December 18, 2013

Mr. Adam Little
Project Manager
CENWO-PM-HB
1616 Capital Avenue
Omaha, NE 68102-4901

Re: Final Non-Time Critical Removal Action Work Plan
174th Attack Wing
New York Air National Guard
Hancock Field Air National Guard Base
Syracuse, New York

Dear Mr Little:

AMEC Environment & Infrastructure is pleased to submit an electronic copy of the above referenced document for the Hancock Field Air National Guard Base for your records. This electronic submittal and associated hard copies will be forwarded to Mr. Robert Corcoran of the New York State Department of Environmental Conservation (NYSDEC); Ms. Jody Murata of the Air National Guard (ANG); and Lt. Brent Lynch at the Hancock Field ANG Base. Hard copy deliverables and the ANG final deliverable compact disks will be shipped within the week. Should you have any questions regarding this submittal, please do not hesitate to call me at 865-671-6774.

Sincerely,

AMEC Environment & Infrastructure

Darlene E. Abbott, L.S.S.
Project Manager/Licensed Soil Scientist

Cc: Robert Corcoran – NYSDEC
Jody Murata – ANG Program Manager
2dLt Brent Lynch – Hancock Air National Guard Base Environmental Manager
Adam Little – United States Corps of Engineers Project Manager
AMEC Central Files (electronic copy)

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FINAL

NON-TIME CRITICAL REMOVAL ACTION WORK PLAN
174TH ATTACK WING
HANCOCK AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

MILITARY MUNITIONS RESPONSE PROGRAM
CONTRACT NO. W9128F-10-D-0059-0001

Prepared for:

Air National Guard Readiness Center
Joint Base Andrews, Maryland

Prepared and presented by:

US Army Corps of Engineers, Omaha District
CENWO-PM-HA
1616 Capitol Avenue, Suite 9000
Omaha, Nebraska

December 18, 2013

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FIGURES

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APPENDICES

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ACRONYMS

AMEC	AMEC Earth & Environmental, Inc.
ANG	Air National Guard
AW	Attack Wing
bgs	below ground surface
C&D	construction and demolition
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COC	constituents of concern
CSE	Comprehensive Site Evaluation
CY	cubic yards
°F	degrees Fahrenheit
DoD	Department of Defense
DOT	Department of Transportation
EE/CA	Engineering Evaluation/Cost Analysis
EM	Engineering Manual
EPP	Environmental Protection Plan
FM	Field Manager
ft	foot/feet
FW	Fighter Wing
GPS	Global positioning system
Hancock Field	Hancock Air National Guard Base
HEAT	high-explosive anti-tank
IDW	investigation derived waste
in.	inch(es)
$in.^2$	square inch
MC	munitions constituent
MD	munitions debris
MDAS	material documented as safe
MEC	Munitions and Explosives of Concern
mg/kg	milligrams per kilogram
mm	millimeter
MPPEH	material potentially presenting an explosive hazard
MRA	Munitions Response Area
MRS	Munitions Response Site
msl	mean seal level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action

NYANG	New York Air National Guard
NYSDEC	New York State Department of Environmental Conservation
NTCRA	Non-Time Critical Removal Action
NYCRR	New York Codes, Rules, and Regulations
PCB	polychlorinated biphenyls
PM	Project Manager
POC	Point of Contact
RA	Removal Action
RAO	removal action objective
RCRA	Resource Conservation and Recovery Act
RDW	Remediation Derived Waste
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SLERA	Screening Level Environmental Risk Assessment
SLHHRA	Screening Level Human Health Risk Assessment
SVOC	semivolatile organic constituent
TCLP	Toxicity Characteristic Leaching Procedure
USACE	U.S. Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USAF	U.S. Air Force
USCS	Unified Soil Classification System
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
VOC	volatile organic constituent
WWII	World War II
XRF	X-ray Fluorescence

1.0 INTRODUCTION

This Non-Time Critical Removal Action (NTCRA) Work Plan presents the activities that will be conducted to perform a soil removal and surface debris pickup at Munitions Response Sites (MRSs) SR001, Small Arms Range and Shooting-In Buttress, and SR002, Firing-In Buttress, located at Hancock Air National Guard Base (Hancock Field), in Syracuse, New York. The boundaries of MRSs SR001 and SR002 were delineated following a Comprehensive Site Evaluation (CSE) Phase II that identified munitions constituents (MC) soil impacts. This NTCRA Work Plan was prepared under a contracted Project Work Statement (Appendix A) through the United States Army Corps of Engineers (USACE), Omaha District, Contract W9128F-10-D-0059-001 using guidance provided in:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA), 1986;
- Resource Conservation and Recovery Act (RCRA);
- National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) 300.415, 2005];
- New York State Department of Environmental Conservation (NYSDEC);
- Department of Defense (DoD) Ammunitions and Explosives Safety Standards (DoD 6055.09-M);
- USACE Engineering Manual (EM) 385-1-97, *Explosives - Safety and Health Requirements Manual*; and,
- Chapter 4 of the USACE EM 1110-1-4009, *Engineering and Design - Military Munitions Response Actions*.

1.1 Purpose and Scope

This document provides a remedial strategy and details the activities associated with the soil removal and surface debris pickup activities to be conducted for MRSs SR001 and SR002. The remedial strategy is based upon the results of the CSE Phase I/Phase II (ITS/Shaw, 2009 and Sky, 2012; respectively) supplemented by the findings of the Engineering Evaluation/Cost Analysis (EE/CA) prepared by the Air National Guard (ANG) (ANG, 2013a). This work plan was developed to guide the activities required to implement the removal action (RA) and to address the removal action objectives. Because munitions and explosives of concern (MEC) have not been identified at the site, risk associated with MRSs SR001 and SR002 is from munitions debris (MD) and residual MCs within environmental media.

The purpose of this removal action is to mitigate risk to human health by removing MC-impacted soil from MRSs SR001 and SR002 to levels below NYSDEC risk-based human health standards. Additionally, the removal action will eliminate future risk to human health and

the environment by removing practice grenade debris at MRS SR001. As a result of this NTCRA, the overall goal of unrestricted use/unrestricted exposure for human health at each MRS will be achieved.

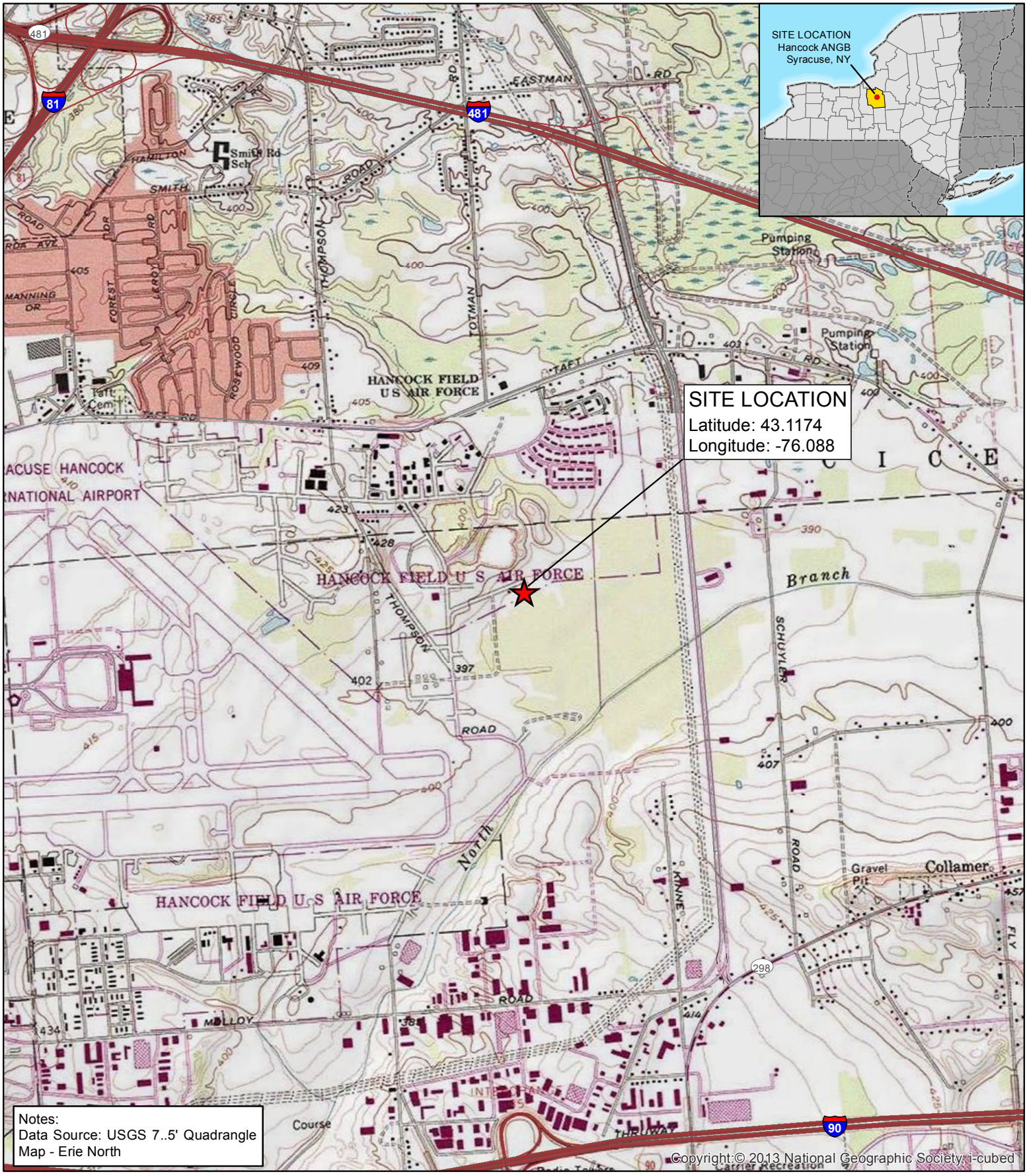
1.2 Site Description and History

1.2.1 Installation

Hancock Field, as shown in Figure 1-1, is located at the Syracuse Hancock International Airport, approximately 5 miles north of the City of Syracuse in Onondaga County, New York. It encompasses approximately 357 acres and consists of several buildings and operational facilities. The installation is divided into two tracts of land: Tract II and Tract III (Figure 1-2). Tract II encompasses approximately 87 acres including MRS SR001 and Tract III encompasses approximately 270 acres including MRS SR002. Both tracts are owned by the United States Air Force (USAF) (fee-owned) with a license to New York State for ANG use. The City of Syracuse owns the land bordering Tract II and the land north of Tract III.

In 1942, Hancock Field, formerly Mattydale Bomber Base, was constructed along with three 5,500-foot (ft) runways. The facility was built to serve as a staging and storage area for repairing and re-outfitting B-17 and B-24 aircraft used in World War II (WWII). The base was also used by the First Concentration Command, later known as the Air Service Command, to assemble and test B-24 aircraft. In 1946, the City of Syracuse took control of the Mattydale Bomber Base, and in 1948, the base was dedicated as a commercial airfield. The Clarence E. Hancock Airport opened in September 1949, attaining international airport status in 1970. Over the last few decades, both the mission and physical size of the Hancock Field (military) installation have been reduced from the initial WWII capacity. Much of the airbase, including the runways, was converted to civilian use as the Syracuse Hancock International Airport (ITSI/Shaw, 2009 and Sky, 2012).

Currently, Hancock Field is home to the 174th Attack Wing (AW) of the New York ANG (NYANG). On October 28, 1947, the 174th AW began as the 138th Fighter Squadron. In 1962, the 138th was officially renamed the 147th Tactical Fighter Group. In 1979, there was a status change from Tactical Fighter Group to Tactical Fighter Wing (FW). In 1992, the Tactical FW was re-designated the 174th FW and in 2012 was designated as the 174th AW. Aircraft historically utilized by the unit include the P-47D Thunderbolt, F-84B Thunderjet, F-86H Sabre, A-10A Thunderbolt II, and F-16A Fighting Falcon (Sky, 2012). The installation's mission is to maintain well-trained, well-equipped units available for prompt mobilization during war and provide assistance during national emergencies (such as natural disasters or civil disturbances).



New York Air National Guard
Syracuse, New York

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FIGURE 1-1
Installation Location Map
Final Non-Time Critical Removal Action Work Plan
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 0.5 1 2 Kilometers
0 0.25 0.5 1 1.5 Miles

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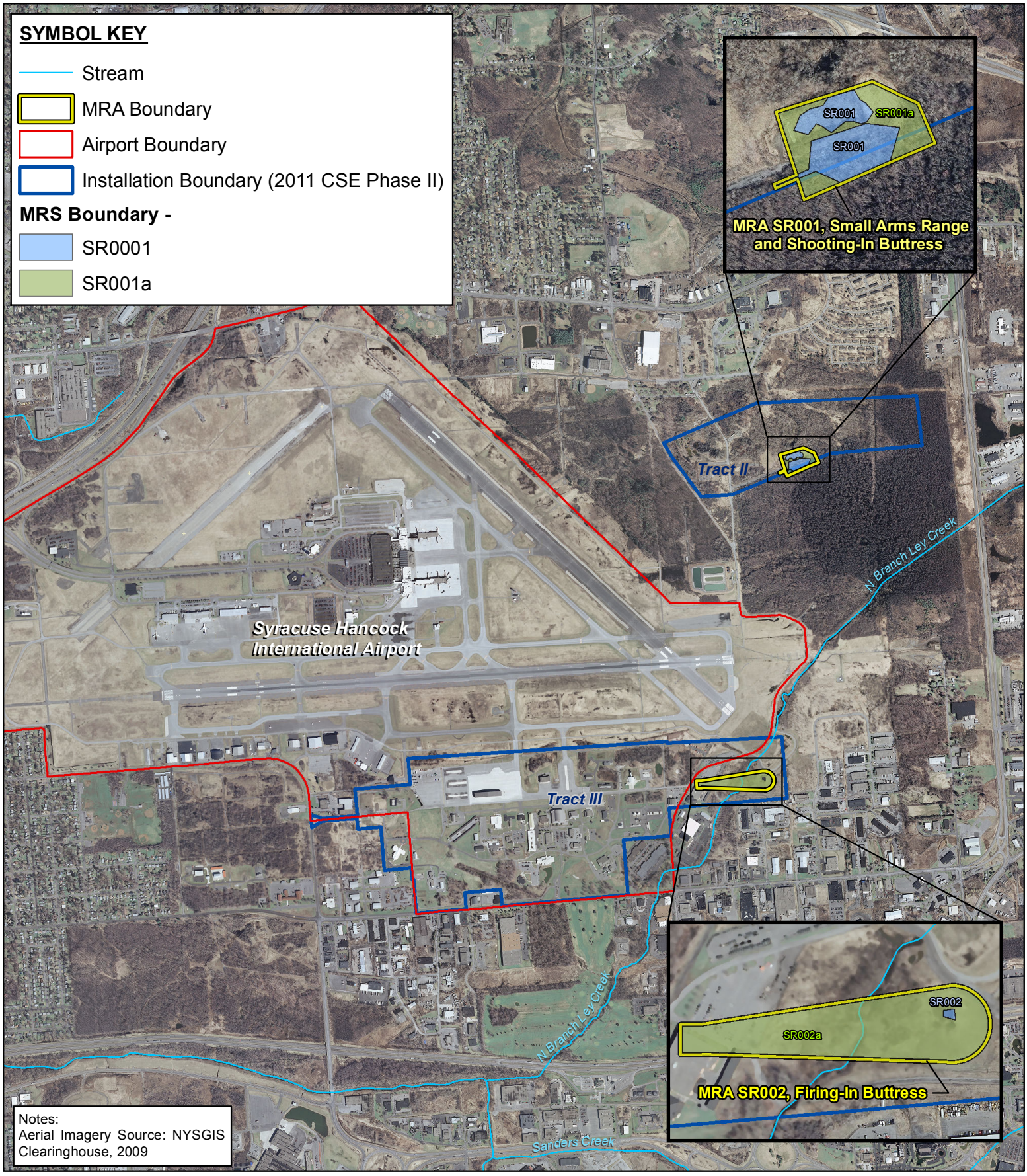

New York Air National Guard
Syracuse, New York

N

FIGURE 1-2
Site Location Map
Final Non-Time Critical Removal Action Work Plan
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 0.5 1 2 Kilometers
0 0.25 0.5 1 1.5 Miles

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During peacetime, the combat-ready units and support units are assigned to most USAF major commands to carry out missions compatible with training, mobilization, readiness, and humanitarian and contingency operations. Mission-related activities include vehicle, aircraft, and runway maintenance, fueling operations, and military training operations.

1.2.2 Munitions Response Area Overview

Munitions response actions are required within three areas located within two MRSs (Figure 1-3 and 1-4).

- MRS SR001
  - Small Arms Range and Shooting In Buttress
  - 40-mm Practice Grenade Area
- MRS SR002 Firing-In Buttress

1.2.2.1 MRS SR001, Small Arms Range and Shooting-In Buttress

MRS SR001 encompasses approximately 1.9 acres of land located within Munitions Response Area (MRA) SR001, Small Arms Range and Shooting-In Buttress (Figure 1-2). Within munitions response area (MRA) SR001, MRS SR001 (Figure 1-3) was delineated based upon lead-impacted soil and the practice grenade debris area identified during the 2011 CSE Phase II. MRS SR001 consists of approximately 0.63 acres located within the former small arms range and approximately 1.27 acres of land historically used as a practice grenade area. A description of MRA SR001 is presented below and a summary of the results of the CSE Phase II is presented in Section 1.3.

The Shooting-In Buttress was constructed during the WWII era. Historical documents do not indicate the types of munitions used, the frequency of use, or when activities ended (ITSI/Shaw, 2009).

The small arms range was constructed in the 1960s and used for training by Hancock Field personnel, the NYANG, local reserve units, and local police. The Shooting-In Buttress may have been removed during construction of the small arms range. According to historical documents, the berm may have been used to construct a portion of the small arms range berm. Ammunition potentially used prior to 1986 at the range included 7.62-mm, .38-caliber, .45-caliber, and .50-caliber munitions. Small arms use after 1986 consisted of 5.56-mm and 9-mm ball munitions. The use of the small arms range was discontinued in 2002 (ITSI/Shaw, 2009).

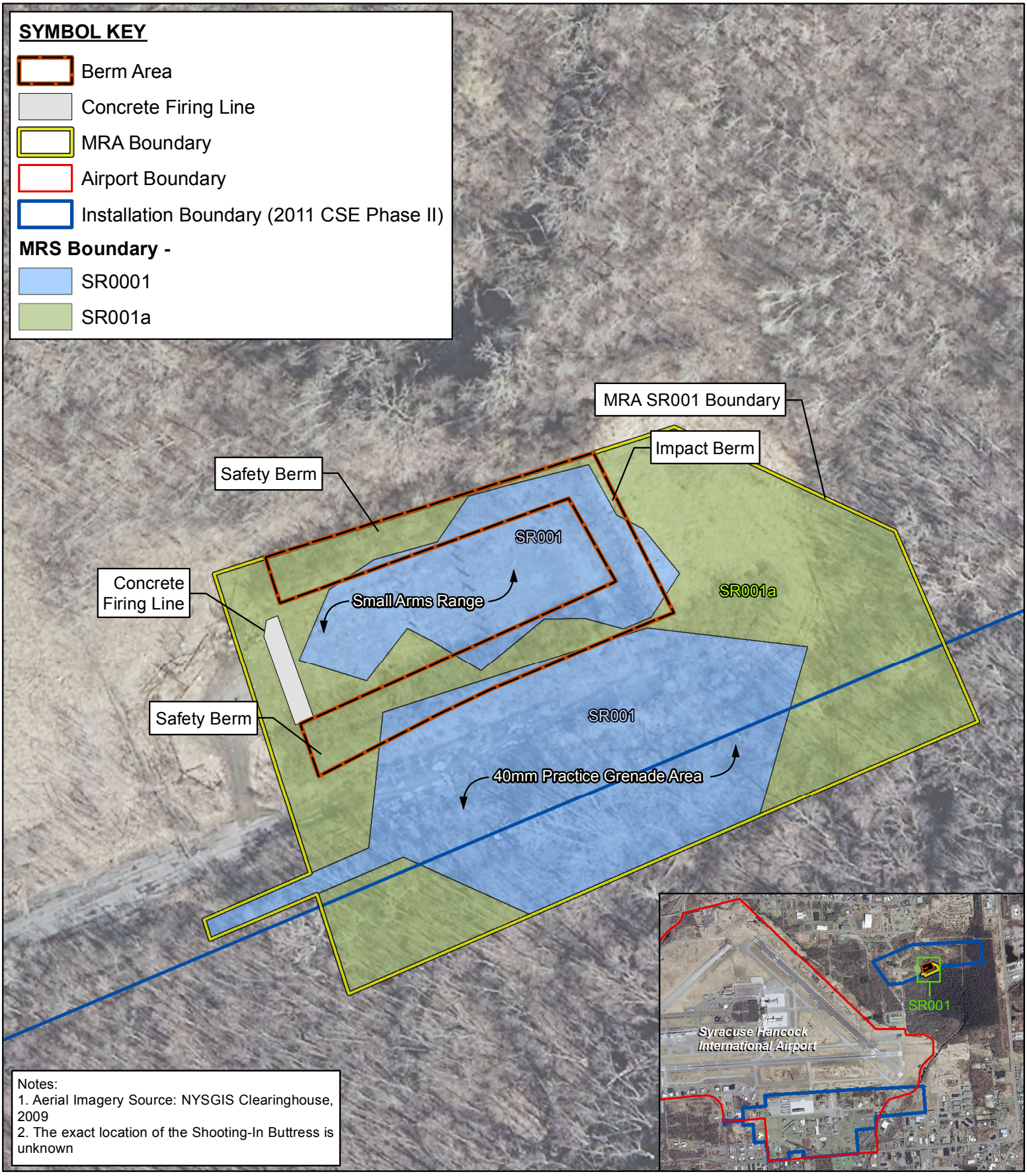

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FIGURE 1-3
MRA SR001 - Site Map
Final Non-Time Critical Removal Action Work Plan
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 50 100 200 300 400 Feet
0 25 50 100 Meters

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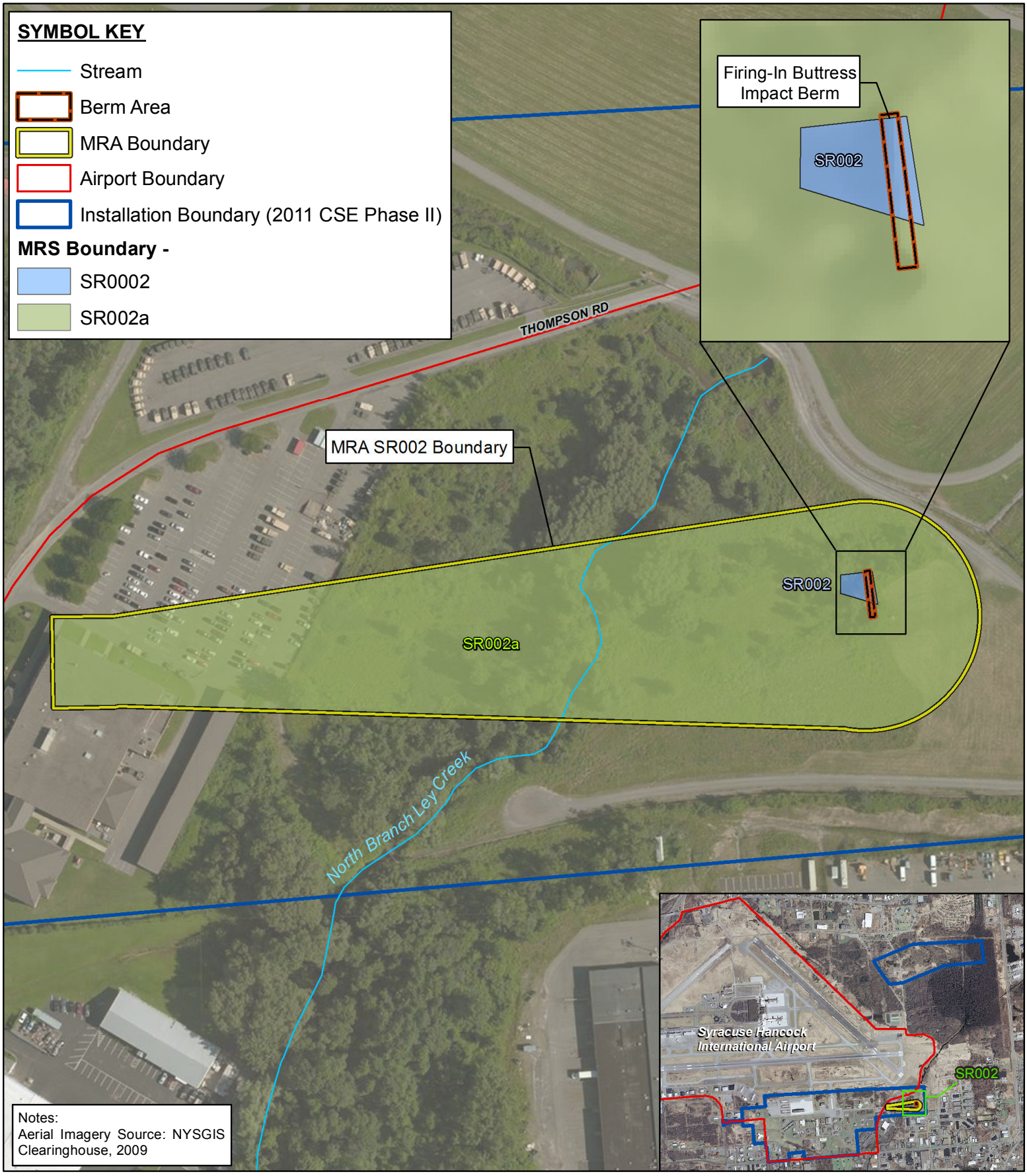

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FIGURE 1-4
MRA SR002 - Site Map
Final Non-Time Critical Removal Action Work Plan
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 75 150 300 450 600 Feet
0 25 50 100 150 200 Meters

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Currently, MRS SR001 consists of vacant land with remnants of berms and small arms facilities. On-site berms consist of safety berms located on the north and south and an impact berm to the east of the site. The berms range in height from 12 to 15 ft and are densely vegetated. A concrete firing pad remains on the western side of the range. Remnants of large target frames made of wooden utility poles are located throughout the range. Many target structures remain upright and have small arms projectiles imbedded in the front sides (ITSI/Shaw, 2009).

A concrete firing pad remains on the western side of the range. Remnants of large target frames made of wooden utility poles are located throughout the range. Many target structures remain upright and have small arms projectiles imbedded in the front sides (ITSI/Shaw, 2009).

During the CSE, a 40-mm practice grenade area was identified and included in MRS SR001.

1.2.2.2 MRS SR002, Firing-In Buttress

MRS SR002 encompasses approximately 0.03 acres of land located within MRA SR002 (Figure 1-2). The area defined as MRS SR002 (Figure 1-4) was delineated within MRA SR002 based upon lead-impacted soil identified during the 2011 CSE Phase II. MRS SR002 consists of the Firing-In Buttress, a wood and concrete structure and the soil within the structure. A description of the MRA SR002 is presented below and a summary of the results of the CSE Phase II is presented in Section 1.3.

The MRS consists of the Firing-In Buttress, constructed of wooden railroad ties, concrete, and sod. According to the CSE Phase I, the top of the structure is comprised of eight rows of wooden railroad ties with a concrete slab over the wooden ties and sod covering the concrete. The side supports consists of 13 rows of wooden railroad ties. The opening of the structure is approximately 15 ft high and 80 ft wide. The inside of the wooden structure contains the soil impact berm. It is not known when activities began at the site; however, it is thought that the Firing-In Buttress was used on rare occasions. The intended use of the site was as a backstop and safety berm for jammed rounds (ITSI/Shaw, 2009). It was also used by F-86 aircraft test firing and boresight alignment of up to .50-caliber ammunition (Sky, 2012). According to an interview conducted during the CSE Phase I, the area has been inactive since at least 1976 (ITSI/Shaw, 2009).

Currently, MRS SR002 is vacant and contains dense vegetation consisting of shrubs and trees. The wooden portion of the Firing-In Buttress structure is still present and largely intact.

1.3 Previous Investigations

Investigations conducted prior to this NTCRA at SR001 and SR002 include:

- Modified CSE Phase I (ITSI/Shaw, 2009);
- CSE Phase II (Sky, 2012);
- EE/CA (ANG, 2013a); and,
- Action Memorandum (ANG, 2013b).

1.3.1 Modified Comprehensive Site Evaluation Phase I

In 2009, a CSE Phase I was performed to identify potential MRAs, evaluate actual or potential releases of MC to the environment, and evaluate associated targets of concern. The CSE Phase I investigated ten potential MRAs at Hancock Field including MRAs SR001 and SR002. Based on the findings of the CSE Phase I, it was determined that there was no evidence of MC releases that would warrant immediate action. However, a potential for environmental impacts from MCs to have occurred was identified at MRAs SR001 and SR002. No Further Action (NFA) or transfer to the Formerly Used Defense Sites Program was recommended for the remaining eight MRAs. The CSE Phase I identified lead, copper, and iron as the primary MCs of concern at MRAs SR001 and SR002. Additionally, a 3.5-inch (in.) high-explosive anti-tank (HEAT) rocket was identified at the Firing-In Buttress, MRA SR002, which resulted in explosives being included as constituents of concerns (COCs). It was recommended that a CSE Phase II be conducted at these two MRAs to assess the potential for environmental release of MC (ITSI/Shaw, 2009). Results of the CSE Phase I are shown on Figures 1-5 and 1-6.

