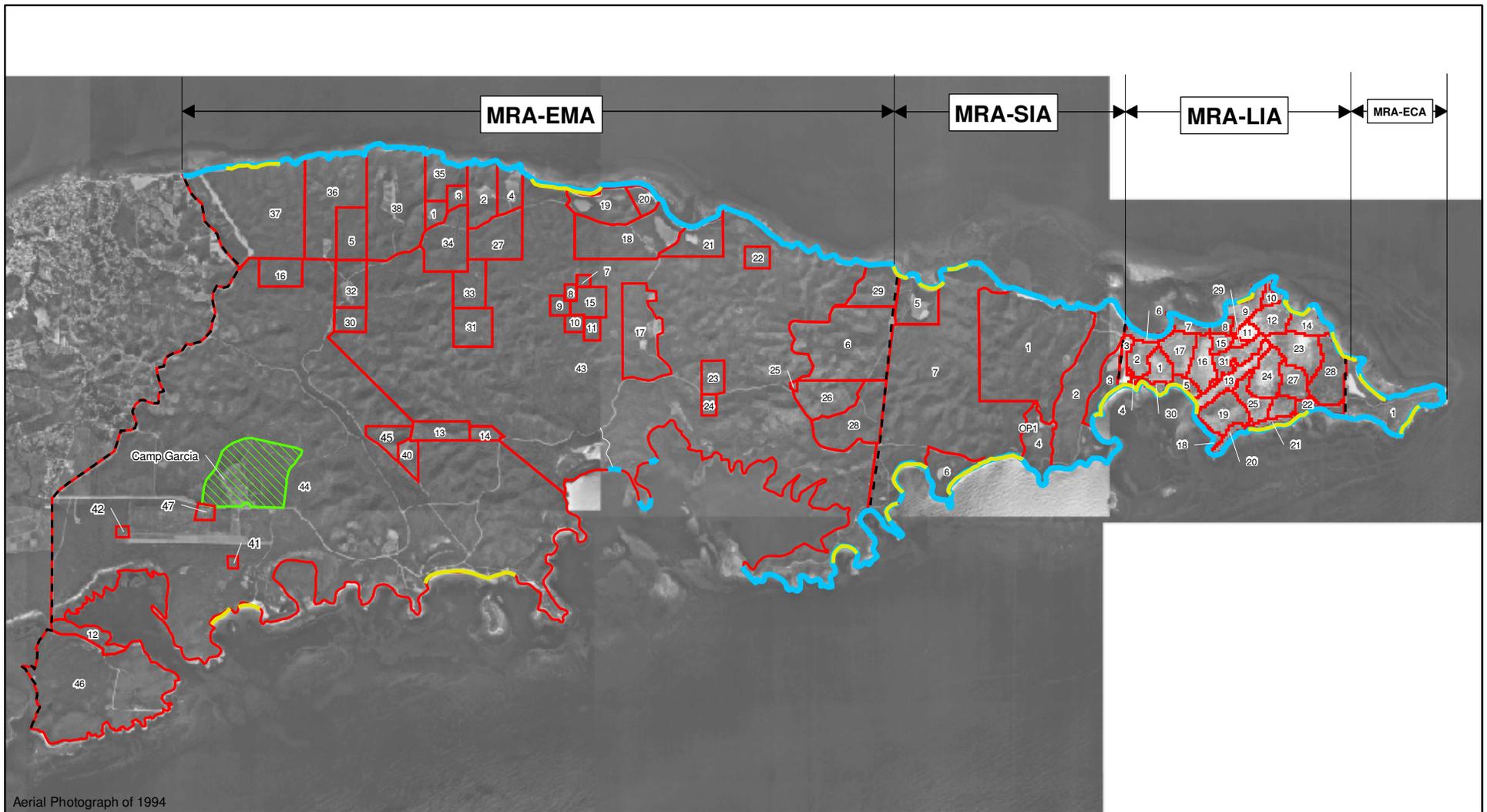
EQB October 2006 Comment:

EQB’s notes from the last MR Committee meeting on this comment say, “It was agreed that the Navy will update the Master Work Plan often to keep up with field changes that are implemented. This will keep the MWP from quickly becoming obsolete.” Issuing a revised MWP and updating it frequently through formal Field Changes will help to eliminate contradictions between the MWP and site-specific work plans.

It is also recommended that if a topic is covered in the MWP that the site-specific work plan only contain information that modifies the information in the MWP. For example, if the description of a GPO is complete in the MWP, the site-specific work plan only needs to show the location of the specific GPO and list the type, number, and depth of MEC that will serve as targets. Listing information that is largely redundant with that in the MWP requires that reviewers compare the two plans almost word by word to spot the differences between the two. This is difficult and time consuming and it would be appreciated if the Navy and their contractors could minimize this effort by crafting the site-specific plan to only include technical items that are changes from the MWP. If this is not possible it would be equally helpful to highlight in some way items in the site-specific plan that represent changes from the MWP. Anything that can help lessen the word-by-word comparison of two complex documents will increase the efficiency of the document review and also help the field personnel charged with implementing these multiple plans to more easily understand the guidance being given to them.

Navy response:

We understand the concerns stated above. The MWP document will be updated regularly. Efforts will be made in the future to reduce duplication of material in site specific work plans that is already covered in the MRP Master Work Plan.



Aerial Photograph of 1994

Legend

- Beach MRS
- Sea Turtle Nesting Areas
- 1 MRS boundary, MRS number identified
- Parcel Boundary and Designation
- MRA Boundary

Notes :

- MRS Numbers Do Not Signify Priority
- EMA-MRS 43 and SIA-MRS 7 include all terrestrial area within the range fan(s) not designated as other MRSs.
- EMA-MRS 44 includes all terrestrial area outside of range fan(s) not designated as other MRSs.



Figure 2-2
Former VNTR Site Map
Former VNTR, Vieques, Puerto Rico

CH2MHILL

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Response to US FWS Comments Draft Expanded Range Assessment and Phase II Site Inspection Work Plan Former Vieques Naval Training Range (VNTR), Vieques, Puerto Rico, November 2006

FWS General Comments

1) There is no discussion regarding the collection of soil samples during Blow-in-Place (BIP) operations. Has it been determined that confirmation sampling is not necessary and that BIP actions do not spread existing or create additional contamination?

Response: The potential for environmental contamination to occur at munitions response sites will be addressed following the completion of munitions investigation/removal work in a separate environmental investigation work plan and further assessed in the site prioritization. However, the BIP locations will be recorded with a GPS.

2) The focus of this Work Plan is on surface Munitions and Explosives of Concern (MEC). Has it been determined that sub-surface items do not present a risk in these areas or is the point of this effort simply to collect information to support a Time Critical Removal Action (TCRA) or a non-TCRA? If sub-surface MEC will be a focus of later efforts, it is recommend that a paragraph be added to address that issue, particularly as it relates to the ability of the Navy to identify Munitions Response Sites (MRSs) and Munitions Response Areas (MRAs) where no further action will be proposed.

Response: The purpose of this SI phase of work is to surface characterize sites to confirm MRSs, and collect data necessary for assessing future prioritization of munitions response actions. Future subsurface characterization will be based on the findings of this investigation, the relative priority, and the final land use plan (designated in the Comprehensive Conservation Plan). The results of this mapping will be evaluated to determine the extent of subsurface removal activities that are to be completed under either a TCRA or non- TCRA. The geophysical mapping of subsurface anomalies in this phase of work will be restricted to high priority land use areas (roads and beaches), that have been identified in the Draft FWS Comprehensive Conservation Plan. The executive summary in the SI Work Plan describes the overall process.