1.3.2 Comprehensive Site Evaluation Phase II

Between 8 September and 17 September 2010, a CSE Phase II was conducted for MRAs SR001 and SR002. The objectives of the CSE Phase II were to determine whether releases of MCs to the environment had occurred, determine if there was a need for an emergency response, and/or whether other munitions response actions were necessary. CSE Phase II activities included visual surveys, ex-situ x-ray fluorescence (XRF) sampling of surface and subsurface soil, a human health risk assessment, and an ecological risk assessment (Sky, 2012).

While the CSE Phase I identified copper, lead, and iron as primary MCs of concern, MC sampling conducted during the CSE Phase II did not include the analysis of copper and iron. Based upon experience at other small arms ranges, lead is the most pervasive of these constituents. Therefore, lead soil concentrations were utilized to delineate the extent of contamination within the MRAs.

An XRF analyzer was used to measure lead concentrations in surface and subsurface soil. To determine the comparability of ex-situ XRF data to laboratory data and to verify the quality of

data, a correlation analysis was conducted. This analysis is necessary to determine what XRF value is equivalent to a laboratory value of 400 milligrams per kilogram (mg/kg) (human health screening value for lead under residential use) and to determine if XRF data is screening level data or definitive data. The method of applicability analysis concluded that an XRF reading of 261 mg/kg correlated to a laboratory result of 400 mg/kg; therefore, 261 mg/kg was used as the XRF screening criterion for the delineation of lead impacted soil. In general, ex-situ XRF results and laboratory results exhibited good correlation. When plotted against laboratory data, the correlation coefficient calculation resulted in a value of 0.96, indicating that XRF data was definitive and could be used for decision-making (Sky, 2012).

1.3.2.1 MRA SR001, Small Arms Range and Shooting-In Buttress

During the visual survey of MRA SR001, small arms casings and lead projectiles of various calibers were observed, indicating past small arms use (Figure 1-5). In addition, the following MD items were observed:

- 40-mm practice grenade debris;
- Smoke canister debris;
- Non-lethal offensive grenade debris; and,
- Small amounts of clay target debris.

No evidence of MEC was observed during the visual survey of the site; therefore, the collection and analysis of soil samples for explosives was not warranted.

As shown on Figure 1-6, a total of 54 ex-situ XRF samples were collected from 40 locations at MRA SR001 and analyzed for lead. XRF lead results ranged from 22 mg/kg to 5,217 mg/kg, and are presented in Table 1-1. Sixteen samples exceeded the modified screening level for lead of 261 mg/kg. Samples that exceeded the modified screening level were located primarily at depths of 0 to 6 in. below ground surface (bgs); however, three samples exceeded the modified screening level at the 6 to 12 in. interval and one sample exceeded the modified screening level at the 12 to 18 in. interval.

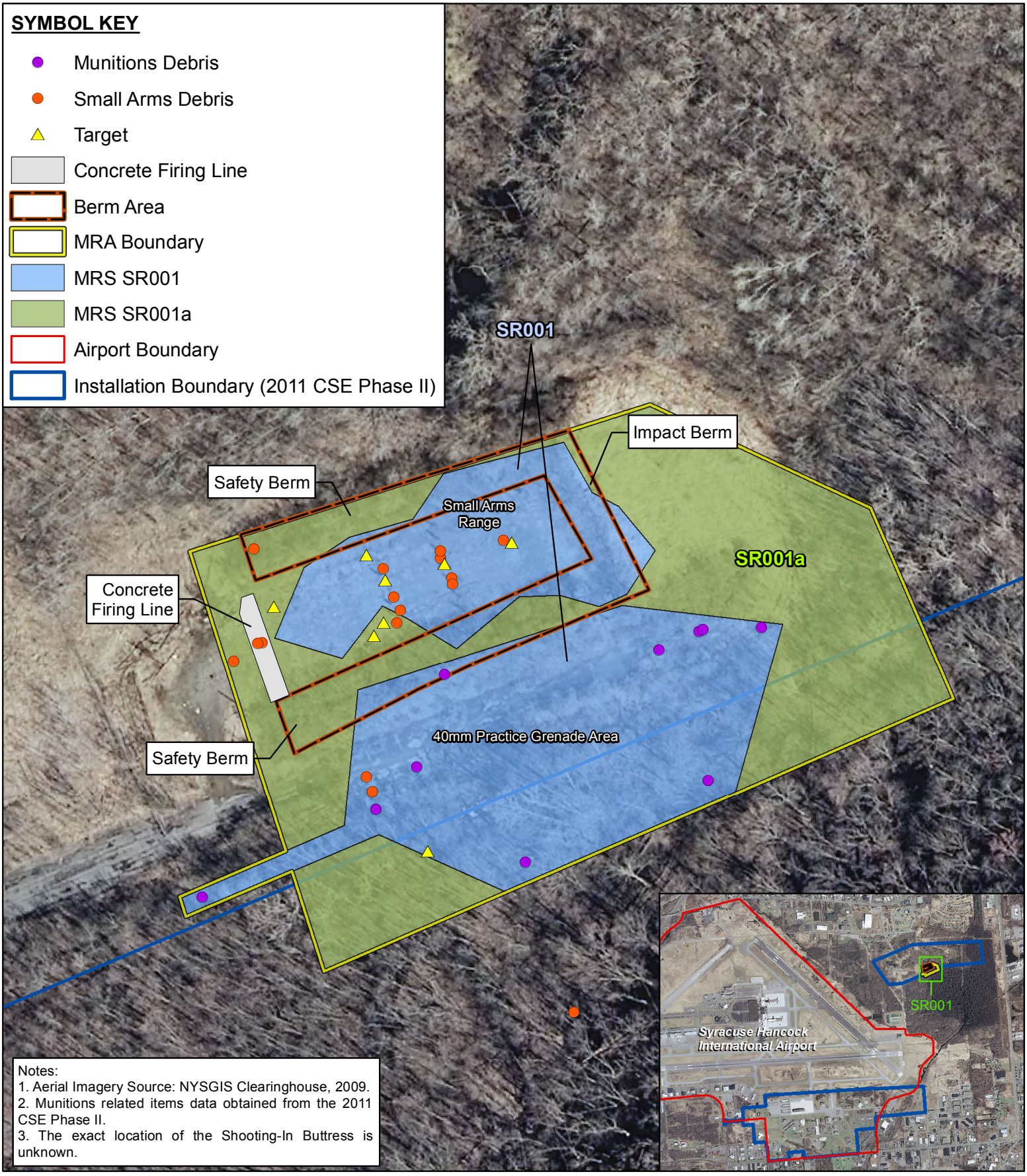

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FIGURE 1-5
CSE Phase I & II Visual Survey Results, MRA SR001
Final Non-Time Critical Removal Action Work Plan
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 50 100 200 300 400 Feet
0 25 50 100 Meters

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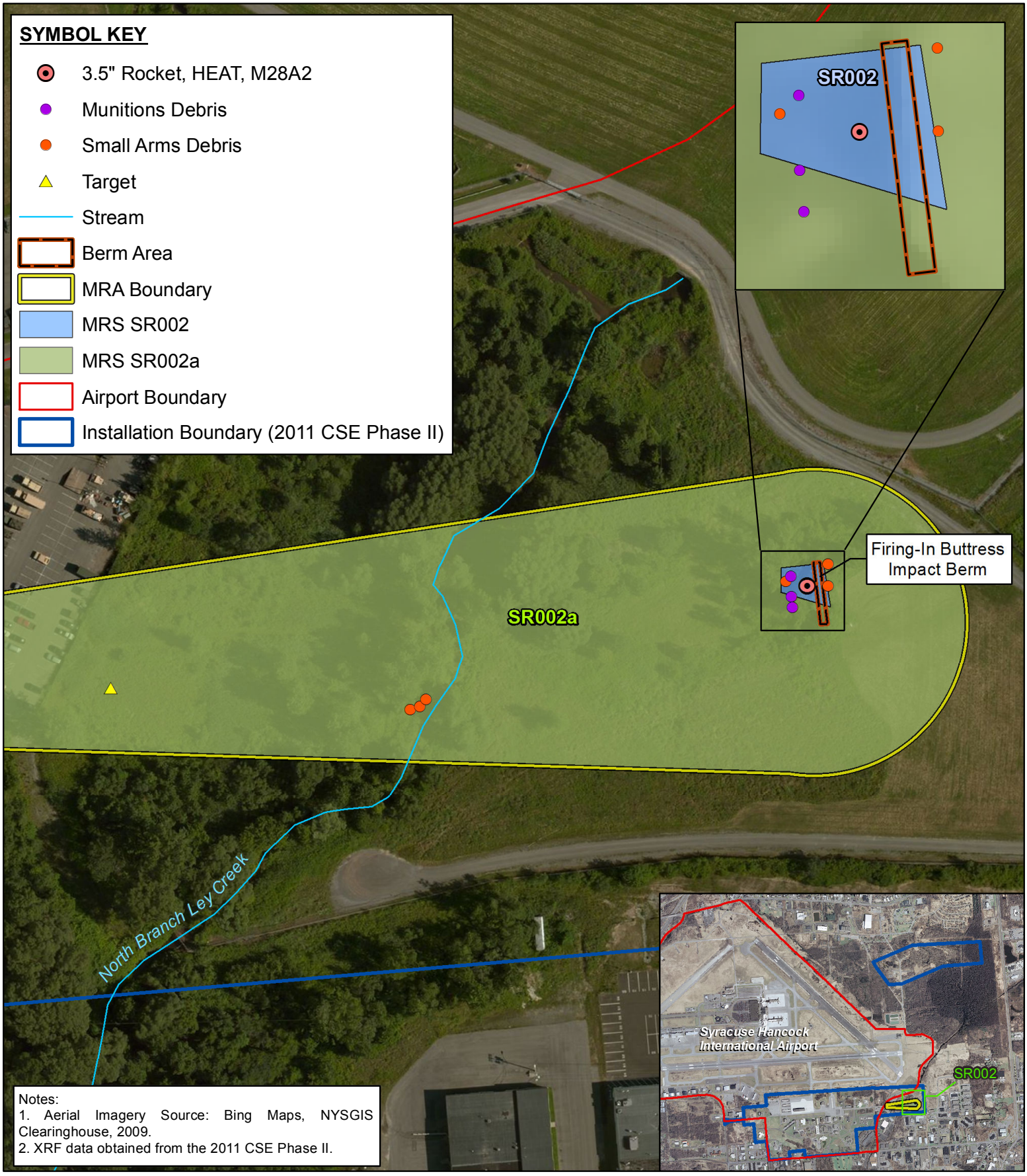

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FIGURE 1-6
CSE Phase I & II Visual Survey Results, MRA SR002
Final Non-Time Critical Removal Action Work Plan
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 125 250 375 500 Feet
0 25 50 100 150 Meters

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Samples that exceeded the modified screening level were located within the small arms range, primarily between the concrete firing line and the impact berm (Figure 1-7).

Table 1-1. Ex-Situ XRF Sampling Results, MRA SR001

Sample ID	Analysis Date/Time	Depth Interval (in. bgs)	Lead Concentration (mg/kg)
C-XR-HF-01-SS-004	9/11/2010 14:57	0 - 6	100
C-XR-HF-01-SS-009	9/11/2010 10:27	0 - 6	**336**
C-XR-HF-01-SS-101	9/11/2010 11:01	0 - 6	**648**
C-XR-HF-01-SB1-101	9/13/2010 13:23	6 - 12	88
C-XR-HF-01-SS-102	9/11/2010 9:29	0 - 6	234
C-XR-HF-01-SS-103	9/11/2010 15:11	0 - 6	**630**
C-XR-HF-01-SB1-103	9/14/2010 14:41	6 - 12	158
C-XR-HF-01-SS-104	9/11/2010 11:42	0 - 6	**1,804**
C-XR-HF-01-SB1-104	9/14/2010 13:40	6 - 12	**278**
C-XR-HF-01-SS-105	9/11/2010 9:44	0 - 6	**4,096**
C-XR-HF-01-SB1-105	9/13/2010 12:27	6 - 12	**371**
C-XR-HF-01-SB2-105	9/13/2010 16:39	12 - 18	141
C-XR-HF-01-SS-106	9/11/2010 13:15	0 - 6	**302**
C-XR-HF-01-SB1-106	9/14/2010 12:54	6 - 12	60
C-XR-HF-01-SS-107	9/11/2010 13:55	0 - 6	56
C-XR-HF-01-SS-108	9/11/2010 13:35	0 - 6	**257**
C-XR-HF-01-SB1-108	9/14/2010 14:23	6 - 12	50
C-XR-HF-01-SS-109	9/11/2010 13:47	0 - 6	261
C-XR-HF-01-SB1-009	9/13/2010 13:46	6 - 12	229
C-XR-HF-01-SS-110	9/11/2010 11:31	0 - 6	**4,411**
C-XR-HF-01-SB1-110	9/14/2010 14:33	6 - 12	123
C-XR-HF-01-SS-111	9/11/2010 12:52	0 - 6	**1,009**
C-XR-HF-01-SB1-111	9/14/2010 15:13	6 - 12	124
C-XR-HF-01-SS-112	9/11/2010 10:43	0 - 6	**5,217**
C-XR-HF-01-SB1-112	9/14/2010 13:12	6 - 12	**902**
C-XR-HF-01-SB2-112	9/14/2010 12:36	12 - 18	**323**
C-XR-HF-01-SB3-112	9/15/2010 14:57	18 - 24	172
C-XR-HF-01-SS-113	9/11/2010 15:03	0 - 6	97
C-XR-HF-01-SS-114	9/11/2010 11:13	0 - 6	**309**
C-XR-HF-01-SB1-114	9/13/2010 15:08	6 - 12	64
C-XR-HF-01-SS-151	9/11/2010 14:03	0 - 6	**294**
C-XR-HF-01-SS-152	9/11/2010 12:02	0 - 6	49
C-XR-HF-01-SS-153	9/11/2010 14:28	0 - 6	73
C-XR-HF-01-SS-154	9/11/2010 16:31	0 - 6	69
C-XR-HF-01-SS-155	9/13/2010 11:39	0 - 6	29
C-XR-HF-01-SS-156	9/13/2010 12:02	0 - 6	47
C-XR-HF-01-SS-157	9/13/2010 13:33	0 - 6	47
C-XR-HF-01-SS-158	9/11/2010 15:37	0 - 6	46
C-XR-HF-01-SS-301	9/13/2010 10:33	0 - 6	25
C-XR-HF-01-SS-302	9/13/2010 10:40	0 - 6	29
C-XR-HF-01-SS-303	9/14/2010 15:06	0 - 6	43
C-XR-HF-01-SS-304	9/13/2010 13:16	0 - 6	178
C-XR-HF-01-SS-305	9/14/2010 13:57	0 - 6	43
C-XR-HF-01-SS-306	9/14/2010 13:05	0 - 6	36
C-XR-HF-01-SS-307	9/14/2010 14:14	0 - 6	62
C-XR-HF-01-SS-308	9/14/2010 13:18	0 - 6	132

Table 1-1. Ex-Situ XRF Sampling Results, MRA SR001 (continued)

Sample ID	Analysis Date/Time	Depth Interval (in. bgs)	Lead Concentration (mg/kg)
C-XR-HF-01-SS-401	9/14/2010 17:00	0 - 6	37
C-XR-HF-01-SS-402	9/14/2010 16:02	0 - 6	66
C-XR-HF-01-SS-403	9/15/2010 13:20	0 - 6	99
C-XR-HF-01-SS-601	9/15/2010 14:12	0 - 6	78
C-XR-HF-01-SS-602	9/15/2010 15:03	0 - 6	22
C-XR-HF-01-SS-701	9/16/2010 11:54	0 - 6	199
C-XR-HF-01-SS-702	9/16/2010 11:59	0 - 6	30
C-XR-HF-01-SS-801	9/17/2010 11:54	0 - 6	27

Notes:
Highlighted cells indicate sample results that exceed the modified soil screening criteria of 261 mg/kg.
bgs – below ground surface
in. – inch(es)
mg/kg – milligrams per kilogram

As lead exceeded the modified screening level of 261 mg/kg, a Screening Level Human Health Risk Assessment (SLHHRA) and a Screening Level Ecological Risk Assessment (SLERA) were performed for MRA SR001. The results indicated that lead was present at concentrations that may present a human health risk under a residential land use scenario. Additionally, lead exceeded ecological risk screening criterion intended to be protective of soil invertebrates, plants, and wildlife (Sky, 2012).

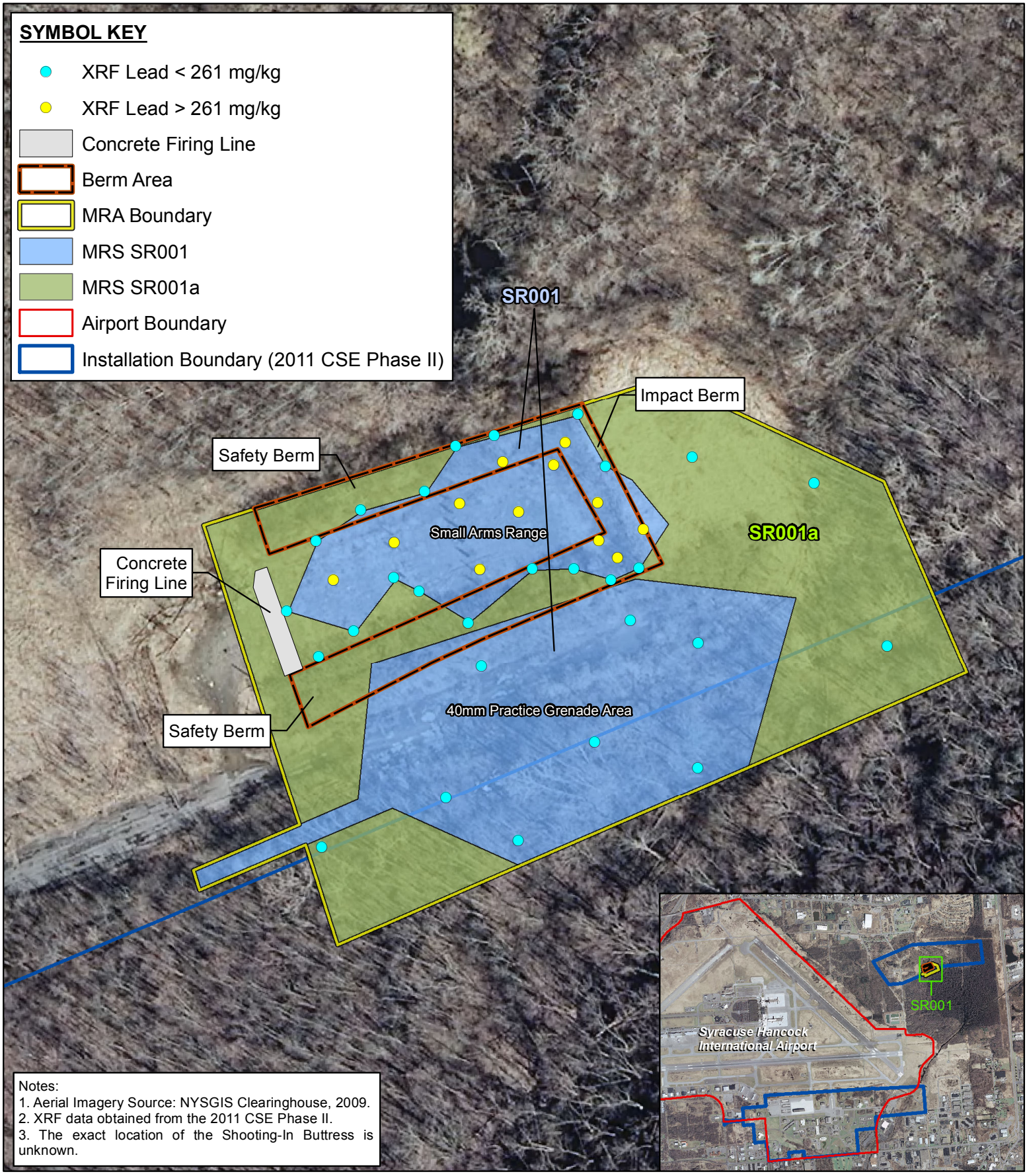
Based on the results of the CSE Phase II, MRA SR001 was divided into two MRSs. Further munitions response was recommended for approximately 1.9 acres, designated as MRS SR001. The CSE Phase II also recommended NFA for approximately 1.8 acres, designated as MRS SR001a (Figure 1-7) (Sky, 2012).

1.3.2.2 MRA SR002, Firing-In Buttress

Evidence of small arms use was observed during the visual inspection at MRA/MRS SR002 (Figure 1-6), and included the following:

- Blank 5.56-mm casings;
- Plastic small arms 5.56-mm magazine; and,
- .50 caliber steel cores.

In addition to the small arms identified during the visual inspection, 20-mm target practice MD and a rocket spacer were observed (Sky, 2012). Although the CSE Phase I identified explosives as a COC due to the identification of the 3.5-in. HEAT rocket, samples were not analyzed for explosives during the CSE Phase II because no other evidence of MEC was observed. The CSE Phase II indicated that significant evidence of MEC use was not identified during the visual survey and that the rocket found at the Firing-In Buttress did not constitute a significant enough source to warrant sampling (Sky, 2012).



New York Air National Guard
Syracuse, New York

N

FIGURE 1-7
CSE Phase II Results, MRA SR001
Final Non-Time Critical Removal Action Work Plan
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

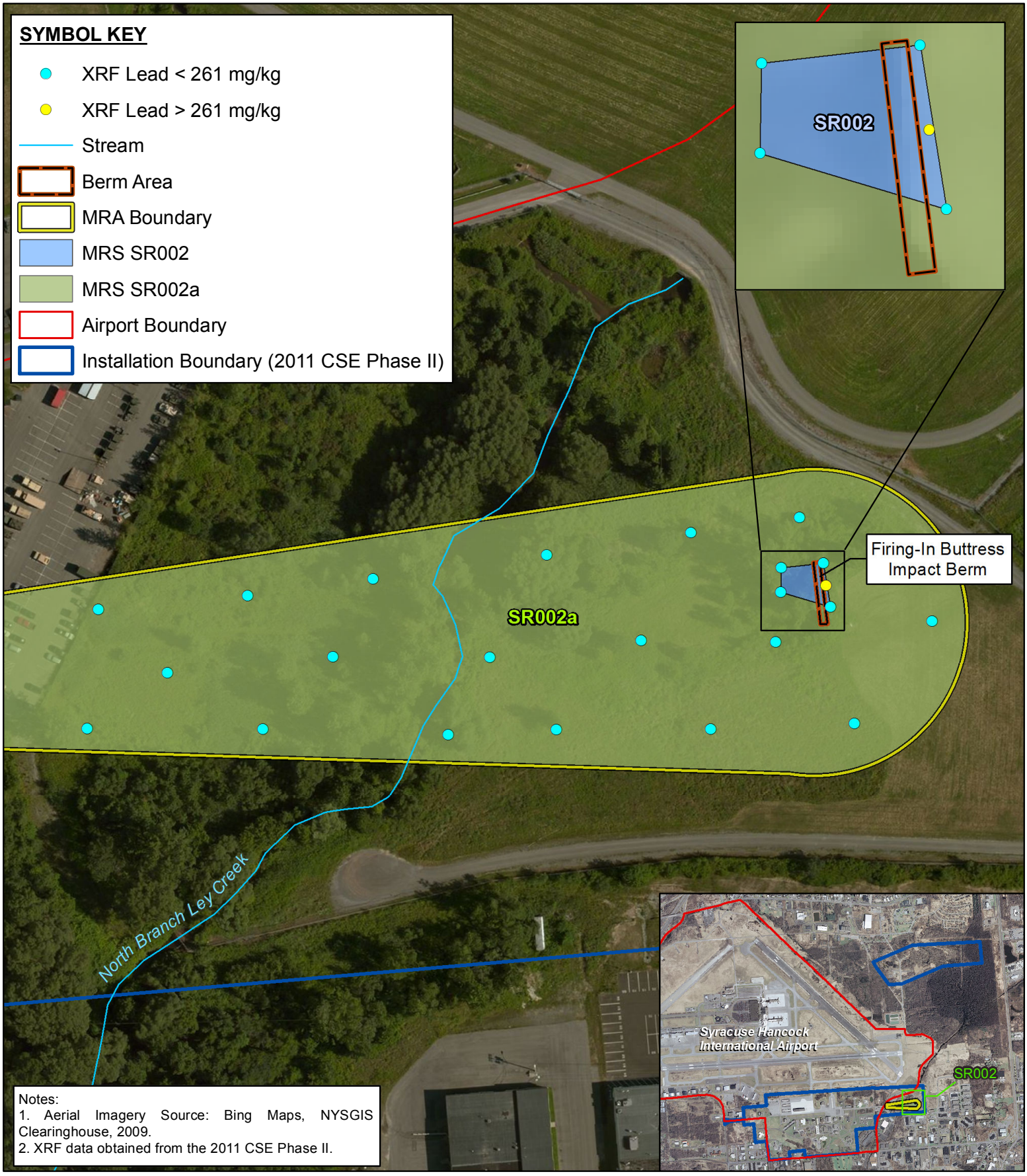
0 50 100 200 300 400 Feet
0 25 50 100 Meters

12/17/2013	File: ANG_Hancock_XRF_SR0001_NTCRA.mxd	
PROJ: 912810001	Drawn: JBO	Page 1-15

As shown in Figure 1-8, ex-situ XRF samples were collected and analyzed for lead at SR002 MRA. The XRF results ranged from below the detection limit to 585 mg/kg, and are presented in Table 1-2. Three samples exceeded the modified screening level for lead of 261 mg/kg at depths ranging from 0 to 18 inches bgs. These samples were located within and at the center of the Firing-In Buttress (Sky, 2012).

As lead exceeded the modified screening level of 261 mg/kg, a SLHHRA and SLERA were performed for MRA SR002. The results indicated that lead concentrations were not likely to present a significant human health risk under a residential land use scenario. However, the assessment concluded that lead was present at concentrations that exceeded ecological risk screening criterion intended to be protective of soil invertebrates, plants, and wildlife (Sky, 2012).

Based on the results of the CSE Phase II, MRA SR002 was divided into two MRSs. Further munitions response was recommended for approximately 0.03 acres, designated as MRS SR002. It also recommended NFA for approximately 5.7 acres, designated as MRS SR002a (Figure 1-8).



New York Air National Guard
Syracuse, New York

N

FIGURE 1-8
CSE Phase II Results, MRA SR002
Final Non-Time Critical Removal Action Work Plan
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 125 250 375 500 Feet
0 25 50 100 150 Meters

12/17/2013

File: ANG_Hancock_XRF_SR0002_NTCRA.mxd

PROJ: 912810001

Drawn: JBO

Table 1-2. Ex-Situ XRF Sampling Results, MRA SR002

Sample ID	Analysis Date /Time	Depth (in. bgs)	Lead Concentration (mg/kg)
C-XR-HF-02-SS-201A	9/13/2010 10:16	0 - 6	103
C-XR-HF-02-SS-202	9/11/2010 15:44	0 - 6	< LOD
C-XR-HF-02-SS-203	9/11/2010 10:06	0 - 6	16
C-XR-HF-02-SS-204	9/13/2010 11:09	0 - 6	24
C-XR-HF-02-SS-205	9/13/2010 10:52	0 - 6	23
C-XR-HF-02-SS-206	9/13/2010 11:33	0 - 6	19
C-XR-HF-02-SS-207A	9/11/2010 15:50	0 - 6	30
C-XR-HF-02-SS-208	9/13/2010 11:51	0 - 6	18
C-XR-HF-02-SS-209A	9/11/2010 9:56	0 - 6	**368**
C-XR-HF-02-SB1-209B	9/14/2010 15:39	6 - 12	**585**
C-XR-HF-02-SB2-209B	9/14/2010 16:11	12 - 18	**431**
C-XR-HF-02-SB3-209B	9/14/2010 16:51	18 - 24	195
C-XR-HF-02-SS-251	9/13/2010 10:47	0 - 6	15
C-XR-HF-02-SS-252	9/13/2010 12:39	0 - 6	17
C-XR-HF-02-SS-253	9/13/2010 11:56	0 - 6	17
C-XR-HF-02-SS-254	9/13/2010 11:46	0 - 6	24
C-XR-HF-02-SS-255	9/13/2010 11:29	0 - 6	21
C-XR-HF-02-SS-256	9/13/2010 11:15	0 - 6	18
C-XR-HF-02-SS-257	9/11/2010 16:26	0 - 6	< LOD
C-XR-HF-02-SS-351	9/13/2010 11:03	0 - 6	14
C-XR-HF-02-SS-352	9/13/2010 12:34	0 - 6	22
C-XR-HF-02-SS-353	9/13/2010 10:26	0 - 6	27
C-XR-HF-02-SS-502	9/15/2010 12:11	0 - 6	14
C-XR-HF-02-SS-503B	9/14/2010 15:19	0 - 6	24
C-XR-HF-02-SS-504B	9/14/2010 15:25	0 - 6	31
C-XR-HF-02-SS-519	9/15/2010 14:39	0 - 6	13

Notes:
Highlighted cells indicate sample results that exceed the modified soil screening criteria of 261 mg/kg.
bgs – below ground surface
in. – inch(es)
< LOD= below the limit of detection. The limit of detection is approximately 12 mg/kg based on the lowest observed value at Hancock Field.
mg/kg – milligrams per kilogram

1.3.3 Engineering Evaluation/Cost Analysis

An EE/CA was developed by the ANG to identify removal action alternatives and evaluate the effectiveness, implementability, and cost of each alternative in order to assist decision-makers in the selection of the appropriate MC response action for both MRSs. Based upon the results of the CSE Phase I/II, a response action is necessary to mitigate potential hazards to human health and the environment. Using the criteria established by the U.S. Environmental Protection Agency (USEPA), the EE/CA evaluated three response action alternatives listed below:

- Alternative One: No Action;
- Alternative Two: Institutional Controls; and,
- Alternative Three: Excavation and Off-site Disposal.

The EE/CA recommended Alternative Three, Excavation and Off-site Disposal, because it met evaluation criteria, removes lead-impacted soil from each MRS, is relatively easy to implement, is effective in both the short- and long-term, and would most likely be acceptable by regulatory agencies and the community. Removal Action Objectives (RAOs) were developed as part of the EE/CA and include:

- Reduce human health risks associated with residual concentrations of lead above 400 mg/kg and copper above 270 mg/kg in soil from the use of small arms ammunition at MRSs SR001 and SR002; and,
- Reduce future hazards and risks by mitigating soils impacted by copper (concentrations greater than 270 mg/kg), lead (concentrations greater than 400 mg/kg), MD, munitions, small arms, and range related debris, thus reducing or eliminating the potential for migration of MCs at concentrations above human health risk standards to surrounding environmental media (ANG, 2013a).

1.3.4 Action Memorandum

An Action Memorandum was prepared to request approval from the ANG to conduct a NTCRA of MC-impacted soil at MRSs SR001 and SR002 at Hancock Field. The purpose of the Action Memorandum was to request and document approval of the selected NTCRA (excavation and off-site disposal) for MRSs SR001 and SR002. The Action Memorandum concluded that the conditions at Hancock Field meet the NCP criteria for a removal action and requested concurrence from the National Guard Bureau to proceed with the NTCRA (ANG, 2013b) within the Response Action Areas identified in Table 1-3.

Table 1-3. Response Action Areas

MRS	Title	MD Pickup	Range Floor	Preberm	Berm
SR001	Small Arms Range	X	✓	✓	✓
	40-mm Grenade Practice Area	✓	X	X	X
SR002	Firing-In Buttress	X	X	✓	✓

Notes:
MRS – Munitions Response Site
mm – millimeter
MD – Munitions Debris
X – response action will not occur at this location
✓ – response action will occur at this location

1.4 Munitions and Explosives of Concern Risk

During previous investigations, one MEC item was identified at MRS SR002 (a 3.5-in. HEAT rocket) and no MEC items have been identified at MRS SR001. Although the 3.5-in. HEAT rocket was identified at MRS SR002, it was reported that the Firing-in Buttress was not intended for use with explosive munitions and the 3.5-in. Heat Rocket firing is believed to be an isolated occurrence (Sky, 2012).

Based upon the findings from previous investigations, SR001 and SR002 do not present a MEC risk. However, if MEC items are identified during the soil removal activities or surface debris removal during material potentially presenting an explosive hazard (MPPEH) inspection, the USACE Project Manager (PM) will be notified to determine the appropriate course of action for the site.

1.5 Munitions Constituents Contaminant Assessment

1.5.1 Soil

Smalls arms of various calibers and/or practice grenades were used at MRSs SR001 and SR002. During the CSE Phase II, small arms were observed on the surface at both MRSs. Additionally, due to soil at the smalls arms range (SR001) being reworked by large machinery for maintenance, spent small arms may be present in subsurface soils. During the CSE Phase II, surface and subsurface soil samples were analyzed for lead using an XRF analyzer. The results indicated that lead was present at concentrations exceeding the modified screening level of 261 mg/kg at both MRSs. At MRS SR001, lead-impacted soil was limited to an area primarily between the concrete firing line and the impact berm (Figure 1-7). At MRS SR002, lead-impacted soil was limited to an area within the Firing-In Buttress (Figure 1-8). In general, lead concentrations above the screening level were limited to the top 6 inches of soil. However, at three locations within MRS SR001 and one location at MRS SR002, lead concentrations were above screening levels at depths ranging from 6 to 18 inches.

1.5.2 Sediment

There are no surface water bodies near MRS SR001; therefore, sediment impacts are not applicable for SR001.

The North Branch of Ley Creek flows approximately 250 ft west of MRS SR002. However, based upon the distance of the creek from MRS SR002 and results of XRF soil sampling, it is unlikely that lead has impacted sediment within the creek.

1.5.3 Surface Water

There are no identified surface water bodies near MRS SR001; therefore, surface water impacts are not applicable for the site.

Soil samples were collected and analyzed for lead throughout MRS SR002 using XRF. Results indicate that soil impacted by lead is limited to an area within the Firing-In Buttress (SR002).

Samples collected between the structure and the creek are an order of magnitude below the modified screening level for soil. Based on the information above, it is unlikely that lead has impacted surface water within the creek.

1.5.4 Groundwater

Groundwater was not evaluated during the CSE Phase I and Phase II. While the groundwater pathway was determined to be potentially complete in the CSE Phase II (Sky, 2012), it is unlikely that lead has impacted groundwater at the MRSs. Since both SR001 and SR002 are located outdoors, bullets and fragments located within the MRSs have contributed to lead loading in site soils through weathering. In the weathering process, lead oxidizes and forms a variety of weathering products, such as lead oxides, sulfates, carbonates, and organic complexes. Rainfall events and humidity create a mechanism for mobility of weathering products (i.e., lead) throughout the soil profile.

Lead exhibits its greatest solubility/mobility at a pH less than 4 and greater than 11 (ITRC, 2003). Of the soil series present at the MRSs (Minoa fine sandy loam and Ontario loam), carbonates are present at depths greater than 36 in. The presence of carbonates is likely due to leaching of base cations to lower soil horizons and can be an indicator that pH increases with depth. According to the Onondaga County Soil Survey, these soils have a pH that ranges from approximately 5.1 to 6.5 between 0 and 15 in. bgs to approximately 5.6 to 6.6 below 15 in. (USDA-SCS, 1977). Increasing pH and increasing carbonate concentration with soil depth suggests that lead migration to groundwater is not favorable since most metals become less mobile with increasing pH. Furthermore, since the analytical results from the CSE Phase II indicate that lead concentrations in soil are confined to the upper 18 in., soluble lead concentrations are expected to decrease with depth and would have the ability to complex with the carbonates present at the 36 in. depth before reaching the water table at depths greater than 36 in. (3 ft).

To confirm that MCs have not impacted groundwater, seven temporary monitoring wells will be installed and sampled.

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2.0 PHYSICAL AND ENVIRONMENTAL SETTING

This section presents the environmental setting of the site, including information regarding climate, topography, geology, soils, surface water hydrology, hydrogeology and threatened/endangered species and habitats.

2.1 Climate

The climate at Hancock Field is relatively mild during summer and relatively cold during winter with frequent precipitation. Monthly mean high temperature ranges from 31 degrees Fahrenheit (°F) in January to 82°F in July. Monthly mean low temperature ranges from 15°F in January to 60°F in July. Average annual precipitation is approximately 38.3 in. Annual mean snowfall is approximately 107.1 in. (ITSI/Shaw, 2009).

2.2 Topography

Hancock Field is located within the Ontario-Mohawk Lowland Region of the Central Lowland Physiographic Province, which extends to Buffalo, New York. This province has relatively flat topography created by glacial erosion and deposition during the Wisconsin Glaciation. The installation is part of an area of flat lowlands situated between Lake Ontario and the Onondaga Escarpment in Syracuse, New York. Topography across the installation rises gradually from approximately 385 ft above mean sea level (msl) at the southeast end of the installation to approximately 425 ft above msl at the west-northwest part of the installation (ITSI/Shaw, 2009).

2.3 Soil

Soils at Hancock Field are generally composed of silty soils with varying amounts of clay and fine to medium sand. Soils within MRSs SR001 and SR002 consist primarily of fill soil with smaller areas of Galen and Minoa soil series. Fill soil is difficult to characterize due to its heterogeneous nature. Land affected by cutting and/or filling will exhibit varying characteristics based on the degree of alteration and the composition of fill material. Fill soils at MRSs SR001 and SR002 consist of gravel and clayey material, which may extend to greater than 2 ft bgs.

2.4 Geology and Hydrogeology

Hancock Field is located in an area of flat lowlands between Lake Ontario and the Onondaga Escarpment. Multiple layers underlie the base, including unconsolidated lake sediments from 0 to 50 ft bgs, glacial till from 50 to 100 ft bgs, and sedimentary bedrock beneath the till. The lake sediments are composed of silts with varying amounts of clay and fine to medium sand.

The glacial till is composed of gravel and large cobbles in a silty clay matrix. The sedimentary bedrock consists of shale and siltstone of the Vernon Formation (ITSI/Shaw, 2009).

The lake sediments contain an unconfined, non-sole source water table aquifer, which are several ft bgs. Due to low yield resulting from low transmissivity, the aquifer is not a suitable source of potable water. A confined aquifer is present in the bedrock below the glacial till. The glacial till layer serves as a barrier to vertical groundwater migration between the overlying lake sediments and underlying sedimentary bedrock. There is a strong upward flow potential between the confined bedrock aquifer and the unconfined water table aquifer (ITSI/Shaw, 2009). Groundwater is encountered at approximately 3 ft bgs at the MRSs SR001 and SR002 (ITSI/Shaw, 2009 and Sky, 2012).

Hancock Field and its surrounding areas contain naturally occurring swamps and poorly drained areas. These natural lowlands and swamps have been drastically altered by development of this area into its current use as a transportation center and military facility. There are delineated wetlands located in the southern and eastern areas of the installation (ITSI/Shaw, 2009). In general, surface drainage near the two sites is south and southeast toward the North Branch of Ley Creek (Figure 1-2). The North Branch of Ley Creek flows from north to south across the central part of the MRA SR002, approximately 250 ft west of MRS SR002 (Sky, 2012).

2.5 Critical Habitats and Endangered /Threatened Species

There are three animal species listed as endangered by the State of New York and are protected by the State; including, two reptiles, the Bog Turtle and Eastern Massasauga Rattlesnake, and one animal species, the Black Tern. Six plant species identified within 4 miles of Syracuse are listed by the State as rare, vulnerable, or threatened, according to the NYSDEC Wildlife Resources Center. The six plant species are the Weak Stellate Sedge, Large Twayblade, Southern Twayblade, Pod Grass, Calypso, and Marsh Valerian. It is unknown if any of the species are present at Hancock Field. However, no threatened or endangered species have been observed at either of the MRSs. There are no archaeological or cultural sites present at either MRS (ITSI/Shaw, 2009).

2.5.1 Wetlands

There are wetlands located in the southern and eastern portion of Hancock Field; however, no wetlands occur at the MRSs (ITSI/Shaw, 2009).

2.5.2 Surface Water

There are no surface water bodies within or in the immediate vicinity of MRS SR001.

Surface drainage near the MRSs is south and southeast toward the North Branch of Ley Creek (Figure 1-2). The North Branch of Ley Creek is located approximately 250 ft west of MRS SR002 and flows from north to south.

2.5.3 Groundwater

The overburden contains an unconfined, non-sole source water table aquifer, which can be found at an average depth of 3 ft bgs (ITSI/Shaw, 2009). However, due to low yield resulting from low transmissivity, the aquifer is not a suitable source of potable water. A confined aquifer is found in the bedrock below the glacial till.

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3.0 ENVIRONMENTAL PROTECTION PLAN

This Site-Specific Environmental Protection Plan (EPP) describes the procedures and methods that will be employed to minimize pollution as well as protect and conserve natural resources during the performance of all tasks at MRSs SR001 and SR002. This EPP was prepared using guidance provided in DID MR-005-12.

3.1 Site Resources

Critical site resources including wetlands, surface water, and groundwater resources are discussed in Section 2.5. Cultural resources have not been identified at MRS SR001 or MRS SR002.

3.2 Potential Environmental Impacts

Because the MRSs consist of land that has already been cleared, altered, and developed; it is anticipated that potential impacts to the environment will be minimal. Typically, vegetation that is first established at locations with similar conditions as the abandoned MRSs consist of opportunistic and/or invasive species of plants. These plants are typically fast to germinate and fast growers and are, due to these characteristics, not found on endangered or threatened species lists. In addition, due to previous development, these MRSs are not suitable habitat for wildlife.

3.3 Measures To Minimize Environmental Impacts

Procedures outlined in this chapter will be implemented to minimize environmental effects attributable to the execution of this removal action. The sampling and excavation activities will be implemented in compliance with applicable federal and state regulations, including those that protect air, water, land, human health and safety, and cultural and biological resources.

3.3.1 Worker Education Briefing

Before the start of removal action activities, on-site personnel will be briefed on health and safety issues and the need for minimizing impact on biological and water resources. The environmental protection measures in this EPP will be briefed and provided to contractor personnel prior to beginning work activities. Methods for avoiding and minimizing the potential impact on the species and communities of concern will be stressed during the on-site training.

3.3.2 Avoidance of Sensitive Areas

It is not anticipated that sensitive areas will be encountered during the implementation of field activities. However, the field team will take steps to avoid impacts to areas outside of the MRS boundaries. If sensitive plants or communities are identified near either MRS, the field team will make every effort to avoid disturbance of the area.

3.3.3 Wildlife Protection

It is not anticipated that threatened or endangered species will be encountered during this removal action. During field activities, workers will avoid harming, harassing, or capturing any wildlife encountered at the MRSs. Common wildlife species encountered during similar field activities are non-listed snakes and deer. Snakes encountered during any phase of work will not be harmed. The encountered snake will either be left alone and the area will not be approached until the snake has left the area or the snake will be relocated outside the area by a qualified biologist.

3.3.4 Dust and Emission Control

Control of fugitive dust and comprehensive air quality monitoring are two necessary elements of this removal action. During excavation activities, unpaved haul roads that are used by construction equipment will be sprayed with water, as deemed necessary.

Airborne dust monitoring will be conducted continuously through excavation activities. Monitoring will be conducted for both ambient air and personnel. If particulate matter levels exceed 5 milligrams per cubic meter, operations will be stopped and the excavation pit and surrounding area will be sprayed with water as a dust control measure.

3.3.5 Erosion and Sediment Control

Because the removal action will impact less than 1 acre, a Surface Water Pollution Prevention Plan is not necessary. However, best management practices and engineering controls will be utilized to mitigate the potential for migration of environmental impacts while excavation activities are performed at MRSs SR001 and SR002. Engineering controls including berms, silt fence, and/or straw or hay bales may be used around excavation areas to prevent the uncontrolled migration of sediment during precipitation events. When feasible, equipment will be positioned outside areas of potential contamination and will not traverse contaminated areas. Plastic covers will be utilized if soil is stockpiled to prevent precipitation and wind from transporting sediment outside of the MRS.

3.3.6 Waste Transportation

Trucks transporting wastes off-site will be completely and tightly covered with a tarp to prevent wastes from falling or blowing out of the truck bed.

3.3.7 Spill Control Plan

Due to the nature of the operations, the potential for a spill of pollutants to the environment (air, water, land) is unlikely. Chemicals that are anticipated to be stored on-site include, Alconox, insect repellant, lubricating oil, diesel fuel, and unleaded gasoline. The following subsections discuss potential spill locations and the methods and procedures that will be implemented to prevent spills and control spills if they occur.

3.3.7.1 Potential Spill Locations

The only vehicles/equipment that will be fueled on-site are those that will remain on-site or within the exclusion zone through the duration of a specific phase of work. Equipment that is anticipated to be fueled on-site includes, but is not limited to, mower(s), chain saws, front loader(s), Geoprobe®, and an excavator. This equipment will be fueled at designated areas within each MRS and will be conducted using preventative spill control measures specified in this section. All other vehicles will be fueled and repaired off-site

Other spills could occur at any location where field activities are being performed. These spills could be the result of hydraulic line or other fluid hose breakage.

3.3.7.2 Preventative Spill Control Measures

Containers of liquids containing petroleum products or other chemicals will have a label that will include product identity, hazard warnings, and manufacturer's name and address to prevent accidental disposal. These containers will be managed carefully when used and when not in use these containers will be kept in a closed cabinet. Flammable chemicals will be kept in a flammable storage cabinet in accordance with National Fire Prevention Association 30:4.3.3. The containers will be stored at the field office, away from the main operations, to decrease chances of container damage and chances of spillage.

Vehicles will be maintained in good operating condition and left running only when necessary. Vehicles that are not essential to actual field operations (e.g., vehicles used for transportation to and from the site) will be fueled, maintained, and serviced at an off-site location.

Drums used to store IDW/remediation derived waste (RDW) will meet DOT and USEPA requirements. Drums will be stored in a secure area and will be inspected weekly for signs of leaks.

If a storage tank is necessary to store diesel fuel for fueling heavy equipment (e.g., excavator, front loader, etc.), it will be positioned or located to prevent a discharge and furnished with a secondary means of containment, such as a dike or catchment basin, sufficient to contain the capacity of the largest single compartment or container with sufficient freeboard to contain precipitation. Whenever possible, the refueling hoses should be used over mobile and impermeable diking materials to recover product due to spillage, overfilling, line rupture, incidental drippage, etc.

3.3.8 Control and Containment of Spill

In areas where spills, leaks, or ruptures may occur; an adequate quantity of absorbent material and approved fire extinguishing equipment shall be available. Spill kits will be equipped with supplies for spill containment and control and will include:

- Absorbent material (Oilophylic pads, rags, broom, etc.);
- Storage/disposal containers (55 gallon drums or equivalent); and,
- Spill/migration controls (poly sheeting, berms, etc.).

For small spills, absorbent materials such as sand or commercial absorbents will be placed directly on the spill to prevent further spreading and recovery. Berms of earthen material will be used to contain large spills and will be constructed downgradient of the leading edge of the spill.

If a spill occurs, the spill will be immediately contained and the area affected will be cleaned and immediately containerized. Additionally, the Field Manager (FM), Site Safety and Health Manager, and Project Manager (PM) will be contacted and made aware of the spill. The PM will immediately report the spill to the Contracting Officer or Contracting Officer Representative.

4.0 REMOVAL ACTION OBJECTIVES

RAOs were developed during the EE/CA and include:

- Reduce human health risks associated with residual concentrations of lead above 400 mg/kg and copper above 270 mg/kg in soil from the use of small arms ammunition at MRSs SR001 and SR002; and,
- Reduce future hazards and risks by mitigating soils impacted by copper (concentrations greater than 270 mg/kg), lead (concentrations greater than 400 mg/kg), MD, munitions, small arms, and range related debris, thus reducing or eliminating the potential for migration of MCs at concentrations above human health risk standards to surrounding environmental media (ANG, 2013a).

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5.0 REMOVAL ACTION ACTIVITIES

The purpose of this section is to identify the principal elements of the removal action, present the technical execution plan for the project, and detail preliminary sequencing of key RA activities. RA activities will be conducted in two primary phases and include the elements of work as outlined below.

Phase I:

- Planning activities
- Site preparation
- 40-mm practice grenade debris pickup
- Monitoring well installation and sampling
- Pre-excavation waste characterization soil sampling

Phase II:

- Structure demolition
- Excavation, confirmatory soil sampling, and post-excavation waste characterization sampling
- Waste Disposal
- Decontamination
- Site restoration

5.1 Planning Activities

Prior to conducting RA field activities, a pre-construction meeting will be conducted to ensure that upcoming activities meet RA objectives and requirements and to address the logistics of the field effort. Planning activities include:

- Hancock field requirements;
- Site access;
- Utility clearances and dig permits; and,
- Field office.

5.1.1 Hancock Field Requirements

The work will be performed on a secure ANG Base Installation and the contractor must become familiar with and comply with Hancock Field requirements. Required badges, passes, and vehicle permits will be acquired with proper authority and prior to commencing work at MRSs SR001 and SR002 (e.g., access pass, camera pass, etc.).

5.1.2 Site Access

MRSs SR001 and SR002 are located within Hancock Field. Access to these sites is restricted to authorized personnel and will require coordination with the Base Environmental Manager.

5.1.3 Utility Clearances and Dig Permits

Excavation activities at MRSs SR001 and SR002 require utility clearance and dig permit prior to initiating field activities. If a utility line is located at either MRS during the removal action, work will cease for inspection and line determination.

5.1.4 Field Office

A portable trailer may be utilized on-site as the field office. The field office will act as the central planning location and is where personnel will meet prior to each workday for the daily safety tailgate meetings. The field office will also be used as a location to store equipment and supplies, health and safety records, Material Safety Data Sheets, site maps, and project documents (e.g., the NTCRA Work Plan).

5.2 Site Preparation

Prior to RA activities, vegetation will be cleared, as necessary, within MRSs SR001 and SR002 to facilitate sampling, excavation, and 40-mm practice grenade debris pickup activities. Vegetation clearing activities at MRS SR001 will include the safety berms and impact berms. At MRS SR002, vegetation will be cleared to facilitate the excavation and removal of MC-impacted soils. Removed vegetation will be disposed off-site.

Prior to soil removal activities, work zones (exclusion zone, contamination reduction zone, and support zone) will be demarcated by interim barriers to ensure the appropriate hazard communication during excavation and sampling.

5.3 40-mm Practice Grenade Debris Pickup

An analog instrument-aided surface sweep of 40-mm practice grenade debris, using an all-metal detector, will be conducted on approximately 1.27 acres of land historically used as a practice grenade area. The objective of the visual debris pickup is to identify and remove surface debris items that are 1 $in.^2$ or larger. An all-metals detector will be used in and around brush to identify MD items that may be obstructed from view.

A boundary-to-boundary surface debris pickup will be conducted along transects located at approximately 10 ft intervals throughout the practice grenade area. The field team will consist of Unexploded Ordnance (UXO) Qualified Technicians who will line up at 5 ft intervals. This will

allow each person to visually inspect the surface 3 ft on either side and to use an all-metals detector in and around brush. Any items found on the surface greater than 1 in^2 will be removed and placed in a bucket that will be carried by each individual. Debris identified during the pickup will be segregated, inspected, and transported off-site for recycling.

Should the certification process identify the presence of MEC, the UXO Quality Control Specialist (QCS) will contact the on-site USACE Ordnance & Explosives Safety Specialist (if present) and/or the USACE PM, as applicable.

5.4 Monitoring Well Installation and Sampling

Groundwater sampling will be conducted at SR001 and SR002 to determine the presence or absence of MCs above applicable groundwater quality standards (Table 5-1). Seven temporary groundwater monitoring wells will be installed and sampled during NTCRA activities.

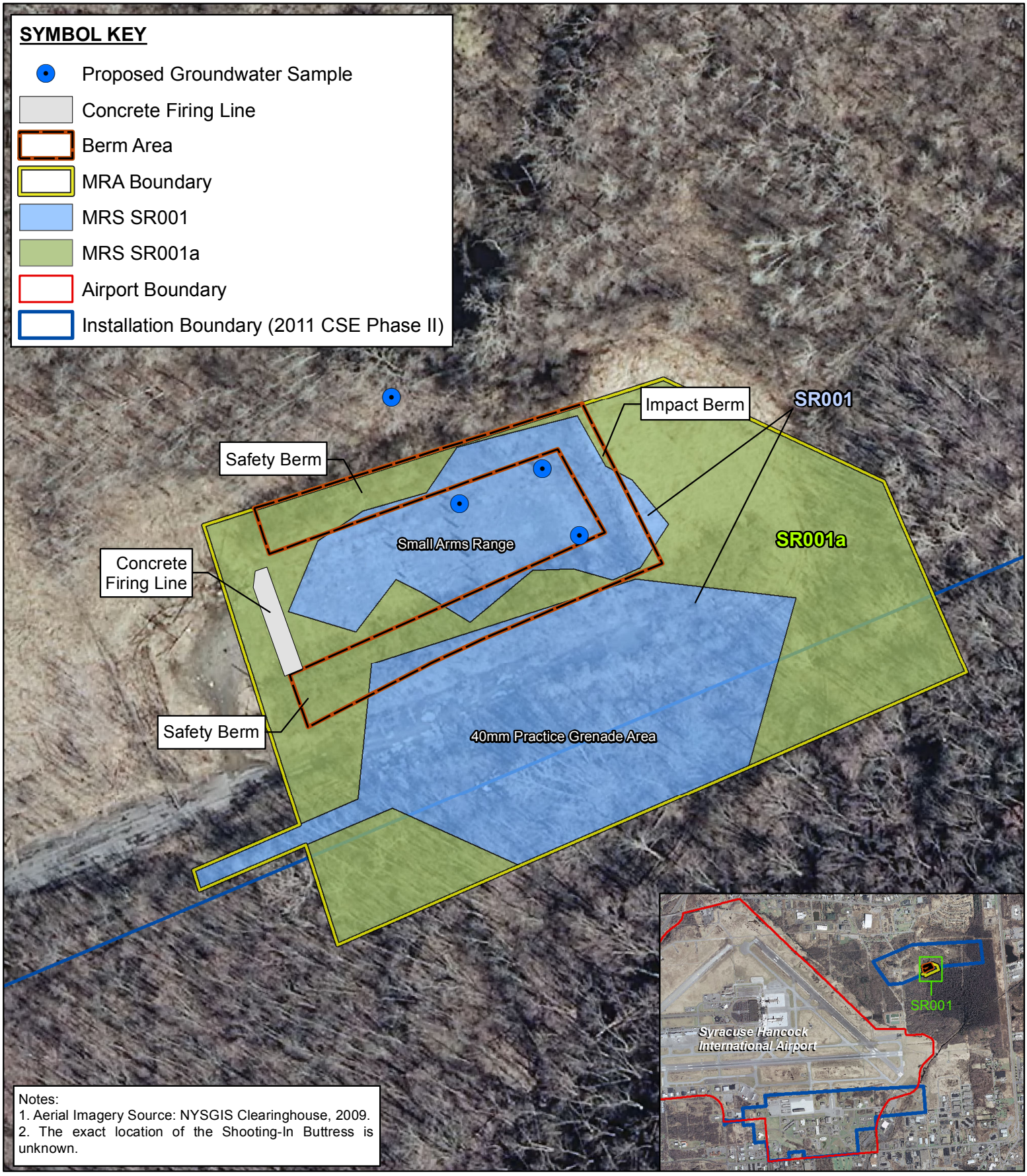
Table 5-1. Groundwater Screening Criteria

Analyte	CAS Number	Groundwater Quality Standards (µg/L)
Antimony	7440-36-0	3[a]
Arsenic	7440-38-2	10[b]
Copper	7440-50-8	200[a]
Iron	7439-89-6	300[a]
Lead	7439-92-1	15[b]
Tin	7440-31-5	9,300[b]
Zinc	7440-66-6	66[a]

Notes:
[a] Value obtained from 6 New York Codes, Rules, and Regulations (NYCRR), Part 703: *Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations*.
[b] Value obtained from USEPA National Primary Drinking Water Regulations, *List of Contaminants and their Maximum Contaminant Levels* (MCLs).
µg/L – micrograms per liter

At SR001, four temporary monitoring wells be installed and sampled at MRS SR001, three wells within the range floor and pre-berm area at locations that exhibited the highest lead concentrations during the CSE Phase II, and one well north of MRS SR001 at a presumed background location (Figure 5-1).

At MRS SR002, three temporary monitoring wells will be installed and sampled, two wells within the Firing-In Buttress where lead exceeded the XRF screening value and one well between MRS SR002 and the North Branch of Ley Creek to confirm that MCs have not migrated toward the creek (Figure 5-2). Groundwater samples will be collected, submitted to an off-site analytical laboratory, and analyzed for total and dissolved antimony, arsenic, copper, iron, lead, tin, and zinc.