3) Phase II greatly expands the scope of current Biological Assessment (BA) for the Live Impact Area (LIA), however, the additional work can be considered an amendment to the existing BA. The Fish and Wildlife Service (FWS) will continue to work closely with the Navy and its contractors regarding the need for any additional surveys and work.

To the extent possible, mechanical clearance of vegetation should not be carried out within 5-meters of any stream bank, stream channel, or inside stream channels. The same holds true for the coastal lagoons found along the north shore of the Surface Impact Area (SIA) and Eastern

Maneuver Area (EMA). A 5-meter buffer should be left between wetland vegetation and the study areas. There are several quebrada conservation zones within the EMA that were designated by the Navy and mechanical vegetation clearance should be avoided in these areas. Again, close coordination with the Navy's qualified biologist as well as FWS Ecological Service and Refuge staff is necessary with regards to vegetation surveys and vegetation clearance within these areas.

Response:

The Navy appreciates the assistance of the FWS and will continue to coordinate closely with them. A biological assessment is currently being conducted for the EMA and SIA. Based on the results of this assessment, mitigation measures for sensitive areas will be developed in close consultation with FWS. The assessment will be presented as an amendment to the biological assessment completed for the LIA. Once the mitigation measures are approved by FWS, they will be implemented for all future munitions response actions within the EMA and SIA.

4) The Eastern Conservation Area (ECA) has been added to the existing TCRA as a MRA. It was established in the early 1980's as a conservation zone because of its unique ecology. However, aerial photos show extensive ground scarring and trails along the southern portion (Photos 1 and 2) that should be targeted for investigation. This area is botanically unique and vegetation removal should be minimized. Site selection and Work Plans for this area should be closely coordinated with the FWS. The existing trail system in this area should be included since it will be used by FWS personnel to access the different sites. We would also like to request that Dr. Gary Breckon be allowed to accompany the flora/fauna survey team into the ECA. Dr. Breckon has been contracted by the FWS to update the flora checklist for Vieques and he has already added several new species to the island botanical inventory. Given the uniqueness of this area, we believe that his participation in the survey would be a benefit to both the Navy and the FWS.

Response:

Prior to conducting any investigation or removal action in the ECA, a biological assessment will be completed to identify endangered and protected species and establish mitigation measures. Due to time constraints and safety considerations, it may not be possible to accommodate additional personnel for the field investigation portion of the BA. Following the TRCA ample opportunities will be available for flora and fauna surveys. The specific locations of transects that will be used to evaluate the MEC contamination in the ECA will be established during the biological assessment. The investigation of MEC surface contamination is designed to be only a preliminary investigation to identify the types and density of MEC present that will be removed as part of the Time Critical Removal Action.

5) The FWS believes that all known sites in the MRA-SIA and the MRA-EMA should be investigated and remediated to a level that would allow FWS personnel to carry out mission related wildlife management activities, reforestation efforts, wildlife surveys, botanical studies, and other Refuge and natural resource conservation tasks. While we recognize that some of these areas will not be open to the general public, the FWS will need access for scientific and general land management purposes.

Response:

Inspection of the MRSs identified in the Phase II SI will be completed to collect additional data such that all the MRSs can be prioritized for potential future munitions response

actions. The sequencing of all future munitions response actions, at specific MRSs, will be dependent on the data from the Phase II SI, the results of the site prioritization (that has not yet been completed), the FWS land use management plan and the Comprehensive Conservation Plan.