New York Air National Guard
Syracuse, New York

N

FIGURE 5-1
Proposed Groundwater Sample Locations, MRA SR001
Final Non-Time Critical Removal Action Work Plan
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 50 100 200 300 400 Feet
0 25 50 100 Meters

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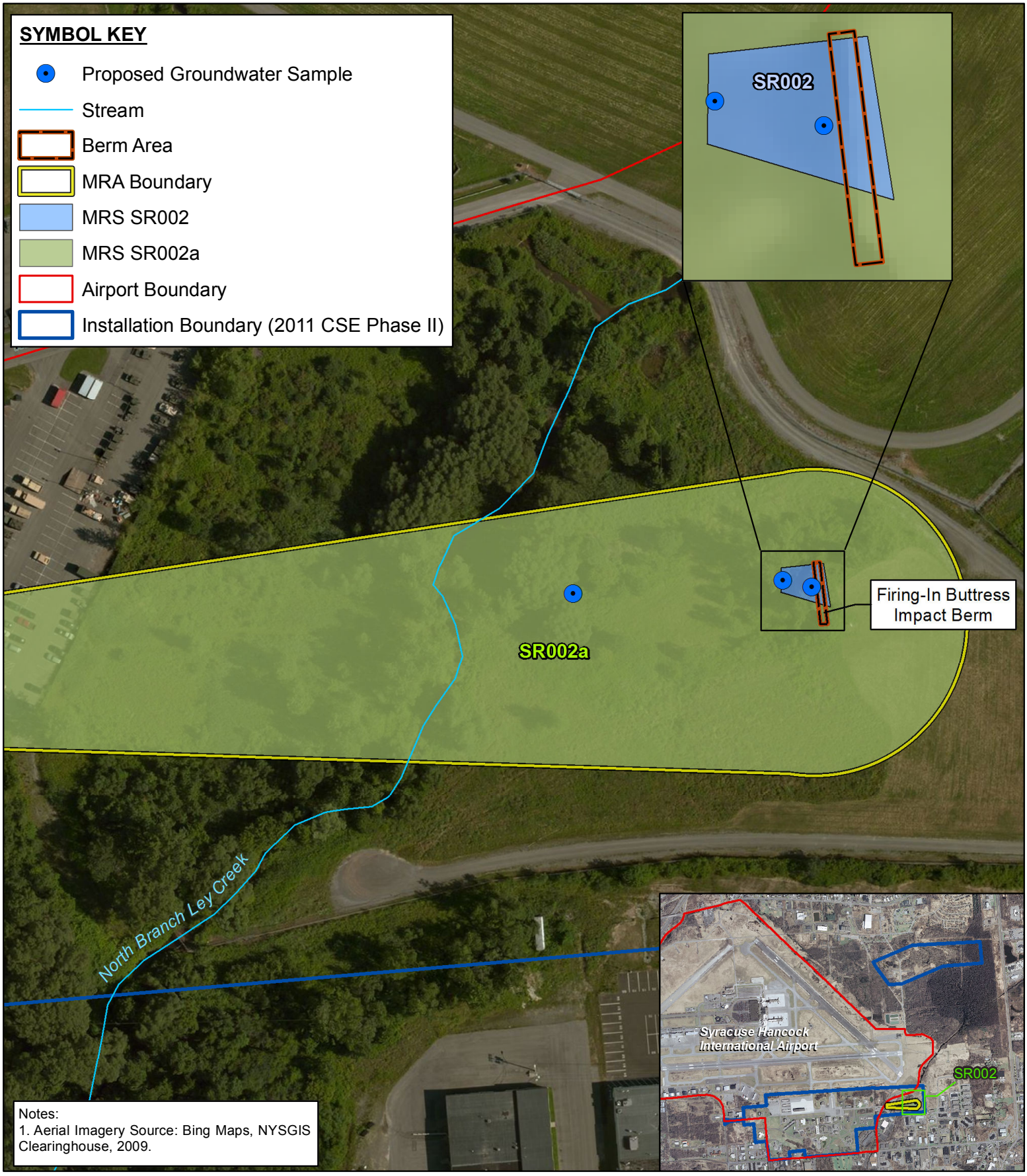

New York Air National Guard
Syracuse, New York

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FIGURE 5-2
Proposed Groundwater Sample Locations, MRA SR002
Final Non-Time Critical Removal Action Work Plan
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 62.5 125 250 375 500 Feet
0 25 50 100 150 Meters

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Soil logs and well construction diagrams will be documented during monitoring well installation and presented in the After Action Report. The lithologic description will be recorded on a boring log using the Unified Soil Classification System (USCS) and described according to the ASTM D2488-90, *Description and Identification of Soils* (Visual-Manual Procedure).

Prior to the collection of groundwater samples, static water levels will be collected to determine the groundwater flow direction. Temporary monitoring wells will be purged and sampled according to the site-specific Sampling and Analysis Plan (SAP)(Appendix B). Following the collection of groundwater samples, pre-pack wells will be removed from the ground, decontaminated, and disposed as C&D waste. Abandoned boreholes will be backfilled with hydrated bentonite in accordance with the SAP (Appendix B).

5.5 Pre-Excavation Waste Characterization Soil Sampling

Prior to excavation activities, discrete pre-excavation soil sampling will be collected within each MRS to facilitate the direct-loading of soil and determine the proper handling and shipping requirements of excavated soil. Discrete soil samples will be collected in accordance with the methodology detailed in the SAP (Appendix B). Samples will be sent to an off-site laboratory and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, and herbicides. Supplemental TCLP metals may be analyzed more frequently than required by the receiving disposal facility.

TCLP VOCs, SVOCs, PCBs, pesticides, and herbicides will be analyzed at a minimum of one sample per 500 cubic yards (CY) of soil, which meets the requirement of the accepting disposal facilities. TCLP metals may be analyzed more frequently to account for the heterogeneity of site conditions. A pre-excavation soil sample summary is provided in Table 5-2. Pre-excavation sampling within each MRS is summarized below.

Table 5-2. Pre-Excavation Waste Characterization Soil Sampling

MRS	Sample Unit Location	TCLP Metals*	TCLP VOCs, SVOCs, PCBs, Pesticides, and Herbicides*	Proposed Number of Samples
SR001	Impact Berm	3	2	3
SR001	Pre-Berm	2	1	2
SR001	Range floor and safety berms	6	2	6
SR002	Impact Berm	1	1	1
SR002	Range Floor	2	1	2

Notes:

* Represents the number of samples that will be analyzed for specific constituents.

Based upon the presence of lead bullets and fragments in soil, it is presumed that the top 6 inches of soil within the range floor and berms will be disposed as hazardous waste. Pre-excavation waste characterization soil samples will be collected from a depth interval of 6 to 18 inches bgs (Figure 5-3 and 5-4).

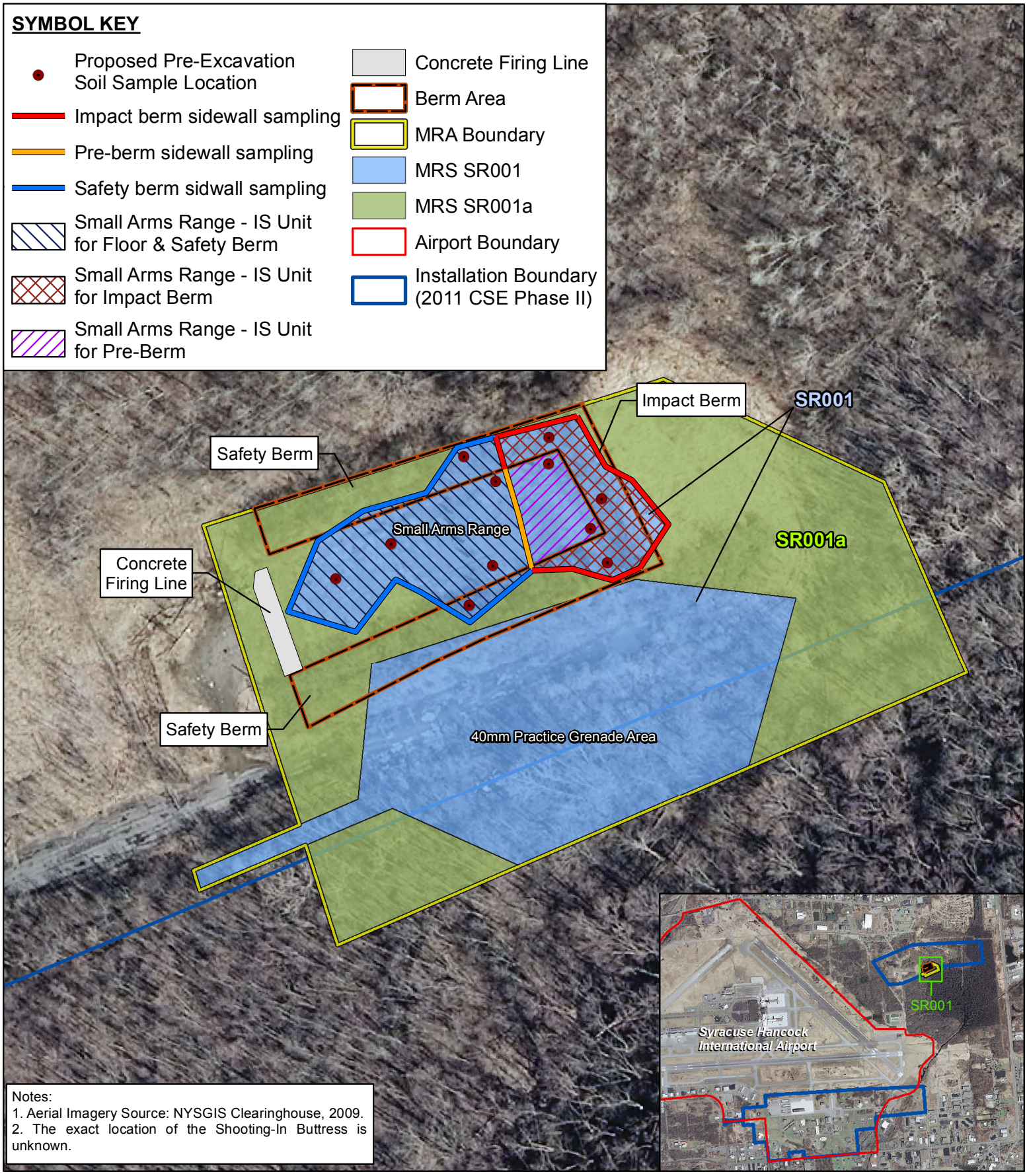
5.6 Structure Demolition

Structures located within the excavation areas at MRSs SR001 and SR002 will be demolished to the extent possible to allow equipment to maneuver within the site and to allow bullets embedded in the structures to be removed. Structures to be demolished include wooden targets located on the range floor of MRS SR001 and portions of the wooden Firing-In Buttress at MRS SR002. Demolition equipment will consist of, but will not be limited to, backhoes, bobcats, chainsaws, and handsaws.

Bullets and metal fragments found in these structures will be removed and segregated from the demolished structures, as possible. Wooden targets and wooden beams of the Firing-In Buttress that are suspected of containing bullets or fragments will be stockpiled on plastic sheeting or like material within a designated area. Wood not suspected of containing bullets or fragments will be stockpiled in a designated area as C&D waste. If possible, bullets and fragments will be collected in a closed top container, dated, and labeled as "Recyclable Lead." Once free of bullets, the debris will be stockpiled with other C&D waste. If bullets cannot be physically removed from the structure material or the process of bullet removal impedes project schedule, the material may be disposed as hazardous.

5.7 Excavation, Confirmatory Soil Sampling, and Post-Excavation Waste Characterization Sampling

Soil that is identified to contain lead and copper at concentrations exceeding the NYSDEC Residential Soil Cleanup Objective of 400 mg/kg (lead) and 270 mg/kg (copper) will be excavated and transported off-site to a permitted disposal facility. The excavation boundaries encompass soil that contained lead concentrations above the XRF modified soil screening level, which was determined through the evaluation of ex-situ XRF data collected during the CSE Phase II. Collectively, a total of 1,874 CY of soil will be excavated from MRSs SR001 and SR002. However, the final volume of soil removed is dependent on confirmatory soil sampling results. A summary of excavation activities within each MRS is provided below.



New York Air National Guard
Syracuse, New York

N

FIGURE 5-3
Incremental Sampling Units and Proposed Pre-Excavation Soil Sample Locations, MRS SR001
Final Non-Time Critical Removal Action Work Plan
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 50 100 200 300 400 Feet
0 25 50 75 100 Meters

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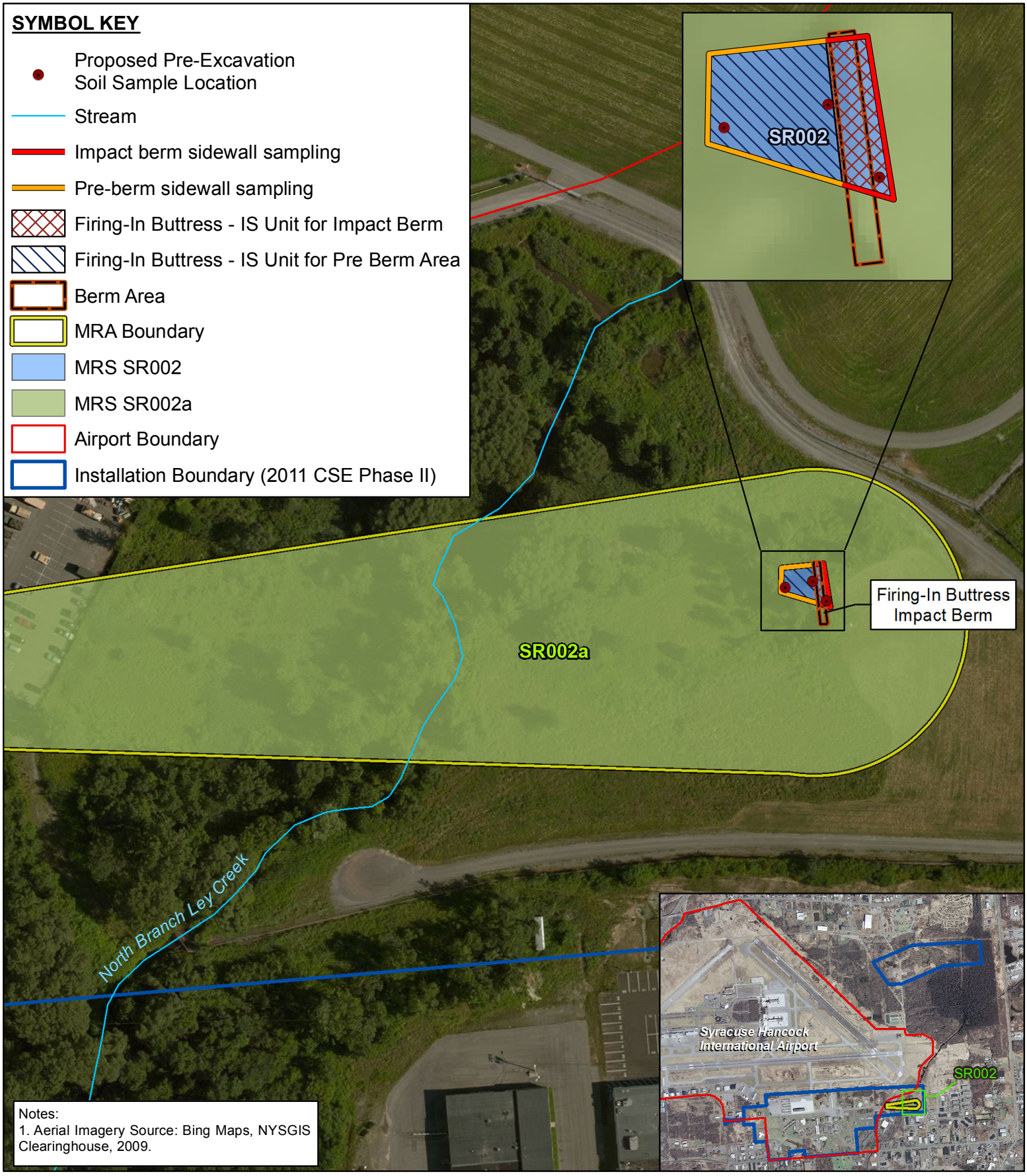

New York Air National Guard
Syracuse, New York

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FIGURE 5-4
Incremental Sampling Units and Proposed Pre-characterization Sample Locations, MRA SR002
Final Non-Time Critical Removal Action Work Plan
174th Attack Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 125 250 375 500 Feet
0 25 50 100 150 Meters

12/17/2013

File: ANG_Hancock_Prop_WC_SR0002_NTCRA.mxd

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MRS SR001

As shown on Figure 5-3, the proposed excavation area at MRS SR001 includes portions of the range floor and safety berms, pre-berm, and impact berm. Due to lead debris within surface soil at the range floor of MRS SR001, an initial scrape will be conducted to remove the top 0 to 6 inches of soil. This soil will be stockpiled on-site in rolloffs and sampled for waste characterization parameters (See Section 5.8).

Following the initial 6 inch surface scrape, soil will be excavated within sample units specified in Table 5-3. The range floor and safety berms will be excavated to an approximate depth of 18 in. for a total of 882 CY of soil (Table 5-3). Excavation activities will continue within the pre-berm and impact berm to an approximate depth of 24 inches for a total of 304 and 577 CY of soil, respectively (Table 5-3). Soil excavated following the initial scrape will be direct-loaded into dump trucks and/or rolloffs and transported to the appropriate facility (Subtitle D landfill as non-hazardous or Subtitle C landfill as hazardous waste). Total soil to be excavated from MRS SR001 is estimated to be 1,763 CY. Actual excavation extents will be determined by confirmatory sampling results. Confirmatory sampling is discussed further in Section 5.7.2.2.

Table 5-3. MRS SR001 Proposed Excavation Areas

Decision Unit	Proposed Excavation Depth (inches)	Preliminary Dimensions* (ft)	Preliminary Volume (ft^3)	Preliminary Soil Volume[a] (CY)
Impact Berm	28	62 x110 x2.3	15,579	577
Pre-Berm	24	51 x 80 x 2	8,208	304
Range floor and safety berms	18	235 x 68 x 1.5	23,814	882

Notes:
* Due to the variability of the sample units, dimensions are approximate.
ft – feet
ft^3 – cubic feet
CY – cubic yards

MRS SR002

As shown on Figure 5-4, the excavation area at MRS SR002 includes the area within the Firing-In Buttress, including the pre-berm and impact berm. Soil within the Firing-In Buttress will be excavated within decision units specified in Table 5-4. Soils within each decision unit will be excavated to an approximate depth of 24 in. and direct-loaded into dump trucks and/or rolloffs. Total soil to be excavated at MRS SR002 is estimated to be 111 CY. Actual excavation extents will be determined by confirmatory sampling results. Confirmatory sampling is discussed further in Section 5.7.2.2.

Table 5-4. MRS SR002 Proposed Excavation Areas

Decision Unit	Proposed Excavation Depth (inches)	Preliminary Dimensions (ft)	Preliminary Volume (ft^3)	Preliminary Soil Volume[a] (CY)
Impact Berm	24	13 x 78 x 2	972	36
Pre-Berm	24	34 x 31 x 2	2,025	75

Notes:
* Due to the variability of the sample units, dimensions are approximate.
ft – feet
ft^3 – cubic feet
CY – cubic yards

5.7.1 Excavation Equipment

Excavation equipment that will be required to remove MC impacted soils may include, but will not be limited to a backhoe and/or trackhoe, front-loader, 20-CY dump trucks, and bobcat. The specific equipment will be selected based upon the operational logistics, weather, and site conditions at the time of removal action implementation.

5.7.2 Excavation Sampling and Screening Activities

5.7.2.1 XRF Screening

In-situ XRF screening will be conducted to guide the excavation and to support decision making with regard to collecting confirmatory soil samples. In-situ XRF screening will be conducted along the sidewalls and floor of each excavation to determine lead concentrations. For screening purposes, an action level of 200 mg/kg will be used, which is ½ the NYSDEC soil cleanup value. If in-situ XRF readings indicate that lead concentrations are above 200 mg/kg, additional soil will be excavated in 6-inch lifts and the soil will be re-analyzed with the XRF. This process will be repeated until XRF readings indicate that lead concentrations are below 200 mg/kg. Once XRF field screening indicates lead concentrations below 200 mg/kg, confirmatory soil samples will be collected from the floor and sidewalls of each excavation to evaluate if residual soils are below the 400 mg/kg cleanup criteria.

5.7.2.2 Confirmation Sampling

Confirmation soil sampling will be conducted using incremental sampling techniques, in accordance with the SAP (Appendix B) and the guidance provided in *Protocols for Collection of Surface Soil Samples at Military Training and Testing Ranges for the Characterization of Energetic Munitions Constituents* (USACE, 2007). Incremental samples will be collected within each excavation area (sample unit) at MRSs SR001 and SR002 (Figures 5-3 and 5-4) and

analyzed for copper and lead (Table 5-5). If confirmation sampling results indicate that lead concentrations are greater than 400 mg/kg and/or copper concentrations are greater than 270 mg/kg, additional soil will be removed in approximate 6-inch lifts, re-analyzed with the XRF, and additional confirmatory samples will be collected.

Table 5-5. Summary of Confirmation Soil Sampling

MRS	Sample Unit Location	Analytes
SR001	Small Arms Range/Safety Berms	Lead and Copper
	Small Arms Range/Safety Berm Sidewalls	
	Pre-Berm	
	Pre-Berm Sidewall	
	Impact Berm	
	Impact Berm Sidewalls	
SR002	Range Floor and Pre-Berm	Lead and Copper
	Range Floor and Pre-Berm Sidewalls	
	Impact Berm	
	Impact Berm Sidewalls	

5.7.3 Post-Excavation Waste Characterization Sampling

An initial six inch scrape within the range floor of MRS SR001 will be conducted to remove soil with lead bullets and fragments. This soil will be stockpiled on-site and sampled for waste characterization parameters via composite soil samples in accordance with the SAP (Appendix B). Samples will be collected at a minimum frequency of one sample per 500 CY of soil and will consist of 5 aliquot samples from each 500 CY of soil. Samples will be submitted to an off-site laboratory for analysis of TCLP metals, VOCs, SVOCs, PCBs, pesticides, and herbicides.

5.8 Waste Disposal

During the removal action, several waste streams will be generated, including:

- C&D waste (vegetation, wood from structure demolition);
- IDW (decontamination water, purge water, and soil cuttings);
- Recyclables (40-mm practice grenade debris and bullets/bullet fragments); and,
- RDW (excavated soil).

IDW/RDW will be managed using guidance provided in the USEPA guidance document entitled *Management of Investigation-Derived Wastes During Site Inspections (*USEPA, 1991) and the *Policy on Air National Guard Investigation or Remediation Derived Waste (IDW/RDW) Management (ANG/CEV, CEV 05-1, 2005).*

5.8.1 Construction and Demolition Waste

C&D waste will include vegetation and other debris not impacted by bullets and fragments. This debris will be stockpiled in designated areas within each MRS. Construction and demolition (C&D) waste will be stockpiled and covered with plastic, if necessary, to prevent windblown debris to be transported. C&D debris will be loaded onto dump trucks and disposed at a C&D or Subtitle D landfill, as appropriate.

5.8.2 Investigation Derived Waste

5.8.2.1 Water IDW

Water IDW will consist of purge water and decontamination water. Water IDW will be containerized in DOT approved drums. The drums will be labeled with the following information:

- The phrase "Analysis Pending;"
- Accumulation start date;
- Name of waste [e.g., water from decontamination or water from purging with well ID number(s)]; and,
- Name and phone number of the Hancock Field Point of Contact (POC) and FM.

The labeled drums will be temporarily staged at a location agreeable to the Base POC. After containerizing purge water and decontamination water, composite samples of the IDW will be collected in accordance with the SAP (Appendix B). Samples will be submitted to an off-site analytical laboratory for analysis of TCLP metals, VOCs, and SVOCs to address requirements for proper management and disposal. IDW will be disposed at the appropriate treatment facility, pending laboratory analysis of waste characterization samples.

5.8.2.2 Soil IDW

Soil IDW will consist of soil cuttings from temporary monitoring well installation. Soil derived from well installation will be placed onto the impact berms within each associated MRS and will be disposed with the berm material during excavation activities.

5.8.3 Remediation Derived Waste

Soil derived from the initial scrape at MRS SR001 will be stockpiled on-site and composite soil samples will be collected at a minimum frequency of one sample per 500 CY of soil. Composite soil samples will consist of approximately five aliquot samples per 500 CY of stockpiled soil. The five aliquot locations will be equally spaced around the perimeter of each 500 cubic yards of soil. Samples will be submitted to an off-site laboratory for analysis of TCLP metals, VOCs,

SVOCs, PCBs, pesticides, and herbicides. Stockpiled soil will be disposed at the appropriate treatment facility, pending laboratory analysis of waste characterization samples. Pre-characterized soil will be direct-loaded and transported for disposal to the appropriate treatment facility.

5.8.4 Recyclables

Bullets/bullet fragments and MD items removed within the 40-mm practice grenade area will be transported to an off-site recycling facility. Debris collected from the 40-mm practice grenade pickup will be containerized in 55-gallon steel drums or other suitable container until field activities are completed and undergo the MPPEH inspection detailed below.

MPPEH Inspection Procedures

All MPPEH will be processed and disposed as detailed in Chapter 14 of EM 1110-1-4009, dated June 15, 2007, and Errata Sheet No. 2. Additionally, site personnel will follow AMEC's US-UXO-SOP-003, *MPPEH Inspection, Certification and Final Disposition Procedures* (Appendix C), which establishes overall practices for AMEC's UXO-qualified personnel inspecting, processing, safeguarding, and managing MPPEH during field activities.

Removal and Disposal

Bullet/bullet fragments as well as 40-mm practice debris items greater than 1 $in.^2$ will be placed in plastic buckets. The on-site UXO Technician (UXO Team Leader) will establish a temporary collection point for non-MD items. The UXO Technician will inspect debris for the presence of explosives. Debris that is free of explosives and does not require venting will be placed in a collection point. Upon completion of field activities, the material in the temporary collection points will be re-inspected. The UXO Team Leader will perform a second inspection of the material to ensure that it is free of explosives and other hazardous materials. The UXOQCS will verify that debris placed in secured containers is free of explosive hazards.

DD Form 1348-1A

The UXOQCS will certify and the USACE Ordnance and Explosives Safety Specialist will verify (if present) that the debris is free of explosive hazards. If the USACE Ordnance and Explosives Safety Specialist is not on-site, the UXOQCS will sign as the verifier. DD Form 1348-1A will be used as certification/verification documentation Appendix C. Completed DD 1348-1A forms will clearly show the typed or printed names of the contractor's UXOQCS, as well as the organization, signature, and home and field office telephone numbers for the persons certifying and verifying the debris as free of explosive hazards. The form will state the following if only MD is being processed:

> *"This certifies and verifies that the munitions debris listed has been 100% properly inspected and to the best of our knowledge and belief, is free of explosive hazards."*

If non-MD is being processed with MD, the form will state the following:

> *"This certifies that the material listed has been 100% properly inspected and, to the best of our knowledge and belief are free of explosive hazards, engine fluids, and illuminating dials and other visible liquid hazardous, toxic, and radioactive waste materials."*

The UXOQCS will complete a DD Form 1348-1A for each container prior to transfer. The form will contain the following information:

- Location where material was obtained,
- Basic material content (type of metal; e.g., steel or mixed),
- Estimated weight,
- The unique identification number of each container, and
- Seal identification number.

Material documented as safe (MDAS) will be disposed of at a recycler where it will be processed through a smelter, shredder, or furnace prior to resale or release in accordance with governing regulations. If it is discovered during the material transfer and shipping process that a seal has been broken and the chain-of-custody of the material cannot be verified, the material in question will be subject to re-inspection following the established MPPEH process. Copies of the MDAS certifications and chain of custody documentation will be included as an appendix in the final report. Material will be accounted for in the daily and weekly reports.

5.8.5 Disposal Facilities

Landfills that will be utilized during the field activities for this project are detailed in Table 5-6. Waste generated during this removal action will be handled in accordance with 40 CFR Subpart 262.34, *Accumulation Time*. Based on the results of waste characterization sampling, waste will be transported to either a Subtitle D landfill (non-hazardous waste) or to a RCRA Subtitle C landfill (hazardous waste).

Table 5-6. Identified Landfills for Removal Action Activities

Non Hazardous C&D Material Disposal
Seneca Meadows, Inc. 1786 Salcman Road Waterloo, NY 13165
Non Hazardous Soil Disposal
Seneca Meadows, Inc. 1786 Salcman Road Waterloo, NY 13165
RCRA Hazardous Material Disposal
Heritage Hazardous Waste Landfill 4370 W CR 1275N Roachdale, Indiana 46172 and/or Max Environmental Technologies, Inc. Yukon Facility 223 Max Lane Yukon, Pennsylvania 15698

A local transportation contractor, possessing a valid New York State Part 364 Waste Transporter Permit, will be subcontracted to provide transport to the disposal facilities. Drivers will be required to sign into the site (Visitors Log) and provide applicable permits, certifications, and licenses for each vehicle upon entry to the site.

Trucks transporting wastes off-site will be completely and tightly covered with a tarp to prevent wastes from falling or blowing out of the truck bed. The tarp will be solid and free of holes, rips, tears, or other openings. Edges of tarps will be tightly secured to the sides of the truck beds. Dump gates will be tightly closed and free of cracks, gaps, or other openings.

Transportation of wastes and materials will be conducted in accordance with DOT regulations, including labeling, use of placards, and documentation of transportation.

5.8.6 Record Keeping

The FM will be responsible for maintaining records for wastes shipped from MRSs SR001 and SR002. Waste disposal tracking documents and tables describing the respective wastes, volume of waste, transporter, disposal facility, and the shipment date will be prepared (Appendix D). These tracking documents will assist in the preparation of the manifests/bills of lading, and will be retained in accordance with 40 CFR 262. The Base Environmental Manager will sign manifests generated as a part of this NTCRA. Copies of any required approvals, permits, and insurance certificates will be obtained from the approved facility and transporters, as required.

5.9 Decontamination

Each piece of reusable, non-dedicated sampling equipment will be decontaminated before mobilization and between each borehole and/or incremental sample using field procedures identified in the SAP (Appendix B).

5.10 Site Restoration Activities

Once sampling activities are complete within the removal action areas, excavation extents will be rough graded and reseeded for site restoration.

5.11 Field Documentation

A field logbook will be maintained to document field activities during each activity of this removal action. Field sheets and other forms to be used to document field activities are presented in Appendix D. In addition, digital photographs will document removal action activities. This information will be included as appendices to the After Action Report.

5.12 Health and Safety

Health and safety procedures to be followed during the execution of this NTCRA are outlined in the Accident Prevention Plan (Appendix E). If conditions or the scope of work change during the implementation of this NTCRA, the Accident Prevention Plan will be updated to reflect the necessary changes.