6) The Puerto Ferro Peninsula area has several MRSs and possibly some additional areas that warrant investigation. This is also the only area within the open section of Camp Garcia that is closed to the public. With its close proximity to open areas and the location of the historic Berdiales Lighthouse, opening this peninsula to public use is a priority for the FWS and the Municipality of Vieques. This area is currently composed of PI (Photo Identified area)-9 (MRS 12), PI-13 (MRS 14 or 46; in Table 3-1 it is cited as MRS 14, but in Figure 3-1 it is shown as MRS 46), the near shore munitions reef, several small trash piles containing shell casings, a small arms dump site and two large pits along a trail (Photos 3 through 8 and Figure 1). Photo Identified area 9 was clearly visible in historic aerial photos of the area (Photos 3 through 5) and is identified as a munitions or explosive storage area. At that time, a dirt road ran south along the west side of the peninsula, and two pits about 6-feet across and 3-feet deep are found on either side of this road, near a small inland lagoon (Figure 1). The origin of these pits is unknown, but there are sizable trees growing near them indicating that the area has not been disturbed in recent years. Another site associated with PI-9 is a fill area first identified in 1959 at the edge of Puerto Ferro and likely associated with an explosive storage area to the west. The deposit of shell casings associated with this site (Photos 6 and 7) are noted as increasing in size in 1962. In the 1970 aerial photos, the current access road to the lighthouse appears along with a large degree of ground disturbance. This is when PI-13 first appears along with the areas that now contain several trash piles (Photo 8). The FWS requests that during the Phase II Site Investigation (SI), all of the sites in the Puerto Ferro Peninsula be investigated.

Response:

Figure 3-7 and Table 3-1 will be updated with the location of the above sites. These areas will be investigated/evaluated during the Phase II site inspection. The data from the site inspection will be incorporated into the site prioritization protocol for evaluation of any additional munitions response actions.

FWS Specific Comments

1) Page V, Lines 6, 9, 15, 17, and 21. These sections indicate that surface MEC evaluations of approximately 10 percent of the indicated MRSs will be performed. In later sections, the text does not provide a rationale for this selection, nor does it discuss how the 10 percent sample area will be selected.

Response: The 10 percent surface evaluation is intended to provide an initial characterization to obtain sufficient information to prioritize the sites for further investigation or removal actions. Transects are selected to cover as wide and even distribution throughout the site as possible to prevent sample bias.

2) Page 2-1, Paragraph 2.2, Line 36. The terms 60-millimeter (mm) to 175-mm are not consistent with the terms used in Appendix C of the Phase I SI Report. It is recommended the MEC terms be standardized.

Response:

The terminology will be revised to ensure consistency with Appendix C of the Phase I SI Report.

3) Pages 2-1 through 2-5, Paragraph 2.2. It is not clear how the investigations referred to in this Section were conducted (i.e., visual reconnaissance). Standard practice is to conduct surface clearance at a regular interval around targets and during annual range maintenance, and sub-surface clearance is not normally part of this action. It is not clear if the investigations and the data support eliminating the indicated MRSs from further investigation.

Response:

The investigations were done as part of the Phase I Site Inspection and Preliminary Range Assessment. Additional information will be needed to eliminate the MRSs from further investigation. Refer to the Expanded Range Assessment and Phase I Site Inspection Report and the Preliminary Range Assessment for further information regarding investigation approaches.

4) Page 3.2, Paragraph 3.2.1, Line 29 and 30 and Page 3.6, Paragraph 3.2.2, Lines 21 and 22. The results of the Geophysical Prove-Out (GPO) Report and Digital Geophysical Mapping (DGM) system should be provided for review prior to start of the field effort.

Response: The Geophysical Prove-Out (GPO) study is done at the commencement of the field geophysical investigation prior to mapping potential MEC sites. The GPO Report and the selected Digital Geophysical Mapping System will be provided to regulators in an expedited fashion prior to conducting the geophysical survey. The geophysical mapping will commence at the completion of the GPO study.

5) Page 3-7, Paragraph 3.2.4, Line 32 and Page 3.8, Paragraph 3.2.5, Lines 30 through 32 and 36. It is unclear how the 10 percent sampling area will be selected for evaluation.

Response:

The 10 percent surface evaluation is intended to provide an initial inspection to prioritize the sites for further investigation or removal actions. Transects are selected to cover an even distribution throughout the site to provide a representative dataset for the site and to prevent sample bias.