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APPENDIX A

PROJECT WORK STATEMENT

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1.0 INTRODUCTION

The goal of the Military Munitions Response Program (MMRP) is to make munitions response sites (MRS) safe for reuse and to protect human health and the environment in the process. The MMRP addresses the unique munitions and explosives of concern (MEC) and munitions constituents (MC) issues associated with MRSs, as well as hazardous substances, pollutants, and contaminants of concern (COC) on other than operational ranges.

The goal of this Statement of Objectives (SOO) is to perform an interim removal action (IRA) for each MRS necessary to achieve unrestricted use and unrestricted exposure (UU/UE). These investigations will include an IRA via the engineering evaluation/cost analysis (EE/CA) process. Following the IRA, a streamlined proposed plan (PP), record of decision (ROD) and the necessary explosive safety submission (ESS) documentation shall be completed if Option 1 is exercised to potentially close out the site.

General performance requirements for these munitions response actions are contained in Table 5-1.

This Statement of Objectives (SOO) complies with the Department of Defense's (DoD) requirements to use performance-based acquisitions.[1]

In conducting the MMRP efforts, the Air National Guard (ANG) will employ a knowledge-driven, performance-based management (KD/PBM) approach that focuses more on end results and less on the process by which the results are obtained.

The key components of the AF's KD/PBM approach include:

- Identify stakeholders' goal and objectives;
- Refine Conceptual Site Models (CSM's) developed during Comprehensive Site Evaluation (CSE) process;
- Develop site-specific Data Quality Objectives (DQOs) and Quality Control (QC)/Quality Assurance (QA) procedures;
- Establish an exit strategy;
- Develop and implement decision-making logic;
- Identify and track of performance-based metrics;
- Procure services through results-based contracting that provide best value to the ANG; and
- Capitalize on experiences gained from the Installation Restoration Program (IRP).

The AF will benefit from the application of the KD/PBM by obtaining data that:

- Is consistent in quality and completeness;
- Supports AF decision-making on whether further munitions response actions or investigations are required;

[1] *Air Force Cleanup Program Performance-Based Management Policy* (SAF/IEE, 27 October 2004).

- Supports the potential follow-up munitions response actions, if required (i.e., program management, relative risk prioritization, cost-estimating, etc.);
- Supports results-based contracting.

Findings of this MMRP action shall support certain administrative actions that may be required of the AF prior to conducting munitions response actions. Administrative actions may include:

- Identification of MRS areas appropriate for the implementation of Land Use Controls;
- Updating MMRP information in EESOH-MIS for program management activities;
- Preparation of supporting documentation for further actions, investigations, or no further action (NFA).

2.0 REGULATORY FRAMEWORK

The munitions response actions in this SOO are being conducted pursuant to Comprehensive Environmental Response Compensations and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and the National Oil and Hazardous Substances Contingency Plan (NCP) requirements. CERCLA has no special provisions for dealing with explosive safety and therefore the provisions in DoD's Ammunition and Explosives Safety Standards (DoD 6055.09-M) and USACE's EM 385-1-97 must be adhered to. All munitions response actions will be conducted in full compliance with USACE, Department of the Air Force, Department of the Army, Department of Defense (DoD) and local/state requirements regarding personnel, equipment and procedures.

3.0 APPLICABILITY

The contractor shall conduct the following in accordance with this SOO at the following MRS.

MRS	Approximate Acreage
Small Arms Range and Shooting-In Buttress (SR001)	1.9
Firing-In Buttress (SR002)	0.1

A summary of information of the identified MRSs covered under this SOO will be provided upon request utilizing the AMRDEC Safe Exchange File Access (SAFE) to one point of contract provided by the proposing contractor.

4.0 GENERAL REQUIREMENTS

The requirements outlined in this SOO for the sites identified in section 3.0 shall be performed in accordance with applicable guidance. The acreages that are presented in section 3.0 are estimated and may be adjusted pending the completed field work.

The contractor shall supply all labor, equipment, and materials necessary to achieve the performance objectives of this SOO.

Documents shall be clear, concise, and written using standard English and shall correctly use

all technical and regulatory terminology.

The contractor shall function as an integral member of the Project Team in support of the AF and ANG mission. To facilitate this, the ANG will rely on the contractor's expertise in munitions response and environmental restoration; however, the ANG as the lead agency under CERCLA retains all decision-making authority.

The contractor shall immediately report to the USACE Project Manager, ANG Program Manager, and Installation Environmental Manager (EM) any irresolvable technical or regulatory problems or issues preventing successful fulfillment of SOO requirements.

The contractor is encouraged to use innovative technologies and management techniques to achieve project objectives and to promote these technologies and techniques to the appropriate stakeholders. Use of innovative technology shall be subject to approval by the USACE/ANG.

Bid information for this solicitation shall be itemized to a site-level of detail.

The contractor is responsible for identifying and reconciling inconsistent data and identifying and providing recommended corrections for any incorrect data found in the government furnished information (GFI).

When a surface clearance is performed the contractor will also dispose of other metallic objects and debris (concrete, trash, etc.) encountered during the surface clearance.

The contractor shall provide an Environmental Resource Program Information Management System (ERPIMS) deliverable to USACE at completion of the project for any analytical data that is collected.

The contractor shall evaluate the need for vegetation clearance at each MRS to accomplish the necessary fieldwork and incorporate these considerations into their proposals.

5.0 SPECIFIC REQUIREMENTS

All work will be coordinated with the Omaha District USACE Project Manager (PM), Hancock Field and NGB personnel.

If MEC is encountered, UXO personnel involved in performing MEC procedures will follow the provisions and work standards identified in Department of Defense Explosive Safety Board (DDESB) Technical Paper (TP) – 18.

If the contractor is intentionally coming in contact with MEC, appropriate planning documents need to be in order to address this.

The contractor may be required to submit personal information (i.e. SSN, driver's license,

etc.) for all individuals working at the installation so that they can gain access to the installation.

The objective of the Interim Removal Action (IRA) via the EE/CA is to ultimately receive no further action.

Elevated levels of munitions related contamination shall be removed under the IRA to achieve unrestricted use and unrestricted exposure (UU/UE) for human health.

Munitions related debris, range related debris and other debris shall be removed and cleared from the surface in and around the MRS (i.e. range structures, 40mm practice grenades, wooden baffles, etc.)

Option 1 for project closeout documentation shall also be included within the proposal. Project closeout documentation should include a streamlined proposed plan (PP), record of decision (ROD) and applicable explosive safety submission documentation.

Table 5-1: Performance Requirements

Performance Tasks	Performance Standards	Submittals (Maximum)	Objectives
1. Prepare and submit EE/CA documents	▪ Develop a comprehensive report that is in compliance of all reporting requirements.	▪ Draft EE/CA Documents for DoD Project Team member review ▪ Draft Final EE/CA Documents for stakeholder project team member review ▪ Final EE/CA Documents ▪ Public notice in newspapers according to the community relations plan to advertise the 30-day public comment period.	▪ Approval of Final EE/CA Document by authorities designated jointly by MAJCOM and/or Installation (DoD Project Team members)
2. Prepare and submit an Action Memorandum (AM)	▪ Develop a comprehensive report that is in compliance of all reporting requirements.	▪ Draft AM Document for DoD Project Team member review ▪ Draft Final AM Document for stakeholder project team member review ▪ Final AM Document	▪ Approval of Final AM Document by authorities designated jointly by MAJCOM and/or Installation (DoD Project Team members)
3. Interim Removal Action Work Plans	• Develop interim removal action work plans to document the processes that will be taken for the MRS to fulfill the EE/CA and AM documentation. • Remove elevated levels of munitions related contamination to achieve unrestricted use and unrestricted exposure (UU/UE) for human health. • Surface clear munitions related debris, range related debris and other debris	▪ The contractor will record in field logbooks a detailed accounting all field activites ▪ All work activities will be recorded in a Daily Operations Report provided to on-site USACE POC by 10:00 am local time, the following work day.	▪ Confirmation samples confirming removal of elevated levels of contamination ▪ Clearance of all surface debris

Table 5-1: Performance Requirements

Performance Tasks	Performance Standards	Submittals (Maximum)	Objectives
4.Prepare and submit an After Action Report	▪ Document all activities; compile data and present data analyses and results of analyses ▪ Develop a comprehensive report that is in compliance of all reporting requirements	▪ Draft AAR Documents for DoD Project Team member review ▪ Draft Final AAR Planning Documents for stakeholder project team member review ▪ Final AAR Planning Documents	▪ Approval of Final AAR Document by authorities designated jointly by MAJCOM and/or Installation (DoD Project Team members)
5. Update and submit the Data Management Tool (DMT) Database	▪ The information collected will be uploaded into the data management tool (DMT) for the Air Force MMRP.	▪ An Access database containing all the appropriate data shall be submitted. The database shall include all the required data, along with specific references to the location in the accompanying report where the information on which the selection or entry was based can be found.	▪ Approval of Access database by authorities designated jointly by MAJCOM and/or Installation (DoD Project Team members)
6. Update the Administrative Record and Information Repository (AR/IR)	▪ Coordinate with the AF POCs responsible for maintaining the AR/IR to obtain the format and number of copies required	▪ Provide AR/IR updates in the appropriate digital and hardcopy formats	▪ Approval of the updates to the AR/IR by installation Remedial Project Manager or equivalent designee
7. Support Public Participation activities and Technical Support	▪ Use existing AF vehicles to create a collaborative, community-based process that informs the public of CSE activities in accordance with CERCLA, NCP, the DOD MRSPP, and any existing interagency agreements ▪ Conduct public participation activities that support development of the MRS Priority ▪ The Contractor shall be responsible for technical support and the development of written reports, as requested by the USACE Project Manager. Efforts under this task may include supporting the USACE Project Manager at technical meetings, public meetings, etc. and may entail the development of briefings, technical papers, etc.	▪ Support of public meetings. Support may include such things as developing a briefing and providing materials.	▪ Obtain acceptance/approval of fact sheets, letters, briefing, and newspaper notices by DoD Project Team members ▪ Develop accepted briefings and technical papers
8. Update the Administrative Record and Information Repository (AR/IR)	▪ Coordinate with the AF POCs responsible for maintaining the AR/IR to obtain the format and number of copies required	▪ Provide AR/IR updates in the appropriate digital and hardcopy formats	▪ Approval of the updates to the AR/IR by installation Remedial Project Manager or equivalent designee

6.0 PERFORMANCE REQUIREMENTS

The contractor shall be responsible for meeting all performance objectives outlined in this SOO.

7.0 SCHEDULE AND MILESTONE PAYMENTS

The contractor shall include an execution schedule and a milestone payment schedule that is based upon the execution schedule in their proposal. In addition, the contractor must structure its proposed milestone and payment schedule, so at least 10% of the value of the task order resulting from this SOO is included in the final milestone payment.

8.0 SCHEDULE OF MEETINGS

Meetings shall be held to brief the Project Team on initiation of activities, coordination of activities, progress, and conclusion of activities. The contractor will coordinate with the service center representative(s) in conducting and participating in the meetings outlined below in Table 8-1. These meetings include a MAJCOM kickoff meeting (tel-con), stakeholder kick-off meeting, and entrance and exit briefings. The contractor shall anticipate at least quarterly status meetings with the service center representative(s) and other meetings (i.e on-board work plan/report meetings, meetings to support PP, ROD, etc.) as required by the Air Force.

Table 8-1: Schedule of Meetings

Meetings	Purpose	Participants
Kickoff Tele-conference	▪ Identify MAJCOM specific execution procedures ▪ Review goals and objectives ▪ Establish approval authority and Project Team members ▪ Establish lines of communication ▪ Pre-coordination for installation visits and access to installation and MRSs ▪ Coordinate document distribution lists ▪ Assign document distribution, comment consolidation and comment resolution responsibilities ▪ Determine MAJCOM-specific geo-spatial data format ▪ Designate AF personnel responsible for AR/IR update	AFCEE, MAJCOM Representatives Service Center Representative(s) Contractor representatives Installation representatives (as directed by MAJCOM) Regulators (as directed by MAJCOM/Installation)
Installation Kickoff Meeting	▪ Identify all stakeholders. ▪ Review goals and objectives of RI program ▪ Establish lines of communication ▪ Present contractor's planned activities for conducting the RI ▪ Pre-coordination for installation visits and access to the installation ▪ Coordination with installation personnel (e.g., natural/cultural resources, flight ops, safety, EOD, etc) ▪ Site visit as required	AFCEE, MAJCOM Representatives Service Center Representative(s) Contractor representatives Installation representatives (as directed by MAJCOM) Regulators (as directed by MAJCOM/Installation)
Installation Entrance Briefing	▪ Identify all stakeholders. ▪ Ensure that all participants understand the RI process. ▪ Present contractor's planned activities for conducting the RI ▪ Discuss specific details of the installation and MRAs. ▪ Facilitate logistics/coordination between installation POCs and the contractor. ▪ Identify and address any anticipated obstacles. ▪ Secure access to MRAs and off-site areas (as needed). ▪ Review planning documents, as needed.	Contractor, Contract Service Center (CSC), AF personnel and regulatory participation will be determined by the AF MAJCOM and installation RPMs.

Meetings	Purpose	Participants
Installation Exit Briefing	▪ Present a summary of data collection activities conducted and preliminary findings. ▪ Discuss potential follow up actions. ▪ Discuss the deliverables schedule, reviews, and budgetary issues. ▪ Discuss any significant challenges encountered. ▪ Discuss and address any outstanding issues. ▪ Ensure that objectives are being met.	Contractor, Contract Service Center (CSC), AF personnel (MAJCOM and installation) and regulatory participation will be determined by the AF MAJCOM and installation RPMs.

9.0 QUALITY ASSURANCE

To ensure the project objectives are met, the Government will employ quality assurance (QA) measures, as described in the following sections. The Government will utilize periodic assessments of the contractor's performance by the PM, KO, COR, and other technical experts, as deemed necessary. Ultimately, the contractor is responsible for its performance and achieving the stated objectives of this SOO.

9.1 Government Reviews

The Government will conduct reviews, as a part of the Project Team. A maximum of 30 calendar days is allowed for DoD review of deliverables. The contractor may request additional Government input or in-progress reviews; however, such requests must be coordinated with the USACE PM. The Government reserves the right to conduct additional reviews, as needed. Other stakeholders may be identified by MAJCOM/installation to review these deliverables, as deemed necessary. After review, comments and suggested revisions will be forwarded to the contractor. The contractor shall address the comments from each entity and incorporate suggested revisions of the draft deliverables, as appropriate.

9.2 Corrective Measures

The Government will execute the following corrective measures, as needed, to insure that it's legal, regulatory, and other guidance objectives are met in conducting the RI.

- If performance deficiencies are found, the contractor will be given the right to correct the deficiencies first.
- Until deficiencies are corrected, the KO may stop milestone payments.
- The Government reserves its rights to seek equitable adjustments under current contract provisions.

10.0 GOVERNMENT POINTS OF CONTACT

Government POCs for administration, coordination, and facilitation of this task order will be provided after award.

11.0 SECURITY CONTRACT LANGUAGE - for all Corps of Engineers' Unclassified Contracts (PIL 2003-06, 19 Feb 03)

All Contractor employees (U.S. citizens and Non- U.S. citizens) working under this contract *(to include grants, cooperative agreements and task orders)* who require access to Automated Information Systems (AIS), (stand alone computers, network computers/systems,

e-mail) shall, at a minimum, be designated into an ADP-III position (non-sensitive) in accordance with DoD 5220-22-R, Industrial Security Regulation. The investigative requirements for an ADP-III position are a favorable National Agency Check (NAC), SF-85P, Public Trust Position.

Proof of a favorable NAC shall be submitted to USACE, Omaha District Security Officer, ATTN: CENWO-SL, 1616 Capitol Avenue, Suite 9000, Omaha, NE 68102-4901, within three (3) working days after award of any contract or task order, and shall be submitted prior to the individual being permitted access to an AIS.

a. Contractors who have a commercial or government entity (CAGE) Code and Facility Security Clearance should submit forms through their Facility Security Office, who shall forward results of the NAC to the Omaha District Security Officer (address above).

b. For those contractors who do not have a CAGE Code or Facility Security Clearance, the SF 85P and 2 copies of the FD-258 (Fingerprint Cards) shall be completed and submitted to the Omaha District Security Officer (address above.) These must be mailed or hand-delivered, as original signatures are required. Fingerprint cards are available upon request and may be taken to any local law enforcement center for completion. For those in the Omaha area, fingerprint cards may be completed by contacting the Omaha District Human Resources Office, (402) 221-4072.

In accordance with Engineering Regulation, ER 380-1-18, Section 4, foreign nationals who work on Corps of Engineers' contracts or task orders shall be approved by the HQUSACE Foreign Disclosure Officer or higher before beginning work on the contract/task order. This regulation includes subcontractor employees. (NOTE: exceptions to the above requirement include foreign nationals who perform janitorial and/or ground maintenance services.) The contractor shall submit to the Division/District Contract Office, the names of all foreign nationals proposed for performance under this contract/task order, along with documentation to verify that he/she was legally admitted into the United States and has authority to work and/or go to school in the US. Such documentation may include a US passport, Certificate of US citizenship (INS Form N-560 or N-561), Certificate of Naturalization (INS Form N-550 or N-570), foreign passport with I-551 stamp or attached INS Form I-94 indicating employment authorization, Alien Registration Receipt Card with photograph (INS Form I-151 or I-551), Temporary Resident Card (INS Form I-688), Employment Authorization Card (INS Form I-688A), Reentry Permit (INS Form I-327), Refugee Travel Document (INS Form I-571), Employment Authorization Document issued by the INS which contains a photograph (INS Form I-688B).

Classified contracts require the issuance of a DD Form 254 (Department of Defense Contract Security Classification Specification).

12.0 RESTRICTIONS

Guidance: The Contractor is cautioned to take no guidance during the course of the work

from any other source except the USACE OE Safety Representative or Project Manager. The Contractor shall make on-site field investigations, as necessary, to verify and obtain information on site utilities and conditions, but is not responsible for performing utility locates for the area. Utility locates shall be the responsibility of the installation. The Contractor shall coordinate with the Project Manager and the USACE OE Safety Representative during the performance of the work.

Release of Information: Unless specifically approved by the Project Manager, the Contractor shall not release, present, clarify or discuss any drawing, specification, design analysis, budget, estimate, schedule or any other material or information of any nature pertaining to the work for which services are performed under the terms of this contract. The provisions of this clause will apply to unnecessary contact with any outside individual or agency during design, solicitation and performance of this project. The Contractor and any subcontractors shall refer all questions and inquiries from outside sources to the Project Manager. The provisions of this clause are not intended to limit, restrict or inhibit normal contact necessary to fulfill the terms of this contract.

End of Section C

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APPENDIX B

SAMPLING AND ANALYSIS PLAN

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FINAL

MUNITIONS CONSTITUENTS SAMPLING AND ANALYSIS PLAN
HANCOCK AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

MILITARY MUNITIONS RESPONSE PROGRAM
CONTRACT NO. W9128F-10-D-0059-0001

Prepared for:

U.S. Army Corp of Engineers, Omaha District
CENWO-PM-HA
1616 Capitol Avenue, Suite 9000
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Prepared and presented by:

Air National Guard Readiness Center
Joint Base Andrews, Maryland

DECEMBER 18, 2013

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APPENDICES

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ACRONYMS

AAR	After Action Report
AMEC	AMEC Environment & Infrastructure, Inc.
ANG	Air National Guard
APP	Accident Prevention Plan
ASTM	American Society for Testing of Materials
bgs	below ground surface
CFR	Code of Federal Regulations
cm	centimeter(s)
CoC	chain of custody
CSE	Comprehensive Site Evaluation
°C	degrees Celsius
DOT	Department of Transportation
DPT	direct-push technology
EM	Engineer Manual
ER	Engineer Regulation
FM	Field Manager
ft	foot or feet
GPS	global positioning system
Hancock Field	Hancock Air National Guard Base
HNO_3	nitric acid
IDW	investigation derived waste
IS	incremental sampling
ITSI/Shaw	Innovative Technical Solutions, Inc. and Shaw Environmental, Inc.
MC	munitions constituent
MD	munitions debris
mg/kg	milligrams per kilogram
ml	milliliter
mm	millimeter(s)
MRA	Munitions Response Area
MRS	Munitions Response Site
MS/MSD	matrix spike/matrix spike duplicate
NTCRA	Non-Time Critical Removal Action
PM	Project Manager
POC	point of contact
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
Sky	Sky Research, Inc.
SOP	standard operating procedure
SSHO	Site Safety and Health Officer
SVOC	semivolatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
UFP	Uniform Federal Policy
USACE	U.S. Army Corps of Engineers

USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
UU/UE	Unrestricted Use/Unrestricted Exposure
VOC	volatile organic compound
XRF	x-ray fluorescence

1.0 FIELD SAMPLING PLAN

This Sampling and Analysis Plan (SAP), with its associated appendices, describes the field activities to be performed and defines the procedures, methods, and quality control (QC) measures that must be used to satisfy the data quality objectives (DQOs) associated with environmental soil and groundwater sampling at Munitions Response Sites (MRSs) SR001, Small Arms Range and Shooting-In Buttress, and SR002, Firing-In Buttress, at Hancock Air National Guard Base (Hancock Field), located in Syracuse, New York.

Sections 1.0 through 9.0 of this SAP are designated as the Field Sampling Plan (FSP). The FSP presents the organization, objectives, functional activities, and specific activities associated with the Non-Time Critical Removal Action (NTCRA) at MRSs SR001 and SR002. This plan presents details regarding establishing project objectives, sampling and preservation procedures for samples collected in the field, sample documentation, sample packaging and shipping, and laboratory analytical procedures for environmental media sampled. It also describes the specific protocols that will be followed for sample handling and storage, chains of custody (CoC), and laboratory analyses.

These activities will be performed under the Military Munitions Response Program managed by the U.S. Army Corps of Engineers (USACE), Omaha District. USACE and the United States Environmental Protection Agency (USEPA) require that environmental monitoring and measurement efforts mandated or supported by these organizations, participate in a centrally managed quality assurance (QA) program. Any party generating data for this project has the responsibility to implement procedures to ensure that the precision, accuracy, representativeness, and completeness of the data are properly determined and documented. To ensure these responsibilities are met uniformly, each party must adhere to the accompanying QA Project Plan (QAPP).

Quality Assurance/Quality Control (QA/QC) procedures have been developed using applicable professional technical standards, USEPA, and USACE requirements, government regulations and guidelines, and specific project goals and requirements. This FSP was prepared using USACE guidance documents, Engineer Regulation (ER) 1110-1-263 (USACE, 1998) and Engineer Manual (EM) 200-1-3 (USACE, 2001).

1.1 Project Background

MRSs SR001 and SR002 were defined during the Comprehensive Site Evaluation (CSE) Phase II based upon their historical use as small arms ranges and due to the potential of environmental impacts from munitions debris (MD) items present at the two sites. A location map for Hancock Field is included on *Figure 1-1 of the NTCRA Work Plan*. Descriptions and locations of each MRS are also provided in the *NTCRA Work Plan (Figure 1-2)*.

1.2 Problem Identification

Based upon the results of the CSE Phase I/II, soil has been impacted by historical activities at both MRSs. The MRSs were used as practice firing ranges for small arms of various calibers. MD has been observed on the surface of each MRS and it is known that the small arms range at MRS SR001 was routinely reworked by large machinery for maintenance, which exposed subsurface soil to potential impacts from expended munitions. Results of ex-situ x-ray fluorescence (XRF) soil sampling during the CSE Phase II

indicate that lead is present at concentrations exceeding the XRF modified field screening level of 261 milligrams per kilogram (mg/kg) at each MRS. At SR001 MRS, lead-impacted soil was limited to an area primarily between the concrete firing line and the impact berm (*Figure 1-7, NTCRA Work Plan*). At MRS SR002, lead-impacted soil was limited an area within the Firing-In Buttress (*Figure 1-8, NTCRA Work Plan*). XRF soil sampling results presented above indicate that lead-impacted soil extends to a maximum depth of 18 inches below ground surface (bgs). According to the CSE Phase I, groundwater is encountered at an average depth of 3 ft bgs.

2.0 PROJECT SCOPE AND OBJECTIVES

2.1 Task Description

The activities to be performed during the NTCRA will be conducted to mitigate unacceptable human health risk associated with lead concentrations in soil. These activities are being conducted based on the results of the CSE Phase I/Phase II supplemented by the findings of the Engineering Evaluation/Cost Analysis prepared by the ANG (ANG, 2012).

The purpose of this removal action is to:

- Reduce human health risks associated with residual concentrations of lead above 400 mg/kg and copper above 270 mg/kg in soil from the use of small arms ammunition at MRSs SR001 and SR002; and,
- Reduce future hazards and risks by mitigating soils impacted by lead (concentrations greater than 400 mg/kg) and copper (concentrations greater than 270 mg/kg), thus reducing the potential migration of lead and copper at concentrations above human health risk standards to surrounding environmental media.

Activities performed during this removal action will include:

- Removal of 40-mm practice grenade debris larger than 1 square inch at MRS SR001;
- Installation monitoring wells and collection groundwater samples at four locations at SR001 and three locations at SR002;
- Collection of discrete pre-excavation soil samples for waste characterization;
- Excavation and offsite disposal of impacted soil;
- In-situ XRF screening and subsequent confirmation sampling to determine final excavation extents;
- Composite soil sampling of stockpiled soil for waste characterization; and,
- Site restoration activities.

Through the execution of these activities, the overall goal of unrestricted use and unrestricted exposure (UU/UE) for human health at each MRS will be achieved.

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3.0 FIELD ACTIVITIES

This section introduces the SOPs associated with each type of field sampling activity anticipated for work at MRSs SR001 and SR002. These protocols and procedures provide guidelines as to how each activity should be performed. The goal of this sampling effort is to collect biased, representative, consistent, and defensible soil and groundwater data at each MRS. RA activities will be conducted in two primary phases and include the elements of work as outlined below.

Phase I:

- Planning activities (*Section 5.1, NTCRA Work Plan*)
- Site preparation (*Section 5.2, NTCRA Work Plan*)
- 40-mm practice grenade debris pickup (*Section 5.3, NTCRA Work Plan*)
- Monitoring well installation and sampling (*Section 5.4, NTCRA Work Plan* and the Sections 3.1, 3.6, and 3.8 below)
- Pre-excavation waste characterization soil sampling (*Section 5.5, NTCRA Work Plan* and Sections 3.2, 3.6, and 3.8 below)

Phase II:

- Structure demolition (*Section 5.6, NTCRA Work Plan*)
- Excavation, confirmatory soil sampling, and post-excavation waste characterization sampling (*Section 5.7, NTCRA Work Plan* and Sections 3.3 through 3.6, and Section 3.8 below)
- Waste Disposal (*Section 5.8, NTCRA Work Plan*)
- Decontamination (*Section 5.9, NTCRA Work Plan* and Section 3.7 below)
- Site restoration (*Section 5.10, NTCRA Work Plan*)

Four types of screening/sampling activities will be conducted during NTCRA activities, to include the following:

- Monitoring Well Installation and Groundwater Sampling (Phase I): Groundwater sampling to determine if historical activities have impacted groundwater at each MRS.
- Waste Characterization Sampling: Discrete and composite waste characterization to determine proper waste handling, transportation, and disposal. Discrete pre-excavation soil sampling for waste characterization analyses will be used to facilitate the direct-loading during site excavation activities (Phase I). Composite soil sampling will be conducted on 6-inch surface-scraped soils and investigation-derived wastewater upon generation (Phase II).
- In-Situ XRF Soil Screening (Phase II): Discrete field readings collected to help guide excavation extents and associated confirmatory sampling efforts.
- Confirmatory Soil Sampling (Phase II): Incremental samples collected by use of a randomized grid pattern across individual sample units (e.g., range floor and berm areas) to confirm excavation extents and evaluate NTCRA completeness. Discrete soil samples collected using a systematic randomized sampling method.

Field activities will be conducted in accordance with the SOPs included in Attachment A.

3.1 Monitoring Well Installation and Groundwater Sampling

The following sections outline the methodologies to be used during monitoring well installation and groundwater sampling activities at Hancock Field. A discussion of the locations, number of samples, and analysis to be conducted can be found in *Section 5.4 of the NTCRA Work Plan*.

3.1.1 Drilling

Drilling will be performed with a direct-push technology (DPT) drill rig in accordance with state of New York regulations, applicable USEPA guidance, and the following requirements. A site geologist will be present during drilling and well installation activities. This individual will be responsible that:

- Each temporary well is drilled, constructed, and developed in accordance with the NTCRA Work Plan, this section, design specifications, and the drilling subcontract scope of work;
- An accurate tally of drilled footage, materials used, and rig downtime is provided;
- The proper rig is used and is properly decontaminated prior to leaving the site;
- Boring logs are completed;
- Sampling and shipment of samples to the contracted laboratory is performed in accordance with the provisions provided in this plan; and,
- Other duties are performed, as defined by the NTCRA Work Plan or the AMEC PM.

A copy of field documentation pertaining to the installation of temporary monitoring wells will be included in the After Action Report (AAR).

Drill rigs, drill tools, and associated equipment should be decontaminated before drilling as per SOP 6 (Attachment A) and the NTCRA Work Plan. The use of any liquid, including water, is to generally be avoided during drilling. Only food-based lubricants may be used on drill rod joints. Dispersing agents (i.e., phosphates) or acids will not be used. There will be no attempt to chemically disinfect the well. Toxic and/or contaminating substances will not be used during any part of the drilling or well installation. Drilling activities and methods will be sufficient to prohibit the introduction of contaminants from one water-bearing stratum to another.