6a) Page 3-10, Paragraph 3.4, Lines 10 through 39. The conversion of site identifiers such as PIs and potential areas of concern to MRSs is causing confusion among reviewers attempting to following particular sites across documents. It is assumed that the Munitions Response Program (MRP) Enterprise data management system will be used to standardize the name and identification of these sites and allow reviews to cross reference the results in a standardized manner.

Response:

PIs and PAOCs do not necessarily convert to MRSs. Following an investigation of a site, the area found to actually contain MEC would be identified as an MRS. This would not likely be the same boundary as the PI or PAOC site. If the site was already inside a MRS, the MRS boundaries would be modified to exclude the area found to be clear of MEC.

The Navy is proposing to make clarifications to the current numbering system. It is our understanding that the primary concerns with the current system fall into two categories: 1) The concern that munition response site (MRS) numbers are non-unique, and can be

confused when the munition response area (MRA) is not cited as well. In response to this concern we propose that whenever a site is discussed in text or in verbal discussion, the MRA identifier (EMA, SIA, LIA, and ECA) will be used as well as the MRS number. This has the additional advantage of giving the reader/listener a cue that narrows down the area in which the MRS lies, making it easier to find on a map or mentally remember where it is located.

2) The concern that there are so many different descriptors for sites; MRAs and MRSs, potential areas of concern (PAOCs), photo identified (PI) sites, areas of concern (AOCs), gun positions, ranges, open burn/open detonation (OB/OD) sites, and solid waste management units (SWMUs). There are many different site descriptors in use on the Vieques Munitions Response Program (MRP). It is important to remember however, that they have different uses. MRAs and MRSs subdivide the areas currently under investigation in the MRP into large and small subdivisions. AOCs are numbered sequentially regardless of the MRA, and are new areas to be preliminarily investigated to determine if they contain munitions. If munitions are identified, they are re-named as MRSs and identified for further investigation. The remainder of the nomenclature are historical site use areas (gun positions, ranges, OB/OD sites) and historical nomenclature for areas that were investigated or of some interest (PIs, PAOCs, and SWMUs). These historical sites use names and area of investigation names often overlap boundaries of MRSs, and as such have little connection with MRS identifiers.

In order to allow easy cross referencing of historical site names with MRSs we have created a MRA, MRS, and historical site use/name matrix table (Table 3-1). Table 3-1 cross references historical site uses with MRAs and MRSs. We have made bold the site names of sites to be investigated as part of Phase II, shaded the names of sites previously investigated in Phase I and cross referenced MRAs, MRSs, and historical site use/names.

Referencing the MRA with the MRS should resolve any MRA/MRS confusion, and cross-referencing tables should clarify any questions as to historical site names.

TABLE 3-1
Parcel, MRA, MRS, and Historical Site Use/Name Matrix
Former VNTR, Vieques, Puerto Rico

MRA	MRS Number	Historical Site Use/Name
MRA-Beach Area*		Differentiated based on associated MRA and MRS
MRA-LIA	MRS 1	SAM West/Air-to-Ground (ATG) Target
	MRS 2	ATG Target
	MRS 3	Strafing Run/ATG Target
	MRS 4, 5, 6, 7, 8*, 9*, 10*	ATG Target
	MRS 11*	Convoy Target/ATG Target
	MRS 12*	ATG Target
	MRS 13*	Mock Runway/ATG Target
	MRS 14*, 15*, 16, 17, 18*, 19*, 20*, 21*, 22*	ATG Target
MRA-LIA continued	MRS 23*	SAM East/ATG Target

TABLE 3-1
 Parcel, MRA, MRS, and Historical Site Use/Name Matrix
 Former VNTR, Vieques, Puerto Rico

MRA	MRS Number	Historical Site Use/Name
	MRS 24*, 25*, 26*, 27*, 28	ATG Target
	MRS 29*	OB/OD/ATG Target
	MRS 30, 31*	ATG Target, EOD range (SWMU 3)
MRA-SIA	MRS 1*	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas, Observation Point 5, 12, 13, 14, Gun Position GP 5. Pls 22, 35.
	MRS 2	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas Gun Position 21. Pls-1, 22.
	MRS 3	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas
	MRS 4	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas PI-34, Observation Point 1, Gun Position GP 1. SWMUs 5, 8, 12. AOC-A
	MRS 5	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas
	MRS 6	Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas PI-17
	MRS 7	Non-Explosive Ordnance Firing Range (SWMU 11) Marine and Naval Target Areas, Gun Positions, Aerial Bombing Target Areas, Pls-32, 33. PAOC Y.
MRA-EMA	MRS 1*	Range 3 – Hand Grenade Range
	MRS 2*	Range 4 – 40mm Rifle Grenade Range PAOC CC
	MRS 3*	Range 4A – Rocket Range
	MRS 4*	Range 4B – Rocket Range PAOC DD
	MRS 5*	Range 5 – Hand Grenade Range
	MRS 6*	Artillery shortfall area, Target area, Observation Points 9, 10, 11, Gun Positions 22, 25, GP 7, GP 9., Pls-15, 16.
	MRS 7*	
	MRS 8*	
	MRS 9*	PI-Gun Position 17
	MRS 10*	PI-Gun Position 18
	MRS 11*	PI-Gun Position 19
	MRS 12*	PI-9
	MRS 13	Observation point/bunker
	MRS 14	PI-3
	MRS 15	Gun Position 14, 15, 16
	MRS 16	Gun Position 9
	MRS 17	Gun Positions 3, 4, 5, 24; PI-27 and PI-28
MRA-EMA continued	MRS 18	Gun Positions 2, 6, 12 and 13
	MRS 19	Area adjacent to Range 6

TABLE 3-1
Parcel, MRA, MRS, and Historical Site Use/Name Matrix
Former VNTR, Vieques, Puerto Rico

MRA	MRS Number	Historical Site Use/Name
	MRS 20	Range 6 - Demolition and small arms range
	MRS 21	Gun Position 26
	MRS 22	Gun Position 1
	MRS 23	Gun Position 32
	MRS 24	Gun Position 33
	MRS 25	Gun Position 20
	MRS 26	Gun Position 34
	MRS 27	Gun Position 28;
	MRS 28	Gun Position 35, Artillery shortfall area. PI-30
	MRS 29	PI-29, 31. Artillery shortfall area, Gun Position GP-9, Observation Point 7. PAOC Z.
	MRS 30	Part of Range 8 Gun Position 8
	MRS 31	Gun Position 29
	MRS 32	Range 9 and Gun Position 7
	MRS 33	PI-12 and Gun Position 11
	MRS 34	Gun Position 10, part of Range 4a
	MRS 35	Gun Position 27
	MRS 36	Range 2 – Small Arms Range using pistols and shotguns, PI-23, PAOC AA
	MRS 37	Range 1 – Small arms range using service rifles, pistols, and machine guns, Gun position 23
	MRS 38	Range 7 with impact areas PAOC BB
	MRS 39	Area of Interest
	MRS 40	PIs-10, 19
	MRS 41	PI-14
	MRS 42	Area of Interest
	MRS 43	Area of Interest, PIs-24, 25, 26, C-3 Bunker/OP, Gun positions 20, 30, 31, 36. AOIs 1, 2.
	MRS 44	PIs-2, 4, 5, 6, 7, 10, 11, 18, 20, 21. PAOCs U, V, W, X, FF, EE. SWMUs 1, 2, 4, 6, 7, 10, AOCs F, G Camp Garcia Gun positions 8, 9. Part of Range 8
	MRS 45	
	MRS 46	PI-13
	MRS 47	PI-8
MRA-ECA	MRS 1	Impacts due to adjacent target areas

* Shaded were evaluated during ERA/Phase I SI
Bold to be evaluated during the ERA/Phase II SI.