Prior to drilling, the qualified site geologist will review with the driller the details of the well installation, including any anticipated potential drilling or completion problems, as known.

The boring will be of sufficient diameter to permit 1 to 2 inches of annular space between the boring wall and all sides of the centered well riser and screen sections and will be compliant with the State of New York requirements for well installation.

Drilling/boring logs (*Appendix D of the NTCRA Work Plan*) will be completed for each boring. Boring logs will be submitted as appendices to the AAR. Soil samples will be visually classified in accordance with the Unified Soil Classification System (USCS) and ASTM D2488, *Standard Practice for Description and Identification of Soils (Visual - Manual Procedure)* (ASTM, 2009). Original field logs will be considered a legal document describing the materials penetrated and the specifics of the drilling and sampling methods and technique used. The field logs will only be edited to add pertinent information not available at the time of drilling (i.e., survey information).

3.1.2 Monitoring Well Installation

During the NTCRA, temporary pre-packed monitoring wells will be installed within borings advanced by the DPT rig at the two MRSs. At select locations, soil borings will be advanced using 5-ft sections of 2.625-inch inside diameter probe casing that will provide a 3.25-inch diameter borehole. Borings will be advanced to the first occurrence of water plus 5 ft. The pre-pack monitoring wells will be constructed of 2-inch diameter, 5 ft long, 0.010-slotted schedule 40 polyvinyl chloride (PVC) well screen wrapped with a stainless steel wire mesh containing a 0.25 inch filter pack. The filter pack will consist of 20/40 mesh, commercially available, clean silica sand with uniform sorting, or similar size compatible with the well slot size. The screen will be capped with a flush-jointed well cap and attached to 2-inch diameter schedule 40 PVC riser pipes.

It is proposed that the well annulus remain open during sampling activities; however, if precipitation is anticipated during sampling activities, the annulus will be backfilled to prevent surface water from entering the borehole. If backfilling is necessary, clean sand will be placed to a minimum of 2 ft above top of screen followed by bentonite that will be placed to the ground surface.

3.1.3 Groundwater Purging and Sampling

Monitoring wells at MRSs SR001 and SR002 will be purged and sampled using low-flow techniques with a peristaltic pump. The standard procedure for purging and sampling using a peristaltic pump is in agreement with procedures described in the *Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers* (USEPA, 2010).

After installation, the pre-pack wells will be allowed to sit undisturbed for approximately 12 hours prior to groundwater sampling. Prior to groundwater sampling activities, static water levels will be collected to determine the groundwater flow direction. The depth-to-water will be recorded to the nearest 0.01 ft. Additionally, the total well depth will be measured prior to sampling. Total well depths will be measured and recorded to the nearest 0.01 ft. The volume of water in the well (cased well volume) will be calculated as follows:

$$\pi \left(\frac{d}{2}\right)^2 (h_1 - h_2) \times 7.48 = \text{cased well volume (in gallons)}$$

Where:
d = inside diameter of well casing (in ft)
h_1 = depth of well from top of casing (in ft)
h_2 = depth to water from top of casing (in ft)

The time and date of the measurement, static water level, total well depth, and volume calculations will be recorded at the time of collection.

Low-flow purging and sampling rates generally range from 0.1 to 1.0 liter per hour. Drawdown during purging will not exceed 0.33 ft (USEPA, 2010). If the minimal drawdown that can be achieved exceeds 0.33 ft, but remains stable, purging will continue. If a stabilized drawdown in the well can't be

maintained at 0.33 ft and the water level is approaching the top of the screened interval, the flow rate will be reduced or the pump will be turned off (for 15 minutes) to allow for recovery (a check valve is required if the pump is shut off). Under no circumstances will the well be pumped dry. Once the well has recharged, pumping will continue at a lower flow rate, if the water draws-down to the top of the screened interval again the pump will be turned off and allow for recovery. If two tubing volumes (including the volume of water in the pump) have been removed during purging, samples may be collected the next time the pump is turned on (USEPA, 2010). Purge water will be disposed as detailed in *Section 5.9 of the NTCRA Work Plan*.

Stabilization of field parameters (i.e., pH, specific conductance, temperature, dissolved oxygen, oxidation-reduction potential, and turbidity) will be used to ensure that formation water is being removed during purging. Stabilized values must be spaced at intervals exceeding the volume within the tubing. Field parameter readings will be obtained during purging of the monitoring wells using a water-quality monitoring unit equipped to measure all parameters. Turbidity will be measured using a turbidity meter. Water-quality meters and the turbidity meter shall be calibrated in accordance with the manufacturer's procedures.

Stabilization of field parameters is achieved when three consecutive readings are within the following limits (The parameters should be collected directly from the pump tubing. Readings should be conducted at a frequency every three to five minutes (USEPA 2010). The amount of time for this to occur is dependent upon the flow rate):

- Turbidity – plus or minus 10 percent (must be 10 nephelometric turbidity units or less);
- Conductivity – plus or minus 3 percent;
- pH – plus or minus 0.1 unit;
- Temperature – plus or minus 0.5 °C (degrees Celsius);
- Oxidation-reduction potential – plus or minus 10 percent; and,
- Dissolved oxygen – plus or minus 10 percent.

Sampling for chemical parameters will be conducted when stabilization of field parameters has been achieved.

Sample bottles will be filled directly from the pump tubing, and will consist of filtered and unfiltered samples. The samples, field duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples will be filled simultaneously. Samples for chemical analysis will be handled as detailed in this plan.

3.1.4 Temporary Monitoring Well and Borehole Abandonment

After groundwater samples have been collected from the temporary monitoring wells, the wells will be removed, decontaminated, and disposed as construction and demolition waste; and the remaining borehole will be backfilled (SOP 7, Attachment A). This will consist of backfilling to the surface with bentonite chips or pellets. Bentonite chips/pellets will be added to the borehole in 2 ft lifts and hydrated with water from a potable water supply. This process should be repeated until the entire borehole is plugged using no less than 5 gallons water per 10 ft of borehole.

3.2 Waste Characterization Sampling

Two types of waste characterization sampling will be collected during removal action activities: Pre-excavation Discrete Soil Sampling and Composite Sampling.

3.2.1 Pre-Excavation Discrete Soil Sampling

As detailed in *Section 5.5 of the NTCRA Work Plan*, discrete pre-excavation soil samples will be collected within the proposed excavation areas. Pre-characterization waste characterization samples will be collected from the locations presented in *Figure 5-3 and Figure 5-4 of the NTCRA Work Plan* to facilitate direct-loading of impacted soil to an approved disposal facility. The offsite laboratory will analyze waste samples using Toxicity Characteristic Leaching Procedure (TCLP) methodology. These samples will be collected during the monitoring well installation phase of the project so that at the time of excavation, impacted soil can be direct loaded and transported for disposal.

1. For pre-characterization samples, use a soil sample tool (stainless steel hand auger or trowel) to collect a discrete soil sample biased toward the areas of highest lead concentrations (*Table 3-2 in the NTCRA Work Plan*);
2. From each location presented on *Figure 5-3 and Figure 5-4 of the NTCRA Work Plan*, collect one discrete soil sample at an interval of 6-18 inches.
3. Immediately fill volatile and semivolatile sample containers to maintain sample integrity, label, and place in cooler for shipment;
4. For samples requiring metals analysis, place the soil sample in disposable aluminum pans and homogenize thoroughly, removing rocks and vegetation;
5. Completely fill sample bottles, label accordingly, and place the sample in the cooler for shipment;
6. Place a security seal around the lid of the sample container (initial and date); and,
7. Package the sample for shipment to the laboratory as specified in Section 3.8.

3.2.2 Composite Sampling

Waste characterization samples will be collected from water investigation derived waste (IDW)/remediation derived waste (RDW) and range soils to determine proper shipment and disposal. The offsite laboratory will analyze waste samples using Toxicity Characteristic Leaching Procedure (TCLP) methodology.

3.2.2.1 Water IDW/RDW

After containerizing decontamination/rinse water, composite samples of the IDW will be collected using a coliwasa sampler in accordance with ASTM D5495-03(2011), *Standard Practice for Sampling with a Composite Liquid Waste Sampler (COLIWASA)*.

3.2.2.2 Soil IDW/RDW

An initial scrape within the range floor of MRS SR001 and SR002 will generate soil that will be stockpiled on-site in roll offs (*Section 5.7 of the NTCRA Work Plan*). Surface scrape soils will be sampled via composite soil sampling. Composite soil samples will be sent to an offsite laboratory for

analysis of waste characterization analyses and will be collected at a minimum frequency of one sample per 500 CY of soil (*Section 5.8 of the NTCRA Work Plan*). Composite soil samples will consist of approximately five aliquot samples per 500 CY of stockpiled soil. The five aliquot locations will be equally spaced around the perimeter of each 500 cubic yards of soil. Sampling will be conducted as follows:

1. For composite soil samples, a stainless steel trowel, stainless steel spoon, or soil auger will be used to collect the sample at least 1 ft below the surface of the stockpile to ensure a fresh soil sample is collected;
2. Immediately fill volatile and semivolatile sample containers to maintain sample integrity, label, and place in cooler for shipment;
3. For samples requiring metals analysis, place the soil sample in disposable aluminum pans and homogenize thoroughly, removing rocks and vegetation;
4. Completely fill sample bottles, label accordingly, and place the sample in the cooler for shipment;
5. Place a security seal around the lid of the sample container (initial and date); and,
6. Package the sample for shipment to the laboratory as specified in Section 3.8.

3.3 In-Situ X-Ray Fluorescence Soil Screening

In-situ XRF field screening will be used to guide the extent of excavation and support decision making with regard to collecting confirmatory soil samples using the guidance provided in Method 6200, *Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment* (USEPA, 2007) and the procedures outlined below. It should be noted that XRF data will not be used as definitive data for this removal action.

- Conduct calibration verification of instrument when instrument is turned on/off.
- Record calibration verification on the field form (*Appendix D, NTCRA Work Plan)*.
- Collect up to three in-situ readings from the floor of the excavation.
- If more than one XRF reading is collected from a particular location for the purposes of a quality check of field readings, RSD should be less than 20 percent and/or all three readings below 200 ppm (which is ½ the soil cleanup criteria for lead). Record XRF results from the instrument display on the XRF sample collection log (*Appendix D, NTCRA Work Plan*).
- Download XRF data to a computer when the day's analysis is complete. The data can then be easily transferred to an Excel-based format for all XRF results.

3.4 Confirmatory Soil Sampling

Two types of confirmatory soil sampling may be used in determining that remaining soil is below the cleanup criteria established for this removal action: Incremental Soil Samples and Discrete Soil Samples.

3.4.1 Incremental Soil Samples

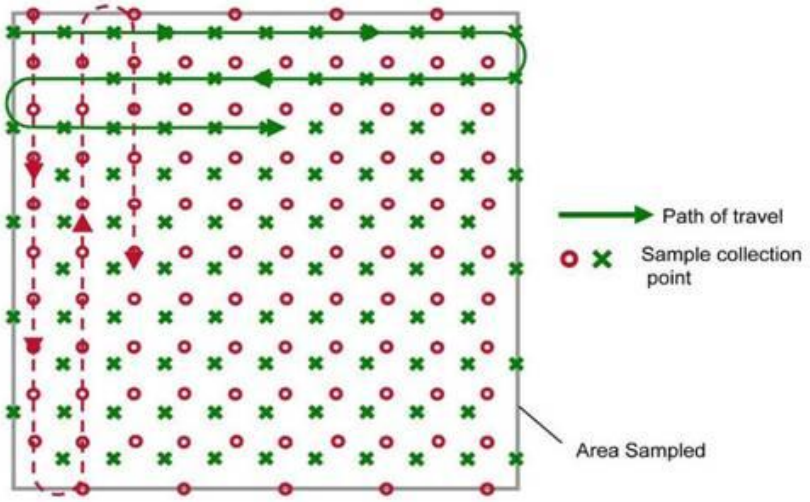
Incremental sampling (IS) will be conducted within each sampling unit to determine if the mean concentration of munitions-related metals within the residual soil meets the removal action objective. Incremental samples will be submitted to the analytical laboratory and analyzed using the multi-increment sample preparation technique, USEPA Method 8330B (prep only) followed by metals analysis by Method

6010. Laboratory samples will be sub-sampled by the laboratory and analyzed on a sieved, pre-ground basis (grinding of soil will not occur).

Each incremental sample will be collected with a stainless steel incremental sampling tool/device from the same relative position in each grid to a depth of 5 centimeters (cm). IS activities will be conducted using the guidance provided in the *Implementation of Incremental Sampling of Soil for the MMRP, Interim Guidance Document 09-02* (USACE, 2009). A minimum number of 30 increments will be collected per incremental sample using an incremental sampling tool, or equivalent and will be collected as follows:

1. Record the associated Global Positioning System (GPS) coordinates for each sample unit corner in the logbook.
2. Use a random number generator to determine a random starting location near one of the four corners.
3. Use the 5 cm depth incremental sampling tool to collect a minimum of 30 aliquots of soil from the sample unit and place sample in a new, clean gallon-size polyethylene bag.
4. Record the total number of aliquots in the field logbook.
5. After the entire incremental sample is collected, seal the bag and tape closed.
6. Label the sample in accordance with Section 3.8 and 4.6 of this FSP.
7. Decontaminate IS equipment between sample units using the SOP provided in Attachment A.

Generalized Multi-Increment Sampling Strategy



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3.4.2 Discrete Soil Samples

In the event that a confirmatory IS sample cannot be collected in an efficient manner, discrete soil samples may be collected and submitted to the laboratory for analysis. Discrete soil samples will be collected in a systematic randomized grid method, in which the first soil sampling location is randomly selected with follow on samples being collected along the same interval at a frequency of every 50 linear feet or at a minimum of one sample if the linear footage is less than 50 linear feet.

3.5 Documentation of Sample Locations

A hand-held Trimble GPS unit with sub-meter accuracy will be used to document sample locations and will be recorded in the field logbook.

3.6 QA/QC Samples

QC samples collected during this investigation include IS triplicates, duplicate/replicate samples, MS/MSD samples, temperature blanks, and rinse blanks.

3.6.1 Incremental Sample Triplicates

Reproducibility of IS results by replicate sampling is key to demonstrating that data are scientifically defensible and representative, and the only means by which confidence can be quantified. In lieu of collecting field duplicates for incremental samples, a total of one triplicate incremental sample will be collected at one sample unit in accordance with *Implementation of Incremental Sampling of Soil for the MMRP, Interim Guidance Document 09-02* (USACE, 2009).

3.6.2 Duplicate/Replicate Samples

A replicate (solid) sample is a second sample collected at the same location as the original sample. Duplicate/replicate sample results are used to assess precision of the sample collection process. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. The frequency of collection for field duplicates is 1 per 10 field samples per matrix sampled. Duplicates/replicates will be collected for discrete samples only.

3.6.3 MS/MSD Samples

One pair of samples MS/MSD will be collected for every 20 samples collected per matrix and will be submitted to the contracted laboratory with environmental samples.

3.6.4 Equipment Rinse Blanks

Equipment rinse blanks are collected after equipment decontamination by the field personnel on reusable sampling equipment only. Equipment rinse blanks are collected for the data user to evaluate the usability of the data. Equipment rinse blanks are collected by pouring deionized water over decontaminated sampling equipment. Rinse water is collected directly into the sample container, labeled, security sealed, and submitted to the laboratory at the same time as the environmental samples.

3.6.5 Temperature Blanks

Temperature blanks are submitted at a rate of one per cooler and are used to evaluate if samples arrive at the laboratory within the 4 degrees Celsius (°C) $\pm$ 2°C criteria.

3.7 Decontamination

This discussion presents procedures for decontamination of personnel and equipment. Decontamination of equipment and personnel will be performed for health and safety precautions to avoid cross contamination of samples collected for chemical analysis, and to limit the migration of contaminants off-site and between on-site work areas.

3.7.1 Equipment Decontamination

Decontamination of equipment will occur at the exclusion zone of the intrusive activities or at central decontamination stations (if required). SOP 6 (Attachment A) discusses the operating procedures for the decontamination of equipment.

Decontamination pads constructed at each drilling location shall be durable, portable, and capable of supporting all equipment to be decontaminated without risk of damage resulting in loss of rinsate. Decontamination pads will also be capable of containing decontamination fluids for collection into appropriate drums for shipment and disposal.

The drilling, excavation, and sampling equipment will be decontaminated at the location of the first activity. Final decontamination of drill rigs (including DPT equipment) and excavation equipment will be conducted at the location of the last activity. Drill rigs and associated equipment used to install monitoring wells and drill soil borings will be decontaminated at the edge of the exclusion zone at the completion of each boring or well installation to prevent cross contamination. Reusable equipment that may come in contact with samples for chemical analysis will be decontaminated between collection of samples.

Cleaning will consist of scraping and scrubbing to remove encrusted materials, if necessary, followed by soap (Alconox) and water wash and then a potable water rinse. Alternatively, the equipment may be cleaned with a high-pressure hot water/steam-cleaning unit. Following decontamination, clean equipment will be allowed to air dry prior to obtaining the next sample, if possible.

3.7.2 Personnel Decontamination

Decontamination of personnel engaged in the intrusive activities will be performed at personnel decontamination stations established at the edge of the exclusion zones. A personnel decontamination station will also be available at the central decontamination station (if required) for decontamination of field personnel.

Personnel decontamination will take place in both the central decontamination station (if required) and at the edge of exclusion zones prior to leaving these areas. Personnel decontamination will consist primarily of removal of gloves, disposable footies, and disposable coveralls (if worn onsite) followed by hand washing in soap and water.

Nonreusable equipment and clothing will be collected in plastic trash bags. Disposal of investigation derived waste (IDW) associated with decontamination activities will be in accordance with Section 5.0.

3.8 Sample Handling Procedures

The instructions contained in this section are to be used by field personnel when collecting and handling samples for packing and shipping.

3.8.1 Sample Containers

A list of sample containers and preservation requirements for various chemical analyses are provided on Worksheets 19 & 30.

3.8.2 Sample Packaging and Shipping Requirements

The instructions contained in this section are to be used by field personnel when collecting and handling samples for packing and shipping. On the occasion that field personnel determine that any of the instructions described in this section are inappropriate, inadequate or impractical and that another procedure must be used, the variance must be documented in the field log book, along with a description of the circumstances requiring its use. At a minimum, the following items are necessary to complete the actions required by this section:

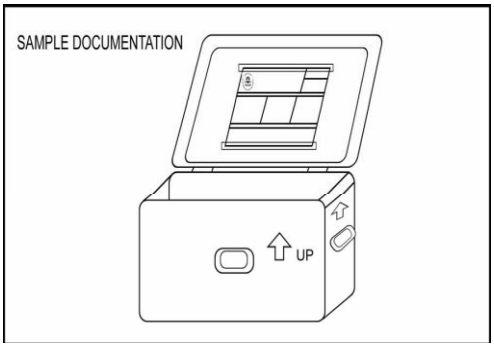
- Indelible black-ink pens;
- Field logbook;
- Ziploc® bags;
- Sample containers;
- Coolers;
- Blue Ice® (or equivalent);
- Strapping tape or duct tape;
- Bubble wrap;
- Garbage bags;
- Sample labels;
- Chain-of-custody forms; and,
- Custody seals.

Once the samples have been collected, it is important that the sampler properly package the samples for shipment/transport and ensure that the samples are sent to the appropriate laboratory as quickly as possible. Sample preservation requirements are specified in QAPP Worksheet 19 & 30. Prompt and proper packaging of samples will:

- Protect the integrity of samples from changes in composition or concentration caused by bacterial growth or degradation from increased temperatures;
- Reduce the chance of leaking or breaking of sample containers that would result in loss of sample volume, loss of sample integrity, and exposure of personnel to toxic substances; and,
- Help ensure compliance with shipping regulations.

Samples will be placed on ice upon sample collection to maintain sample integrity. Prior to shipment, samplers will conduct an inventory of the contents of the shipping cooler or container against the corresponding CoC record when packing for shipment to the laboratory. An inventory will ensure that the proper number of containers have been collected for each analysis of the samples, that the required QC samples and cooler temperature blanks are included, and the correct sample numbers have been assigned to each sample.

After samples are packaged within shipping coolers, samplers must carefully secure the top and bottom of the coolers with tape, place return address labels clearly on the outside of the cooler, and attach the required CoC seals. Paperwork/CoC records will be placed in a plastic bag or pouch and then secured to the underside of the shipping cooler lids (see example on right). Custody seals will be placed on all shipping containers to ensure that tampering or unauthorized opening does not compromise sample integrity. Further information regarding sample handling procedures can be found in SOP 3, located in Attachment A.



Collected samples will be shipped to the analytical laboratory within 24 hours of collection. Samples will be shipped in accordance with applicable DOT requirements (49 CFR 171 through 49 CFR 178) and USEPA sample-handling, packaging, and shipping methods (40 CFR 262).

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4.0 FIELD OPERATIONS DOCUMENTATION

During sampling activities, field personnel will document field activities, issues, variances, progress, and any other pertinent information. This documentation will be kept on-site during fieldwork. The following sections list the forms/logs which will be used to document field activities.

4.1 Field Logbook

Field logbooks will be maintained to record pertinent information. The type of information to be recorded is provided below.

The cover of each field logbook will contain the following information:

- Project name and number;
- Book number;
- Activity type;
- Start date; and,
- Stop date.

Entries to a field logbook will be made and completed daily. At a minimum, the information provided will consist of the following:

- Date;
- Start time;
- Weather;
- Field personnel present;
- Visitors to the site (time, name, and company);
- Level of personnel protection used;
- Type of activity conducted;
- Sampling location;
- Sample identification number;
- Description of sampling point;
- Method of sampling;
- Type of sample;
- Air monitoring readings, if applicable;
- Pertinent field observations;
- Instrument identification numbers;
- Results of field instrument calibration;
- Field measurements;
- Anticipated disposition of sample;
- Description of all related activities; and,
- Signature of the person making the entry.

Measurements made and samples collected will be recorded in indelible ink. No erasures are permitted. If an incorrect entry is made, the data shall be crossed out with a single strike mark and initialed. Entries will be organized into easily understandable tables, if possible.

At each station where a sample is collected or a measurement made, a detailed description of the location of the stations will be recorded. Equipment used to make measurements will be identified, including the date and time on which the equipment was calibrated. In addition, the FM will maintain a daily field summary book. Entries into this book will include:

- Types of activities conducted throughout the day;
- Personnel involved with each activity;
- Description of instructions given to field personnel;
- Health and safety related problems and corrective measures taken;
- Summary of discussions with the PM;
- List of site visitors with purpose for the visit;
- Changes/modifications to sample locations or procedures; and,
- Any other pertinent information related to site activities.

Field documentation requirements for the SSHO are presented in the APP, which is *Appendix E of the NTCRA Work Plan*.

4.2 Variance Logs

Variances from the NTCRA Work Plan will be formally documented on the Variance Form located in *Appendix D of the NTCRA Work Plan*.

4.3 Photographic Records

Photographs will be taken, prior to and after conducting field activities. Photographs will be accompanied with a numbered photograph log that will include the Contractor's project name, date, and description of activity (e.g., surface soil sampling and corresponding sample identification number).

4.4 XRF Logs

XRF logs shall be completed as documentation of XRF surveys/screenings. These logs include calibration verification logs and XRF sample collection logs (*Appendix D of the NTCRA Work Plan*).

4.5 Removal Action Report Elements

The AAR will be developed upon completion of field activities and will serve as the primary documentation to support UU/UE for both MRSs. The general outline of the report will minimally include the following elements:

- Description the purpose, scope, and organization of the project;
- Facility and MRS background information;
- Regional and local environmental settings of the site;
- Removal action field activities;
- Sampling results;
- Updated conceptual site models per MRS;
- Updates to the munitions response site prioritization protocol worksheets; and,
- Summary and recommendations for each MRS.

4.6 Sample Documentation

Sampling collection logs for soil and groundwater shall be completed while environmental samples are collected for laboratory analysis, as certain field conditions, environments, and other notes may assist in the interpretation of analytical results. Sample collection logs are presented in *Appendix D of the NTCRA Work Plan*.

A sample identification system has been established for sampling activities. Sample identification provides a method for tracking each sample through collection, analysis, and data reduction. Sample labels shall be pre-printed if possible. A Station ID will correspond with a unique location within an MRS. Sample IDs will be numbered sequentially and represent a unique sample and identify the type of sample (soil, groundwater, etc). Nomenclature to be used is presented in the site-specific QAPP.

4.6.1 Chain of Custody Records

The sampler will be responsible for initiating and completing the CoC. The field team members are responsible for the care and custody of the samples collected until the samples are transferred to another individual or shipped to the analytical laboratory. The CoC will be signed, with date and time, by the sampler when samples are relinquished to anyone else. The CoC will accompany the samples at all times. Individuals who subsequently take possession of the samples will also sign, with date and time, the CoC. The only exception to this requirement is that of common carriers (i.e., Federal Express, Airborne, United Parcel Service, etc.). The shipping document provided by them will suffice for custody. The CoC accompanies each cooler containing samples sent to the analytical laboratory. Laboratory personnel are responsible for the receipt and entry of samples into the laboratory, which have been submitted under a CoC document. Additionally, samples received will be entered into the laboratory CoC procedures by properly documenting and maintaining CoC from the moment that they take custody of the sample until the sample is properly disposed of. The CoC procedures are summarized as follows:

- At the time of sample collection, the CoC is completed for the sample collected.
- When the form is full or when all samples have been collected that will fit in a single cooler, the field team members will crosscheck the form for possible errors. Corrections are made to the record with a single strike mark and dated and initialed. All entries will be made in blue or black ink. The CoC will be signed when the samples are relinquished.
- If shipping samples to a laboratory off-site, a shipping bill is completed and the shipping bill number recorded on the CoC prior to enclosing inside a clear plastic bag and attaching it to the inside of the cooler lid.

When transferring custody of the samples, the individual relinquishing custody of the samples will verify sample numbers and condition and will document the sample acquisition and transfer by signing, with date and time, the CoC. The field sample coordinator will assist the samplers in grouping the samples for shipment to the analytical laboratory and review the completed CoC for each cooler. Samples will be packaged for shipment and submitted to the analytical laboratory with a separate CoC accompanying each cooler.

Custody seals will be used to ensure that the shipping containers have not been opened during shipment and prior to receipt at the off-site laboratory. The following information will be included on the custody seals:

- Signature of the sample coordinator; and,
- Date when the sample package is sealed.

Seals will be completed using indelible ink. The seals will be affixed to the front and back of the cooler, at the interface of the cooler and the lid. The placement of the seals will be in a manner that breaking the seals would be necessary in order to open the sample shipping cooler.

In conjunction with data reporting, the analytical laboratory will return the original or a photocopy of the original CoC to the field office for inclusion into the project file.

Samples collected will remain in the possession of the sampling crew until shipment. Locked vehicles or trailers will be used for interim storage if necessary. If coolers (used for sample storage) must be left unattended for extended periods of time, signed custody seals will be placed on the front and back of each cooler or the cooler will be stored under lock until shipped to the off-site laboratory.

4.6.2 Sample Receipt Forms

When the analytical laboratory receives the sample coolers, a cooler and/or sample receipt form for the samples will be initialed and faxed back to the job site or submitted to the AMEC PM. This form will document the sample condition upon receipt. Receipt nonconformance situations will be initiated through the use of the laboratory's standard sample receipt form.

4.6.3 Documentation Procedures

The original page of each CoC will be sent with the samples to the laboratory, and the copy will be retained by the sampling team and placed in the project files. For sample packages sent by carrier to a laboratory off-site, bills of lading will be retained as part of the documentation for CoCs.

5.0 INVESTIGATION DERIVED WASTE

This IDW Management Plan is compliant with guidance provided in the USEPA guidance document entitled *Management of Investigation-Derived Wastes During Site Investigations* (USEPA, 1992).

During the field effort, waste container information shall be kept in the field logbook and shall include the following information:

- Waste container identification number;
- Type of waste;
- Volume of waste;
- Date waste generated;
- Source of waste; and,
- Reference to available analytical data.

Containers will also include this information on the label. A "Pending Analysis" label will be affixed to the waste container at the initiation of accumulation. In addition, a contact name and number will be provided on the waste container.

IDW wash water generated from field activities will be contained in a DOT approved drum. The drum will be labeled and will be temporarily staged at each sampling location. After containerizing equipment rinse water, composite samples of the IDW will be collected. Samples will be submitted to an analytical laboratory for applicable SW-846 analyses to address requirements for proper management and disposal.

Soil cuttings from soil borings advanced for temporary monitoring well installation will be placed on the berm area to be excavated from each MRS.

If analytical results indicate that the IDW wash water meets the pre-treatment standards, IDW water may be discharged to the sanitary sewer. If a sanitary sewer treatment system is not available for the IDW or if the analytical results indicate that IDW water is above the Resource Conservation and Recovery Act (RCRA) regulatory limits, the IDW water will be disposed of at an approved facility.

Non-hazardous personal protective equipment will be containerized in a household-type trash bag and may be disposed of in an onsite trash receptacle/dumpster.

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6.0 DAILY QUALITY CONTROL REPORTS

During field activities, Daily QC Reports (*Appendix D of the NTCRA Work Plan*) will be prepared. Each Daily QC Report will be dated, signed by the FM, and sent to the USACE-designated point of contact on a weekly basis. The reports will include the following:

- Weather information at the time of sampling;
- Field instrument measurements;
- Field instrument calibrations;
- Field variances;
- Problems encountered during sampling; and,
- Instructions received from the USACE personnel.