6b) The discussion indicates that the MRP Enterprise data management system will be used cradle-to-grave to capture field data and processing notes. Based on the Phase I SI review, there

is little evidence that MEC data standards have been employed, coordinated, or standardized among potential users and multiple contractors including the Defense Installation Spatial Data Infrastructure (DISDI) activities, the FWS, and the Commonwealth of Puerto Rico. As the Commonwealth of Puerto Rico Land Management System is considered to be the "grave," this is an important aspect of the overall Vieques Project. Accordingly, evidence of data standardization and coordination is requested.

Response:

No other standardized munitions response data management system has been presented to the Navy since the initiation of the Vieques munitions response program. The Vieques Munitions Response Data System is NAVFAC's munitions response data collection system where information has been standardized. As a result, that data collection and management system will be used for Vieques.

7) **Figure 5-1.** Figure 5-1 shows inhalation, direct contact, and ingestion as potential routes of exposure for MEC, but none of the data to be collected per this Work Plan or presented in the Phase I SI Report attempt to evaluate the risk. The figure meshes risks and safety issues associated with MEC with chemical issues associated with components of the MEC items. It is suggested that an explanation be added to this section to discuss that evaluation.

Response:

Figure 5-1 is a conceptual diagram that will be updated as more information becomes available. It will incorporate information on munitions explosive hazards that is collected during the SI. Any environmental contamination issues will be evaluated following the completion of the munitions investigations. The Expanded Range Assessment and Phase II Site Inspection Work Plan, and the work proposed therein is designed to collect MEC data at sites for future evaluation of the MEC explosive hazard. Based on the results of the MEC explosive hazard evaluation, the MRSs will be prioritized for future munitions response actions. Environmental contamination will be addressed following the completion of munitions investigation/removal work.

8) **Page 3-11, Paragraph 3.5, Lines 2 through 21 and Figures 3-3, 3-4, and 3-5.** Are there any plans to communicate with the island residents and/or the Commonwealth of Puerto Rico regarding BIP actions and/or decisions? The control of public access is included in a block of Figure 3-4, however there is no inference to any communication with the Environmental Protection Agency (EPA), the FWS, or Commonwealth of Puerto Rico regarding their involvement in the decision making process.

Response:

Figure 3-4 has been removed as unnecessary in response to previous comments. Communication of BIP actions will follow Appendix D of the Master Work Plan, BIP/Demolition Operations Notification Protocol. This protocol provides for notification of EPA, FWS and EQB prior to initiating any BIP activities.

9) **Page 5-1, Paragraph 5.1, Lines 6 through 9 and Figure 5-1.** The Conceptual Site Model (CSM) is key to understanding risk and does a good job of identifying the most probable origin of MEC contamination at the site as a whole, but there is no discussion of data gaps and it fails to indicate how exposure will occur and what the most probable pathways are.

Response:

This document provides a plan for collecting MEC data such that a hazard assessment can be completed to prioritize sites for future munitions response actions. Environmental investigations will be conducted and data will be assessed after the MEC are addressed. Once this information is collected the CSM will be updated for individual MRSs to identify potential exposure pathways.

10) Page C-4, Paragraph B.17. The final site-specific GPO Report and the Finalized Data Quality Objectives (DQO) for the Geophysical Investigation should be provided for review.

Response:

The final site-specific GPO Report and the finalized DQOs will be provided in an expedited fashion prior to conducting the geophysical mapping, see specific comment 4, above.

11) Page C-8, Paragraph B.20.7. It is stated in this Section that "If a suitable point is not available, a Puerto Rico-certified PLS will establish a minimum of two new monuments or survey markers with a minimum of third-order accuracy." This seems to indicate there are no control points in the Eastern end of the island. Is this true?

Response:

Control points are available on Eastern Vieques. However, in the event that control points are located in areas that are not convenient to the work or additional points are needed, they will be added.