Any deviations that may affect the ability to meet objectives of the NTCRA will be conveyed to the USACE-designated point of contact immediately. The following information may be attached to the Daily QC Reports:

- Field analytical QA/QC Information;
- Field logbook or copies of applicable pages from field logbooks;
- Copies of the CoC Records; and,
- Field sample collection sheets.

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7.0 THREE-PHASE INSPECTION PROCEDURES

The Three-Phase Control Process will be utilized during sampling acitivities to ensure that project activities comply with the approved plans, procedures, and specifications. The elements of the Three-Phase Control Process are:

- Preparatory phase;
- Initial phase; and,
- Follow-up phase.

A Three-Phase Control Process will be implemented for each definable feature of work performed during the project. Each control phase is important for obtaining a quality product. However, the preparatory and initial inspections are particularly valuable in preventing problems. Production sampling work must not be performed until successful preparatory and initial phase inspections have been completed.

The AMEC PM, the Technical Lead, the FM, and other key personnel must work together to ensure that project objectives are being achieved. The FM will communicate observations to the the Technical Lead and PM on a regular basis. This may be accomplished through staff meetings, project QC meetings, surveillance reports, QC reports, and e-mail correspondence.

7.1 Preparatory Phase

A preparatory phase inspection will be performed prior to beginning the field sampling work. The purpose of the inspection is to review plans, specifications, SOPs, and other applicable documents, and to verify that necessary resources, conditions, and controls are in place before work starts. This review will be conducted with personnel responsible for performing the work, including managers, supervisors, and site personnel to ensure that all involved know what is expected and understand their role. The FM will be responsible for confirming that:

- Personnel required for the activity are identified and positions filled;
- Personnel have received and reviewed a copy of the SAP and APP;
- Training has been identified and completed;
- Preliminary work and coordination have been completed;
- Equipment and materials required to perform the activity have been identified and are available; and,
- Reviews have been conducted.

Deficiencies identified during preparatory phase inspections will be documented and corrective action taken prior to beginning work. The FM will verify with the PM that corrective action has been completed and is appropriate before production work can begin.

7.2 Initial Phase

Initial phase inspections are performed when a work process begins for each crew or team performing the process. The purpose of the inspection is to verify that work complies with procedures and contract specifications, establish acceptable levels of workmanship, review the Preparatory Phase Inspection

Checklist, and resolve any differences of interpretation. Initial phase inspections may be repeated when acceptable levels of quality are not demonstrated or at the discretion of the FM.

The FM will be responsible for conducting initial phase inspections and verifying that:

- Compliance with procedures and specifications has been achieved;
- Acceptable levels of workmanship are being performed;
- Corrective action taken during the preparatory phase inspection has resolved the deficiency and prevents recurrence; and,
- Any differences of interpretation are resolved.

Deficiencies identified during initial phase inspections will be documented, and corrective action will be taken. The FM will verify with the PM that corrective action has been completed and is appropriate to prevent recurrence of the condition. When corrective action cannot be completed in a timely manner (i.e., 2 days), or the root cause is not known, immediate corrective action that fixes the deficiency may be taken and verified, and work may be continued pending root cause analysis and more appropriate corrective action.

7.3 Follow-Up Phase

Follow-up phase inspections will be performed after a work process has begun and periodically throughout the work process. The purpose of the inspections will be to ensure that the process is being completed in accordance with agreed-upon standards, to identify changes in the process, and to ensure that the level of quality meets expectations. The FM will be responsible for monitoring work processes taking place and verifying continued compliance with contract specifications and requirements.

8.0 NON-CONFORMANCE/CORRECTIVE ACTIONS

Corrective action is initiated whenever there is a non-conformance or deviation to procedures and requirements in the applicable planning documents. If unforeseen field conditions arise, modifications to the SAP may be necessary.

Deviations from this SAP that do not jeopardize sample integrity or violate the intent of the approach will be fully documented in the field logbook. Major problems that cannot be corrected on-site will be discussed with the USACE PM within 24 hours of occurrence. This will be followed by a written record of the problem along with a discussion of the corrective actions taken, their effectiveness, and qualitative and quantitative effect on the data's quality. This written record will be used in data evaluation. The USACE PM will be notified of any problems that cannot be corrected without compromising sample integrity.

Project personnel have the responsibility, as part of their normal work duties, to promptly identify deviations, solicit approved correction and report conditions which are not in accordance with the SAP. If unanticipated field conditions are encountered that significantly impact the project, the AMEC PM will be notified immediately. Any conditions that result in a field change will, at a minimum, be reported to the USACE PM.

The procedures outlined in this SAP will be followed at all times during field activities. If it is discovered that procedures are not being followed, the impacts to the project's quality will be evaluated and the cause will be documented. Corrective action(s) will be taken to prevent further deviation from the SAP. The AMEC and USACE PMs will be informed about the problem and the corrective action will be documented.

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9.0 REFERENCES

ASTM Standard D2488, 2009. *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*. ASTM International, West Conshohocken, PA, 2009, DOI: 101520/D2488-09A, www.astm.org

Code of Federal Regulations (CFR), Title 40 – *Protection of Environment*, Chapter I – *Environmental Protection Agency*, Subchapter I – *Solid Wastes*, Part 261 – *Identification and Listing of Hazardous Waste*, Subpart C – *Characteristics of Hazardous Waste*, § 261.24 – *Toxicity Characteristic*, Table 1 – *Maximum Concentration of Contaminants for the Toxicity Characteristic*.

CFR, Title 40 – *Protection of Environment*, Chapter I – *Environmental Protection Agency*, Subchapter I – *Solid Wastes*, Part 262 – *Standards Applicable to Generators of Hazardous Waste*.

CFR, Title 49 – *Transportation*; Subtitle B – *Other Regulations Relating to Transportation*; Chapter I – *Pipeline and Hazardous Materials Safety Administration, Department of Transportation*; Subchapter C – *Hazardous Materials Regulations*; Part 171 to 178.

Innovative Technical Solutions, Inc. and Shaw Environmental, Inc. (ITSI/Shaw), 2009. *Hancock Field ANGB, CSE Phase I Report*. September.

Sky Research, Inc. (Sky), 2012. *Hancock Field ANGB CSE Phase II Report (Final)*, U.S. Army Corps of Engineers, Omaha District. November 2012.

U.S. Army Corps of Engineers (USACE), 1998. *ER 1110-1-263, Engineering and Design – Chemical Data Quality Management for Hazardous, Toxic, Radioactive Waste Remedial Activities*. April 30.

USACE, 2001. EM 200-1-3, Requirements for the Preparation of Sampling and Analysis Plans.

U.S. Environmental Protection Agency (USEPA), 1992. *Publication 9345.3-03FS, Management of Investigation Derived Wastes*. January.

USEPA, 2002. *EPA, 542-S-02-001, Groundwater Sampling Guidelines for Superfund and RCRA Project Managers*. May.

USEPA, 2010. *Low Stress (low flow) Purging and Sampling Procedure For The Collection Of Groundwater Samples From Monitoring Wells.* January.

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10.0 QUALITY ASSURANCE PROJECT PLAN

The QAPP is presented in the worksheets that follow.

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QAPP WORKSHEET #1 & 2: TITLE AND APPROVAL PAGE

Site Name/Project Name: Non-Time Critical Removal Action, Munitions Response Sites SR001 (Small Arms Range and Shooting In Buttress) and SR002 (Firing In Buttress)
Site Location: Hancock Air National Guard Base, Syracuse, New York
Contract Number: W9128F-10-D-0059-0001

Lead Organization:
Air National Guard
3501 Fetchet Avenue
Andrews Air Force Base, MD 20762
Lead Agency's Project Manager: Jody Murata
(jody.murata@ang.af.mil)

Signature

State Regulatory Agency:
New York State Department of Environmental Conservation
625 Broadway, 12th Floor
Albany, NY 12233
State Agency's Project Manager: Robert Corcoran
rkcorcor@gw.dec.state.ny.us

Signature

Preparer:
U.S. Army Corps of Engineers, Omaha District
1616 Capitol Avenue, Suite 9000
Omaha, Nebraska 68102
Preparer's Project Manager: Adam Little
Adam.R.Little@usace.army.mil

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DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=LITTLE.ADAM.R.1274303065
Date: 2013.12.30 17:34:58 -06'00'

Signature

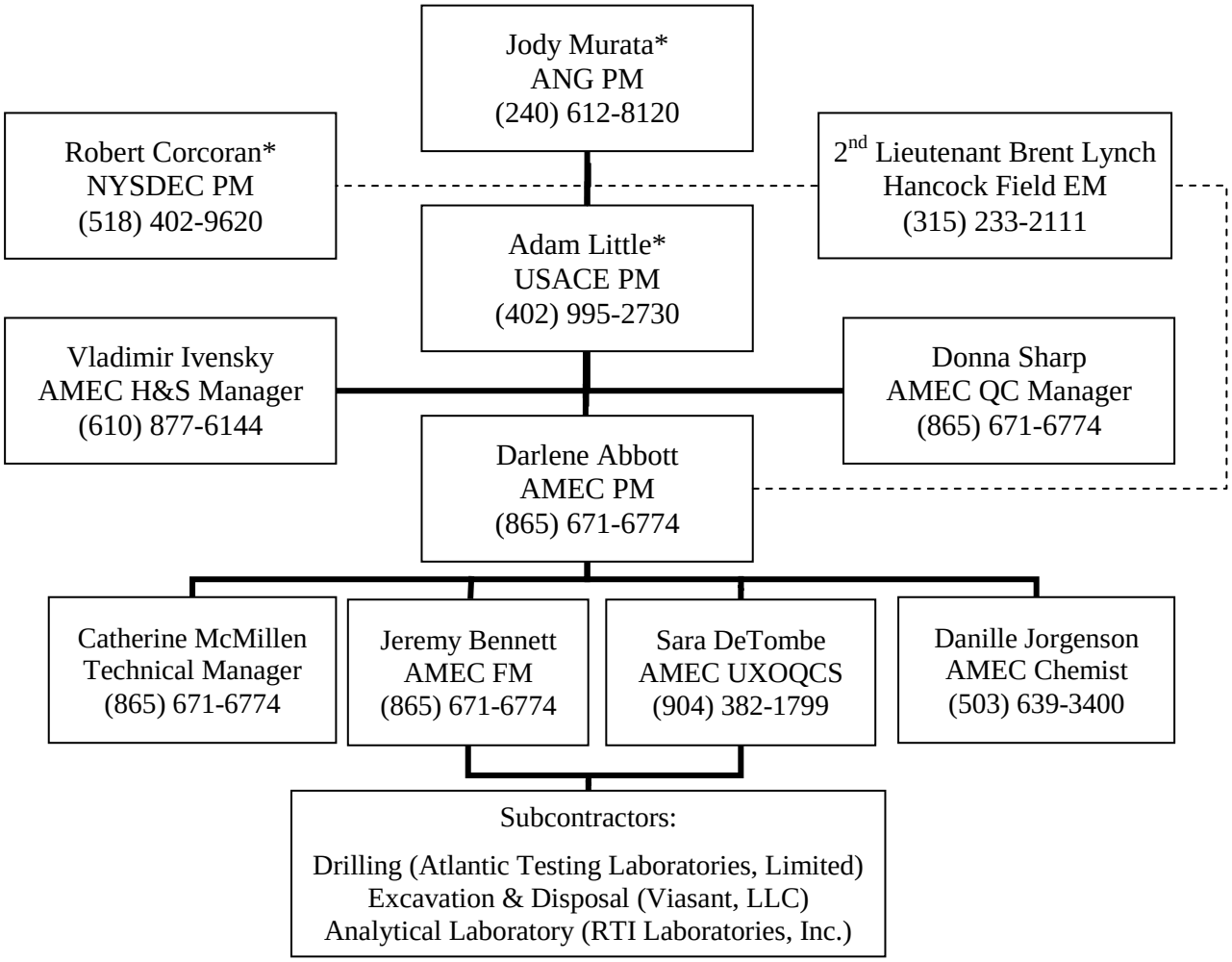
Plans and Reports from Previous Investigation:

- Comprehensive Site Evaluation (CSE) Phase I (ITSI/Shaw, 2009)
- CSE Phase II (Sky, 2012)

QAPP WORKSHEET #3 & 5: PROJECT ORGANIZATION FOR MUNITIONS CONSTITUENTS SAMPLING AND QAPP DISTRIBUTION

*QAPP recipient

Lines of authority _____ Lines of Communication ----------



QAPP WORKSHEET #4, 7 & 8: PERSONNEL QUALIFICATIONS AND SIGN-OFF SHEET

ORGANIZATION: AMEC Environment & Infrastructure, Inc. (AMEC)

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Darlene Abbott	Project Manager	M.S. Soil Science/13 years	CPSS Tennessee 22 PSS NC 1295	
Catherine McMillen	Technical Manager	M.S. Environmental Engineering/10 years	PE Tennessee 110410	
Jeremy Bennett	Field Manager	B.S. Environmental Science/8 years	CHMM 16002	
Danille Jorgenson	Project Chemist	B.S. Chemistry/8 years	n/a	
Donna Sharp	Quality Control Manager	B.S. Geology/18 years	PG Tennessee 3946	

Notes:
M.S. – Master of Science
B.S. – Bachelor of Science
CPSS – Certified Professional Soil Scientist
PE – Professional Engineer
CHMM – Certified Hazardous Materials Manager
PG – Professional Geologist
n/a – not applicable

ORGANIZATION: RTI Laboratories, Inc. (RTI)

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Chino Ortiz	Project Manager	HS Diploma 1yr College /12 years	RTI Internal PM Training	

*Signatures indicate personnel have read and agree to implement this QAPP as written

QAPP WORKSHEET #6: COMMUNICATION PATHWAYS

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Regulatory agency interface	ANG	Jody Murata Project Manager	(240) 612-8120	Is the primary point of contact for regulator interface. Contact will be through telephone or electronic mail and a record will be retained detailing the correspondence.
Interface between contractor and client	USACE	Adam Little Project Manager	(402) 995-2730	Is the USACE point of contact for regulatory interface as well as client and contractor interface. Contact will be through telephone or electronic mail and a record will be retained detailing the correspondence.
Field progress reports	AMEC	Darlene Abbott Project Manager	(865) 218-1025	Is the AMEC point of contact for stakeholders. Daily progress reports will be received from the AMEC Field Manager and communicated to the project team through telephone or electronic mail.
Stop work due to safety issues	AMEC and Subcontractors	On-site personnel	--	On-site personnel must notify the Site Health and Safety Officer, who in turn notifies the AMEC Project Manager (verbal, electronic).
QAPP changes prior to field work	AMEC	Catherine McMillen, Technical Manager	(865) 218-1081	Notify the AMEC Project Manager for approval of changes to the QAPP.
QAPP changes during project execution	AMEC	Catherine McMillen, Technical Manager	(865) 218-1081	Will notify the AMEC Project Manager who in turn will contact the ANG Project Manager.
Field corrective actions	AMEC	Darlene Abbott Project Manager	(865) 218-1039	Field corrective actions will be developed by the AMEC Project Manager and will be communicated to the AMEC Field Manager, who will communicate corrective actions to the field team.
Sample receipt variances	RTI	Chino Ortiz Project Manager	(734) 422-8000	Will notify the Field Manager, who will then contact the AMEC Project Manager.
Laboratory quality control variances	RTI	Chino Ortiz Project Manager	(734) 422-8000	Will notify the AMEC Quality Control Manager.
Analytical corrective actions	AMEC	Donna Sharp QC Manager	(865) 218-1969	Will respond to issue from laboratory with potential corrective action (verbal, written or electronic)
Data verification issues, e.g., incomplete records	AMEC	Donna Sharp QC Manager	(865) 218-1969	The AMEC Quality Control Manager will resolve any data verification issues with the contract laboratory.
Data validation issues, e.g., non-compliance with procedures	AMEC	Donna Sharp QC Manager	(865) 218-1969	The AMEC Quality Control Manager will resolve any data validation issues with the contract laboratory.
Data review corrective actions	AMEC	Donna Sharp QC Manager	(865) 218-1969	The AMEC Quality Control Manager will communicate necessary data review corrective actions with the contract laboratory.

Notes:
ANG – Air National Guard
AMEC – AMEC Environment & Infrastructure, Inc.
QC – Quality Control
RTI – RTI Laboratories, Inc.

QAPP WORKSHEET #9: PROJECT PLANNING SESSION SUMMARY

Date of planning session: Project Kickoff Meeting
Location: Hancock Air National Guard Base, Syracuse, New York
Purpose: Project Kickoff Meeting

Participants:

Name	Organization	Title/Role	Email/Phone
Jodi Murata	ANG	Project Manager	jodi.murata@ang.af.mil
2nd Lt. Brent Lynch	174th FW	Base Environmental Manager	brent.lynch@ang.af.mil
Adam Little	USACE Omaha	USACE Project Manager	adam.r.little@usace.army.mil
Bob Corcoran	NYSDEC	NYSDEC Project Manager	rkdcorcor@gw.dec.state.ny.us
Maj. James Oaksford	174 CES	Base Civil Engineer	james.oaksford@ang.af.mil
2nd Lt. David Livesay	174 CES	Deputy Base Civil Engineer	david.livesay.2@ang.af.mil
Patricia Smith	174th FW Real Property	Real Property Specialist	patricia.smith.2@ang.af.mil
Paula Bond	AMEC	Project Manager	paula.bond@amec.com
Donna Sharp	AMEC	Assistant Project Manager	donna.sharp@amec.com
Scott Sigler	AMEC	Site Supervisor	scott.sigler@amec.com
Patrick Kelly	Booz Allen Hamilton	ANG Oversight	patrick.kelly.ctr@ang.af.mil

Notes/Comments:

Mr. Little began the Kickoff Meeting presentation (presentation attached) giving a general overview of the Air Force MMRP and the CSE Process. The focus of the presentation was to:

- Provide the regulatory framework for the EE/CA and the Non-Time Critical Removal Action (NTCRA) planned for two MRS at Hancock Field;
- Summarize the results of the previous investigations;
- Describe the project elements;
- Discuss the general process for the NTCRA; and,
- Present the draft project schedule.

Ms. Paula Bond (AMEC) presented the site specific information and proposed project elements and processes. A CSE Phase I performed at Hancock Field in 2009 recommended two potential MRAs (SR001 and SR002) undergo a CSE Phase II. A CSE Phase II was conducted in 2010 with the following summary of results.

SR001 - Small Arms Range (SAR) and Shooting-In Buttress

- Approximately 3.7 acres
- Operated ca.1940 – 2002
- Identified munitions debris, 40mm practice grenades and small arms, range targets and infrastructure
- No MEC identified

- Lead concentrations in soil ranged from 25 mg/kg to 5217 mg/kg
- Recommended response action for lead impacted soil and 40mm grenade MD area
- XRF action level was 261 mg/kg for lead due to correlation with lab data

SR002 – Firing-In Buttress

- Approximately 5.8 acres
- Unknown operational period
- Identified small arms munitions debris and targets
- No MEC identified
- Lead concentrations ranged from 24 mg/kg to 585 mg/kg
- Recommended response action for lead in soil

The primary elements and submittals for the project are:

- Meetings & Briefings
- EE/CA
- Action Memorandum
- Interim Removal Action (IRA)
  - IRA Work Plan
  - Interim Removal Action
  - After-Action Report
- Updates to USAF Data Management Tool
- Submittals to AR/IR
- Public Participation
- Proposed Plan
- Record of Decision
- No Department of Defense Action Indicated/Explosive Safety Submission (Air Force requirement, not CERCLA)

Proposed NTCRA activities will include vegetation clearance, structure removal, soil removal to the RAO of 400 mg/kg in soil, soil stabilization, transport and disposal, grenade debris pickup (SR001 only), confirmation sampling, and leveling remaining earthen berms. This is a logistically challenging activity, so close coordination with the ANG, NYSDEC, and contractor is required. The field work is scheduled to begin in September 2012. The first document to be reviewed by the project Team will be the EE/CA in the first quarter 2012.

Regulator Questions/Concerns

1) B Corcoran is familiar with the CSE Phase I, but hasn't seen the Phase II.

   A Little – Due to availability of funding, the removal action has been pushed ahead.

2) B Corcoran asked what the NY lead concentration is.

   P Kelly – NY unrestricted residential level is 63 mg/kg lead in soils; restricted residential level is 400 mg/kg. Restricted residential likely means easements on property.

   J Murata – ANG prefers to get unrestricted use.

P Bond – what is background? B Lynch will look to see if they have soil background values. B Corcoran said that would change the unrestricted number if background is higher.

3) B Corcoran – asks about the potential for subsurface items (grenades or bullets) in the grenade area.
   S. Sigler – there would be evidence on surface if anything in subsurface
4) B Corcoran – SR002 – where are we taking the 24 inches off of the berm?
   P Bond – We will scrape the soil off of the face of berm. We will continue to remove soil until below the RAO. Also, there may be less soil removed than planned based on the XRF- Lab results.
   B Lynch – we are knocking down the remaining berm after removing the soil above 400 mg/kg
5) B Corcoran - Incremental Sampling – He is not very familiar with IS, how many aliquots will be collected?
   P Bond – we will collect between 30-50 increments in a sampling unit. An example of a sampling unit is the range floor or the impact berm.
   B Corcoran – He is fine with IS as long as the sampling is denser than the NYSDECs traditional excavation confirmation sampling.

Other Questions/Concerns

1) S Sigler – Is the base interested in the munitions debris for recycling?
   B Lynch – He will check and let AMEC know.
2) P Bond- Are there any security issues? Lynch – No. Contact B Lynch for contractor badging.
3) A Little- When they conducted the CSE Phase II, they did not expect to see munitions other than small arms, but found some evidence of 40 mm practice grenades at SR001. The debris will be picked up during the NTCRA.
4) A Little stated that one practice rocket was found imbedded into the structure at SR002. It was removed.
5) P Bond described the soil treatment and disposal decision process; a lot of coordination with the state will be required to determine whether the bullets will need to be removed.

Action Items:

Action	Responsible Party	Due Date
P Bond to send B Corcoran link to USEPA website to explain the NTCRA process.	AMEC	Not established
P Bond to send B Corcoran information on Incremental Sampling	AMEC	Not established
Look for base-specific metals background data to determine the lead concentrations in soil at Hancock Field	Base EM (Lt Lynch)	Not established

QAPP WORKSHEET #10: CONCEPTUAL SITE MODEL

A summary of the CSM is provided in Table 1. Additional information can be found in the work plan.

Table 1. Preliminary Conceptual Site Model
Hancock Air National Guard Base, New York

Site Identification	Site Description	Contaminants and Impacted Media	Migration Pathway	Exposed Population
MRS SR001	• Small arms range and Shooting-In Buttress • Munitions used consist of 7.62- mm, .38-caliber, .45-caliber, .50-caliber, 5.56-mm and 9-mm ball munitions • Consists of vacant land with remnants of berms and small arms facilities • Located in an industrial area	• Lead	• Residual constituents bound to soil material transported via stormwater • Infiltrate surface soil • Leach through soil into groundwater • Movement within groundwater	• Site workers • Visitors/trespassers • Biota Via • Dermal • Accidental ingestion • Inhalation
MRS SR002	• Consists of the Firing-In Buttress, a wood and concrete structure and the soil within the structure • Used as a backstop and safety berm for jammed rounds and by F-86 aircraft test firing and boresight alignment of up to .50-caliber ammunition • Located in an industrial area	• Lead	• Residual constituents bound to soil material transported via stormwater • Infiltrate surface soil • Leach through soil into groundwater • Movement within groundwater	• Site workers • Visitors/trespassers • Biota Via • Dermal • Accidental ingestion Inhalation

Notes:
mm – millimeter

QAPP WORKSHEET #11: PROJECT/DATA QUALITY OBJECTIVES

Step 1: State the Problem

Releases of munitions constituents (MC) have been identified at MRSs SR001 and SR002. The purpose of the NTCRA is to mitigate risk to human health by removing impacted soil from MRSs SR001 and SR002 to levels below the NYSDEC risk-based human health standards.

The planning team consists of the PM, Technical Manager, and FM, with oversight from the ANG and the USACE.

Step 2: Identify the Problem

The primary decisions and questions that will be determined during this NTCRA are as follows:

- Has groundwater been negatively impacted by MCs as a result of historical activities at MRSs SR001 and SR002?
- Are the concentrations of MCs in residual soils below the regulatory cleanup criteria?
- Is the impacted soil characterized as RCRA hazardous?

Step 3: Identify Information Inputs

The following data and informational needs are required to achieve the goals:

- Historical site activities;
- Historic investigation results;
- Analytical results of laboratory analysis of groundwater samples for antimony, arsenic, copper, iron, lead, tin, and zinc using USEPA Method 6010C;
- Analytical results of laboratory analysis of confirmatory soil samples for copper and lead using USEPA Method 6010C; and,
- Analytical results of laboratory analysis of soil samples using the USEPA's standard TCLP extraction techniques (as detailed in 40 CFR Part 261).

Step 4: Define the Boundaries of Data Collection

Data will be collected within the boundaries of MRSs SR001 and SR002 and field efforts will be carried forward until data results indicate that specific tasks are complete.

Step 5: Develop the Analytical Approach

Sampling of soil and groundwater will be necessary to (1) confirm that MC concentrations in residual soil are below the cleanup criteria, (2) determine if MCs are present in groundwater at concentrations that pose a risk to human health, and (3) determine if the impacted soil is RCRA-hazardous. The following criteria will be used to evaluate data:

- Cleanup criteria for soil; and,
- Groundwater Quality Standards; and,
- Toxicity characteristic as defined (40 CFR Part 261).

NYSDEC values will be used to evaluate analytical data collected at the MRSs, unless the NYSDEC does not have a risked-based value for a specific constituent of concern. In such a case, the USEPA Regional Screening Level (RSL) or the USEPA Maximum Contaminant Level (MCL) will be used to evaluate soil and groundwater data, respectively.

MC Screening and/or Cleanup Criteria

Analyte	CAS Number	Soil Cleanup Criterion (mg/kg)	Groundwater Quality Standards (µg/L)
Antimony	7440-36-0	n/a	3[b]
Arsenic	7440-38-2	n/a	10[c]
Copper	7440-50-8	270[a]	200[b]
Iron	7439-89-6	n/a	300[b]
Lead	7439-92-1	400[a]	15[c]
Tin	7440-31-5	n/a	9,300[c]
Zinc	7440-66-6	n/a	66[c]

Notes:
[a] Value obtained from 6 New York Codes, Rules, and Regulations (NYCRR), Part 375: *Environmental Remediation programs*, Subpart 375-6: *Remedial Program Soil Cleanup Objectives*.
[b] Value obtained from 6 New York Codes, Rules, and Regulations (NYCRR), Part 703: *Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations*.
[c] Value obtained from USEPA National Primary Drinking Water Regulations, *List of Contaminants and their Maximum Contaminant Levels* (MCLs).
mg/kg – milligrams per kilogram
µg/L – micrograms per liter
n/a – not applicable
USEPA – United States Environmental Protection

Step 6: Performance and Acceptance Criteria

- Field and analytical performance/acceptance criteria per method as detailed in the Department of Defense (DoD) Quality Systems Manual V4.2.
- USEPA Method 6010C, 8260B, 8270C, 8082, 8081, and 8151A will provide an acceptable detection limit and accuracy for use in decisions related to attaining cleanup criteria.
- The laboratory will review and apply usability qualifiers to the analytical data.
- A Level IV data validation will be conducted by an experienced chemist in accordance with the DoD QSM or the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2004). A data validation will be conducted on 10 percent of the analytical data. Data usability will be evaluated by the appropriate agencies for final approval.

Step 7: Develop the Plan for Obtaining Data

The NTCRA sampling approach is a two-part process. For groundwater characterization, a biased sampling approach will target areas within and near each MRS most likely affected by releases of MCs. For confirmatory soil sampling within the excavation extents, a systematic approach will be used to verify that impacted soil have been removed from the MRSs.

QAPP WORKSHEET #12A: MEASUREMENT PERFORMANCE CRITERIA

Matrix: Soil - Groundwater
Analytical Group or Method: Metals – 6010
Concentration Level: Low

Data Quality Indicator	QC sample or measurement performance activity	Measurement Performance Criteria
Accuracy/ Contamination	Method blank per batch of 20 or less samples	< ½ RL
Accuracy	LCS per batch of 20 or less samples. Recovery within 80-120%	% Recovery
Precision and Accuracy	MSD per batch of 20 or less samples. RPD <20%, Recovery within 80-120%	% Recovery RPD
Precision and Accuracy	MS per batch of 20 or less samples. Recovery within 80-120%	% Recovery
Sensitivity	Beginning and end of each analytical batch. Contract required Quantification limit within 80-120%.	CRQL
Instrument Performance	CCV analyzed after every 10 samples and at the end of the analytical batch	ICV 90-100% CCV 90-110%

QAPP WORKSHEET #12B: MEASUREMENT PERFORMANCE CRITERIA

Matrix: TCLP Extract/Solid

Analytical Group or Method: Metals – 7470A/7471A/6010C

Concentration Level: Low

Data Quality Indicator	QC sample or measurement performance activity	Measurement Performance Criteria
Accuracy/ Contamination	Method blank per batch of 20 or less samples	< ½ RL
Accuracy	LCS per batch of 20 or less samples. Recovery within 80-120%	% Recovery
Precision and Accuracy	MSD per batch of 20 or less samples. RPD <20%, Recovery within 80-120%	% Recovery RPD
Precision and Accuracy	MS per batch of 20 or less samples. Recovery within 80-120%	% Recovery
Sensitivity	Beginning and end of each analytical batch. Contract required Quantification limit within 80-120%.	CRQL
Instrument Performance	CCV analyzed after every 10 samples and at the end of the analytical batch	ICAL cc >0.998-6010C, cc>0.995-Hg CCV 90-110%

QAPP WORKSHEET #12C: MEASUREMENT PERFORMANCE CRITERIA

Matrix: TCLP Extract/Solid
Analytical Group or Method: Pesticides – 8081A
Concentration Level: Low

Data Quality Indicator	QC sample or measurement performance activity	Measurement Performance Criteria
Accuracy/ Contamination	Method blank per batch of 20 or less samples	< ½ RL
Accuracy	LCS per batch of 20 or less samples	% Recovery QSM 4.2 Limits
Precision and Accuracy	MS per batch of 20 or less samples	% Recovery QSM 4.2 Limits
Precision and Accuracy	MS/MSD per batch of 20 or less samples	% Recovery QSM 4.2 Limits RPD <20%
Sensitivity	Each analytical batch	Reporting limit verification 70-130%
Instrument Performance Second source ICV CCV Second column	After ICAL Daily prior to analysis, after every 10 samples and at the end of the run. Positive results	85-115% 85-115% RPD <40%

QAPP WORKSHEET #12D: MEASUREMENT PERFORMANCE CRITERIA

Matrix: TCLP Extract/Solid
Analytical Group or Method: Herbicides – 8151A
Concentration Level: Low

Data Quality Indicator	QC sample or measurement performance activity	Measurement Performance Criteria
Accuracy/ Contamination	Method blank per batch of 20 or less samples	< ½ RL
Accuracy	LCS per batch of 20 or less samples	% Recovery QSM 4.2 Limits
Precision and Accuracy	MS per batch of 20 or less samples	% Recovery QSM 4.2 Limits
Precision and Accuracy	MS/MSD per batch of 20 or less samples	% Recovery QSM 4.2 Limits RPD <20%
Sensitivity	Beginning and end of each analytical batch	Reporting limit verification 70-130%
Instrument Performance Second source ICV CCV Second column	After ICAL Daily prior to analysis, after 10 samples and at the end of the run. Positive results	85-115% 85-115% RPD <40%

QAPP WORKSHEET #12E: MEASUREMENT PERFORMANCE CRITERIA

Matrix: TCLP Extract/Solid
Analytical Group or Method: VOCs – 5030/8260
Concentration Level: Low

Data Quality Indicator	QC sample or measurement performance activity	Measurement Performance Criteria
Accuracy/ Contamination	Method Blank per batch of 20 or less samples	< ½ RL
Accuracy	LCS per batch of 20 or less samples	% Recovery QSM 4.2Limits
Precision and Accuracy	MSD per batch of 20 or less samples	% Recovery RPD QSM 4.2 Limits
Precision and Accuracy	MS/MSD per batch of 20 or less samples	% Recovery QSM 4.2 Limits
Sensitivity	Monitored for each Sample and QC samples Reporting limit verification standard	Internal Standard Area –50%-+100% RLVS 70-130%
Instrument Performance Second Source ICV CCV	BFB solution passes method criteria After ICAL Daily prior to analysis	Tune Criteria – Method Specs. 80-120% 80-120%

QAPP WORKSHEET #12F: MEASUREMENT PERFORMANCE CRITERIA

Matrix: TCLP Extract/Solid
Analytical Group or Method: SVOCs – 8270D
Concentration Level: Low

Data Quality Indicator	QC sample or measurement performance activity	Measurement Performance Criteria
Accuracy/ Contamination	Method Blank per batch of 20 or less samples	< ½ RL
Accuracy	LCS per batch of 20 or less samples	% Recovery QSM 4.2 Limits
Precision and Accuracy	MSD per batch of 20 or less samples	% Recovery RPD QSM 4.2 Limits
Precision and Accuracy	MS/MSD per batch of 20 or less samples	% Recovery QSM 4.2 Limits
Sensitivity	Monitored for each Sample and QC samples Reporting limit verification standard	Internal Standard Area –50%-+100% RLVS 70-130%
Instrument Performance Second Source ICV CCV	DFTPP solution passes method criteria After ICAL Daily prior to analysis	Tune Criteria – Method Specs. 80-120% 80-120%

QAPP WORKSHEET #13: SECONDARY DATA USES AND LIMITATIONS

Data type	Source	Data uses relative to current project	Factors affecting the reliability of data and limitations on data use
Meteorological	National Weather Service	Estimations of seasonal fluctuations.	None
Topographic	USGS	Surface water drainage pathways.	Topography at MRSs SR001 and SR002 have been altered by construction of small arms ranges.
CSE Phase II Report	Sky, 2012	Data will be used to locate groundwater sample locations and to estimate excavation areas.	None

Notes:
CSE – Comprehensive Site Evaluation
USGS – U.S. Geological Survey
MRS – Munitions Response Site

QAPP WORKSHEET #14/16: PROJECT TASKS & SCHEDULE

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Mobilization/demobilization	AMEC and subcontractors	8/5/13	9/6/13	Field notes (included in AAR)	10/11/13
Soil boring advancement	AMEC and subcontractors	8/6/13	8/6/13	Field notes, boring logs, and cross sections (included in AAR)	10/11/13
Temporary Monitoring Well Installation	AMEC and subcontractors	8/6/13	8/8/13	Field notes, well construction diagrams (included in AAR)	10/11/13
Purging and sample collection- groundwater	AMEC and subcontractors	8/6/13	8/8/13	Field notes and field measurements (included in AAR)	10/11/13
Soil boring abandonment	AMEC and subcontractors	8/8/13	8/8/13	Field notes (included in AAR)	10/11/13
40-mm practice grenade debris pickup	AMEC	8/6/13	8/9/13	Field notes, MD certification, disposal documentation (included in AAR)	10/11/13
Sample Collection - Pre-excavation soil samples	AMEC	8/6/13	8/9/13	Field notes and analytical data (included in AAR)	10/11/13
Excavation of MC-impacted soil at SR001 and SR002	AMEC and subcontractors	8/12/13	8/30/13	Field notes (included in AAR)	10/11/13
Sample collection – incremental soil sampling	AMEC	8/21/13	8/30/13	Field notes (included in AAR)	10/11/13
Composite stockpile soil sampling	AMEC	8/12/13	8/30/13	Field notes and analytical data (included in AAR)	10/11/13
Soil transport and disposal	AMEC and subcontractors	9/2/13	9/6/13	Field notes, waste profiles, Bills of Lading, disposal documentation	10/11/13
Analyses	RTI Laboratories, Inc.	8/23/13	9/13/13	Report of analyses/Data package (included in AAR)	10/11/13
Validation	AMEC	9/16/13	9/20/13	Validation Summary (included in AAR)	10/11/13
After Action Report	AMEC	9/9/13	10/11/13	After Action Report	10/11/13

Notes:
AAR – After Action Report

QAPP WORKSHEET #15A: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS

Matrix: Soil **Analytical Group:** TAL Metals – 6010 **Concentration:** Low		**Laboratory-Specific**		**Screening Criteria[a] (mg/kg)**
Analyte	**CAS Number**	**DL (mg/kg)**	**LOQ (mg/kg)**	
Copper	7440-50-8	0.077	5	270
Lead	7439-92-1	0.243	5	400

Notes:
[a] Value obtained from 6 New York Codes, Rules, and Regulations (NYCRR), Part 375: *Environmental Remediation programs*, Subpart 375-6: *Remedial Program Soil Cleanup Objectives*.

QAPP WORKSHEET #15B: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS

Matrix: Groundwater **Analytical Group:** TAL Metals – 6020B **Concentration:** Low		Laboratory-Specific[a]		Screening Criteria (µg/L)
Analyte	**CAS Number**	**DL (µg/L)**	**LOQ (µg/L)**	
Antimony	7440-36-0	0.104	0.5	3[a]
Arsenic	7440-38-2	0.122	0.3	10[b]
Copper	7440-50-8	0.049	1	200[a]
Iron	7439-89-6	9.541	40	300[a]
Lead	7439-92-1	0.048	0.2	15[b]
Tin	7440-31-5	0.076	5	9,300[b]
Zinc	7440-66-6	0.351	10	66[a]

Notes:
[a] Value obtained from 6 New York Codes, Rules, and Regulations (NYCRR), Part 703: *Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations*.
[b] Value obtained from USEPA National Primary Drinking Water Regulations, *List of Contaminants and their Maximum Contaminant Levels* (MCLs).

QAPP WORKSHEET #15C: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS

Matrix: Soil/Groundwater **Analytical Group:** TCLP Metals – 6010/6020B/1311 **Concentration:** Low **Analyte**	**CAS Number**	**Laboratory-Specific[a]**		**Screening Criteria (mg/L)**
		DL (mg/L)	**LOQ (mg/L)**	
Arsenic	7440-38-2	0.006386	0.04	5.0
Barium	7440-39-3	0.00057	0.2	100.0
Cadmium	7440-43-9	0.000222	0.005	1.0
Chromium	7440-47-3	0.001209	0.01	5.0
Lead	7439-92-1	0.00303	0.1	5.0
Selenium	7782-49-2	0.015655	0.04	1.0
Silver	7440-22-4	0.00036	0.02	5.0

Matrix: Soil/Groundwater **Analytical Group:** TCLP Mercury – 7470/7471/1311 **Concentration:** Low **Analyte**	**CAS Number**	**Laboratory-Specific[a]**		**Screening Criteria (mg/L)**
		DL (mg/L)	**LOQ (mg/L)**	
Mercury	7439-97-6	0.000018	0.0002	0.2

QAPP WORKSHEET #15D: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS

Matrix: Soil/Groundwater **Analytical Group:** TCLP SVOCs – 8270/1311 **Concentration:** Low **Analyte**	**CAS Number**	**Laboratory-Specific[a]**		**Screening Criteria (mg/L)**
		DL (mg/L)	**LOQ (mg/L)**	
2,4,5-Trichlorophenol	95-95-4	0.00132	0.025	400.0
2,4,6-Trichlorophenol	88-06-2	0.00148	0.02	2.0
2,4-Dinitrotoluene	121-14-2	0.00126	0.025	0.13
2-Methylphenol	95-48-7	0.00095	0.025	200.0
3,4 Methylphenol	106-44-5	0.00193	0.05	400.0
Hexachlorobenzene	118-74-1	0.00126	0.005	0.13
Hexachlorobutadiene	87-68-3	0.00157	0.005	0.5
Hexachloroethane	67-72-1	0.0117	0.025	3.0
Nitrobenzene	98-95-3	0.00132	0.015	2.0
Pentachlorophenol	87-86-5	0.00818	0.025	100.0
Pyridine	110-86-1	0.00485	0.05	5.0

QAPP WORKSHEET #15E: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS

Matrix: Soil/Groundwater **Analytical Group:** TCLP VOCs – 8260/1311 **Concentration:** Low		Laboratory-Specific[a]		Screening Criteria (µg/L)
Analyte	**CAS Number**	**DL (µg/L)**	**LOQ (µg/L)**	
1,1-Dichloroethene	75-35-4	0.03860	0.2	0.7
1,2-Dichloroethane	107-06-2	0.03780	0.2	0.5
1,4-Dichlorobenzene	106-46-7	0.03680	0.2	7.5
Benzene	71-43-2	0.03900	0.2	0.5
Carbon tetrachloride	56-23-5	0.07280	0.2	0.5
Chlorobenzene	108-90-7	0.04500	0.2	100.0
Chloroform	67-66-3	0.03740	0.2	6.0
Methyl ethyl ketone	78-93-3	0.05560	2	200.0
Tetrachloroethene	127-18-4	0.05300	0.2	0.7
Trichloroethene	79-01-6	0.05380	0.2	0.5
Vinyl chloride	75-01-4	0.04840	0.2	0.2

QAPP WORKSHEET #15F: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS

Matrix: Soil/Groundwater **Analytical Group:** TCLP Pesticides – 8081/1311 **Concentration:** Low **Analyte**	**CAS Number**	**Laboratory-Specific[a]**		**Screening Criteria (µg/L)**
		DL (µg/L)	**LOQ (µg/L)**	
Chlordane, total	57-74-9	0.002	0.002	0.03
Endrin	72-20-8	0.000015	0.0001	0.02
gamma-BHC (Lindane)	58-89-9	0.000014	0.0001	0.4
Heptachlor	76-44-8	0.000018	0.0001	0.008
Heptachlor epoxide	1024-57-3	0.000013	0.0001	0.008
Methoxychlor	72-43-5	0.000025	0.0001	10.0
Toxaphene	8001-35-2	0.002	0.002	0.5

QAPP WORKSHEET #15G: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS

Matrix: Soil/Groundwater **Analytical Group:** TCLP Herbicides – 8051/1311 **Concentration:** Low **Analyte**	**CAS Number**	**Laboratory-Specific[a]**		**Screening Criteria (µg/L)**
		DL (µg/L)	**LOQ (µg/L)**	
2,4,5-TP	93-72-1	0.0015	0.01	1.0
2,4-D	94-75-7	0.0035	0.01	10.0

QAPP WORKSHEET #17: SAMPLING DESIGN AND RATIONALE

Four types of screening/sampling activities will be conducted during NTCRA activities, to include the following:

- Monitoring Well Installation and Groundwater Sampling (Phase 1): Seven monitoring wells will be installed and groundwater sampling will be conducted to determine if historical activities have impacted groundwater at each MRS. Of the seven temporary monitoring wells to be installed, four monitoring wells will be installed at SR001 and three monitoring wells will be installed at SR002.
- Waste Characterization Sampling: Discrete and composite waste characterization will be conducted to determine proper waste handling, transportation, and disposal. Waste characterization samples will be analyzed for TCLP metals, PCBs, pesticides, and herbicides by the contracted offsite analytical laboratory.
    - Discrete pre-excavation soil sampling for waste characterization analyses will be used to facilitate the direct-loading during site excavation activities (Phase 1). These samples will be collected at the 6-18 inch interval.
    - Composite soil sampling will be conducted on 6-inch surface-scraped soils and investigation-derived wastewater upon generation (Phase 2). A minimum of one sample will be collected for every 500 cubic yards of excavated soil. In addition IDW waste water will composite sampled prior to disposal. IDW waste water will be analyzed for TCLP metals.
- In-Situ XRF Soil Screening (Phase 2): Discrete field readings will be collected to help guide excavation extents and associated confirmatory sampling efforts. In-situ XRF field screening will be used to guide the extent of excavation and support decision making with regard to collecting confirmatory soil samples. In-situ XRF samples will be collected along the perimeter and floor of the proposed soil excavation. Once in-situ XRF field screening indicates the remaining lead concentrations in soil are below the action level (1/2 of the remedial action goal of 400 mg/kg), incremental sample confirmatory soil samples will be collected from the floor and sidewalls of each excavation. If XRF screening indicates lead is above the action level, additional soil will be removed in 6-inch lifts at the location where elevated lead was observed. XRF field screening and excavation will continue until lead concentrations are below the action level (200 mg/kg).
- Confirmatory Soil Sampling (Phase 2): Incremental samples collected by use of a randomized grid pattern across individual sample units to confirm excavation extents and evaluate NTCRA completeness. Samples collected and analyzed using IS methodology will be sub-sampled by the laboratory and analyzed on a sieved, pre-ground basis (grinding of samples will not occur). Incremental soil samples or discrete samples will be collected within each sampling unit, which will consist of the range floor, pre-berm area, berm area, and three sidewall areas at SR001 and the pre-berm area, berm area, and two sidewall areas at SR002. Discrete soil samples will be collected using a systematic randomized sampling method. Confirmatory soil samples will be collected and analyzed for copper and lead. The purpose of confirmatory samples is have defensible data documenting that residual soils are below the project's soil cleanup criteria.

QAPP WORKSHEET #18: SAMPLING LOCATIONS AND METHODS

Station ID	Sample ID	Matrix	Depth (inches bgs)	Type	Analyte/ Analytical Group	Sampling SOP	Comments
MRS – SR001, Small Arms Range and Shooting-In Buttress							
SR1001	SR1GW001	Groundwater	TBD	Regular	Antimony, arsenic, copper, iron, lead, tin, zinc	AMEC-02	None
SR1002	SR1GW002			Regular			
SR1003	SR1GW003			Regular			
SR1003	SR1GW004			Field Duplicate			
SR1004	SR1GW005			Regular			
SR1004	SR1GW006-MS			Matrix Spike			
SR1004	SR1GW007-MSD			Matrix Spike Duplicate			
SR1005	SR1SB001	Soil	6-18	Regular	TCLP metals, TCLP VOCs, TCLP SVOCs, PCBs, pesticides, herbicides	AMEC-01	Range Floor
SR1006	SR1SB002			Regular			
SR1007	SR1SB003			Regular			
SR1008	SR1SB004			Regular			
SR1009	SR1SB005			Regular			Safety Berm
SR1010	SR1SB006			Regular			
SR1011	SR1SB007			Regular			Pre-Berm
SR1012	SR1SB008			Regular			
SR1013	SR1SB09			Regular			Impact Berm
SR1014	SR1SB010			Regular			
SR1015	SR1SB011			Regular			
SR1017	SR1IS001		0-2	Regular - Incremental Sample	Copper and lead		Range Floor/Safety Berm
SR1018	SR1IS002			Regular - Incremental Sample			Range Floor/Safety Berm Sidewalls
SR1019	SR1IS003			Regular - Incremental Sample			Pre-Berm Area
SR1019	SR1IS004			Field Triplicate			Pre-Berm Area
SR1019	SR1IS005			Field Triplicate			Pre-Berm Area
SR1020	SR1IS006			Regular - Incremental Sample			Pre-Berm Sidewall
SR1021	SR1IS007			Regular - Incremental Sample			Impact Berm
SR1022	SR1IS008			Regular - Incremental Sample			Impact Berm Sidewalls
MRS SR002 – Firing-In Buttress							
SR2001	SR2GW001	Groundwater	TBD	Regular	Antimony, arsenic, copper, iron, lead, tin, zinc	AMEC-02	None
SR2001	SR2GW002			Field Duplicate			
SR2002	SR2GW003			Regular			

Station ID	Sample ID	Matrix	Depth (inches bgs)	Type	Analyte/ Analytical Group	Sampling SOP	Comments
SR2003	SR2GW004	Groundwater	TBD	Regular	Antimony, arsenic, copper, iron, lead, tin, zinc	AMEC-02	None
SR2003	SR2GW005-MS			Matrix Spike			
SR2003	SR2GW006-MSD			Matrix Spike Duplicate			
SR2004	SR2SB001	Soil	6-18	Regular	TCLP metals, TCLP VOCs, TCLP SVOCs, PCBs, pesticides, herbicides	AMEC-01	Pre-Berm
SR2005	SR2SB002			Regular			
SR2006	SR2SB003			Regular			Impact Berm
SR2006	SR2IS001		0-2	Regular - Incremental Sample	Copper and lead		Pre-Berm
SR2007	SR2IS002			Regular - Incremental Sample			Pre-Berm Sidewalls
SR2008	SR2IS003			Regular - Incremental Sample			Impact Berm
SR2009	SR2IS004			Regular - Incremental Sample			Impact Berm Sidewalls
IDW001	IDW001	Water	n/a	Regular	TCLP metals, VOCs, SVOCs	n/a	none
RDW001	RDW001	Soil	6-12	Regular			
RDW002	RDW002						

Notes:
*Station ID and Sample Identification numbers will follow sequentially and are subject to change during the field event.
TBD – to be determined
TCLP – Toxicity Characteristic Leaching Procedure
VOCs – volatile organic compounds
SVOCs – semivolatile organic compounds
PCBs – polychlorinated biphenyls

QAPP WORKSHEET #19 & 30: SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES

Primary Laboratory:
RTI Laboratories
Livonia, Michigan
Chino Ortiz 734-422-8000

Backup Laboratory:
Trimatrix Laboratories, Inc.
Grand Rapids, MI

Matrix	Analytical Group	Analytical and Preparation SOP Reference[1]	Container	Sample Volume	Preservation Requirements	Maximum Holding Time (Preparation/Analysis)[2]	Data Package Turnaround
Soil	Metals	3050_070212_R10_v1 6010C_110812_R0	1-4 oz. glass jar	100 g	None	180 days for 6010/6020	21 days
Water	Metals	3050_070212_R10_v1 6010C_110812_R0	1-250 ml plastic	250 ml	4°C , HNO3	180 days for 6010/6020	21 days
Soil/TCLP	TCLP	SW846 1311	2-8 oz. Glass jar	500 g	4°C	14 days VOC, SVOC, Pesticides, Herbicides 28 days Mercury 180 days Metals	14 days
	TCLP VOCs	SW846 5030 8260B	2-8 oz. Glass jar	500 g	4°C	14 days	14 days
	TCLP SVOCs	SW846 8270D, 3510B	2-8 oz. Glass jar	500 g	4°C, light protected	7 days to extraction, 40 days post extraction	14 days
	TCLP Metals	SW846 6010C, 3020A/ Mercury 7470A	2-8 oz. Glass jar	500 g	None	28 days Hg 180 days Metals	14 days
	TCLP Pesticides	SW846 8081A, 3510C	2-8 oz. Glass jar	500 g	4°C, light protected	7 days to extraction, 40 days post extraction	14 days
	TCLP Herbicides	SW846 8151A	2-8 oz. Glass jar	500 g	4°C, light protected	7 days to extraction, 40 days post extraction	14 days
	Metals - Soil	SW846 6010C, 3050B	1-4 oz. Glass jar	100 g	None	180 days	14 days

Notes:
[1] The reference analytical methods associated with these SOPs can be found in Worksheet #23
[2] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

QAPP WORKSHEET #20: FIELD QC SUMMARY

Matrix	Analyte/Analytical Group	Field Samples	Field Duplicates/Triplicates	Matrix Spikes	Matrix Spike Duplicates	Equipment Blanks	Trip Blanks	Other	Total Samples
Groundwater	Metals	7	2 (duplicate)	2	2	1	0	0	14
Soil (Incremental)	Metals	2	1 (triplicate)	0	0	1	0	0	5
Pre-Excavation Soil	TCLP metals, TCLP VOCs, TCLP SVOCs, PCBs, pesticides, herbicides	14	0	0	0	0	1	0	15
Investigation Derived Waste (water)	TCLP metals	1	0	0	0	0	0	0	1
Post-Excavation Soil	TCLP metals, TCLP VOCs, TCLP SVOCs, PCBs, pesticides, herbicides	2	0	0	0	0	1	0	3

Notes:
TCLP – Toxicity Characteristic Leaching Procedure
VOCs – volatile organic compounds
SVOCs – semivolatile organic compounds
PCBs – polychlorinated biphenyls

QAPP WORKSHEET #21: FIELD SOPS

SOP # or reference	Title, Revision, Date, and URL (if available)	Originating Organization	SOP option or Equipment Type (if SOP provides different options)	Modified for Project? Y/N	Comments
AMEC-01	Soil Sampling	AMEC	Incremental Soil Sampler	No	None
AMEC-02	Groundwater Sampling	AMEC	Variable rate peristaltic pump/tubing	No	None
AMEC-03	Sample Handling and Custody	AMEC	NA	No	None
AMEC-06	Drilling and Heavy Equipment Decontamination	AMEC	Power washer, decontamination pad	No	None
AMEC-07	Borehole Abandonment	AMEC	Grout, tremie pipe	No	None

Notes:
SOP – standard operating procedure
NA – not available

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

Field Equipment	Activity	SOP Reference	Title or position of responsible person	Frequency	Acceptance Criteria	Corrective Action
Water Quality Meter	Calibration	Manufacturer's User Guide	Field Manager	Daily, before groundwater monitoring	Most units: Verification of calibration passes if result is within +20% certified/ expected value	Troubleshoot problem(s), repeat calibration. If check fails again, obtain new unit and calibrate new unit for use. Document in field logbook.
Turbidity Meter	Calibration	Manufacturer's User Guide	Field Manager	Daily, before groundwater monitoring	Most units: Verification of calibration passes if result is within +20% certified/ expected value	Troubleshoot problem(s), repeat calibration. If check fails again, obtain new unit and calibrate new unit for use. Document in field logbook.
PID	Calibration	Manufacturer's User Guide	Field Manager	Daily, before soil disturbance activities	Reading should be +/- 20% to calibration gas concentration	Troubleshoot problem(s), repeat calibration. If check fails again, obtain new unit and calibrate new unit for use. Document in field logbook.
XRF	Calibration	Manufacturer's User Guide	Field Manager	Daily, before soil disturbance activities	Results should be within +/- 20 percent of the true value for the standard reference material or within the acceptance range supplied by the manufacturer.	Troubleshoot problem(s), repeat calibration. If check fails again, obtain new unit and calibrate new unit for use. Document in field logbook.
Dust Trak	Zero Calibration	Manufacturer's User Guide	Field Manager	Daily, before soil disturbance activities	Must attach a Zero Filter. Instrument should read a zero measurement.	Troubleshoot problem(s), repeat calibration. If check fails again, obtain new unit and calibrate new unit for use. Document in field logbook.

QAPP WORKSHEET #23: ANALYTICAL SOPS

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
3050_070212_R10_v1 6020_032112_R9_1_v2	Metals Extraction/Analysis 7/02/2012	Definitive	Soil and Groundwater Metals	ICP/MS	RTI	N
8260B_110810_R7	ANALYSIS OF VOLATILE ORGANIC COMPOUNDS by GCMS Revision, 11/8/10	Definitive	TCLP Extract – Volatile Organic Compounds	GC/MS	RTI	N
8270D_072312_R12	ANALYSIS OF SEMI-VOLATILE ORGANIC COMPOUNDS GCMS Revision 12, 7/23/12	Definitive	TCLP Extract – Semi-Volatile Organic Compounds	GC/MS	RTI	N
1311_072212_R5 1311ZHE_052708_R3	Toxicity Characteristic Leaching Procedure Revision 5, 7/22/12 Revision 3, 5/27/08	Definitive	Solid - TCLP		RTI	N
8081_8082_072312_R9	ANALYSIS OF PESTICIDES Revision 9, 07/23/12	Definitive	TCLP Extract – Chlorinated Pesticides	GC/ECD	RTI	N
8151_072012_R6	ANALYSIS OF CHLORINATED HERBIDIDES Revision 6, 7/20/12	Definitive	TCLP Extract – Chlorinated Herbicides	GC/ECD	RTI	N
6010C_042213_R2	ANALYSIS OF ELEMENTS BY INDUCTIVELY COUPLED PLASMA-OPTICAL EMISSIONS SPECTROMETRY Revision 2, 04/22/13	Definitive	Soil/TCLP Extract – Metals Water – Hardness	ICP-OES	RTI	N
6020_032112_R9_R8	ANALYSIS OF ELEMENTS BY INDUCTIVELY COUPLED PLASMA-MASS SPECTROMETRY Revision 9, 03/21/12	Definitive	Water – Metals	ICP/MS	RTI	N
7470A_7471A_092310_R6	ANALYSIS FOR MERCURY Revision 6, 09/23/10	Definitive	TCLP Extract – Metals	CVAA	RTI	N

Notes:
* Analytical performance/acceptance criteria developed in accordance with DoD Quality Systems Manual (QSM) V4.2.

QAPP WORKSHEET #24: ANALYTICAL INSTRUMENT CALIBRATION

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
Agilent 5890/5972 P&T GCMS (3)	SW846 5030/8260B	As needed – on unacceptable CCV	<15% RSD, <30%RSD CCC compounds. cc>0.99	Instrument maintenance as required	GCMS Analyst	8260B_110810_R7
Agilent 6890/5972 GCMS (2), Agilent 5890/5972 GC/MS	SW846 8270D	As needed – on unacceptable CCV	<20% RSD. cc>0.99	Instrument maintenance as required	GCMS Analyst	8270D_072312_R12
Varian 3400 w/ dual ECD, HP5890 GC, HP6890 GC, HP 6890N GC	SW846 8081A	As needed – on unacceptable CCV	cc>0.99	Instrument maintenance as required	GC Analyst	8081_8082_072312_R9
Agilent 5890 GC dual ECD	SW846 8151A	As needed – on unacceptable CCV	cc>0.99	Instrument maintenance as required	GC Analyst	8151_072012_R6
Perkin-Elmer ICP-OES Optima 8300 DV	SW846 6010C	Daily or each analytical event	cc>0.998	Instrument maintenance as required	ICP-OES Analyst	6010C_042213_R2
Perkin-Elmer/Cetac ICP 9000, MS DRCe, ASX-520	SW846 6020A	Daily or each analytical event	cc>0.995	Instrument maintenance as required	ICPMS Analyst	6020_032112_R9
Cetac M-6100 w/ ASX-260 Auto Sampler	SW846 7470A	Daily or each analytical event	cc>0.995	Instrument maintenance as required	Hg Analyst	7470A_7471B_092310_R6

Notes:
* Analytical performance/acceptance criteria developed in accordance with DoD Quality Systems Manual (QSM) V4.2.

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

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GCMS	Daily/Regular as specified	SW846 5030/8260B	Instrument operating parameters	Daily	Per SOP	Recalibrate/stop for service on failure	RTI/GCMSVOC Analyst	8260B_110810_R7
GCMS	Daily/Regular as specified	SW846 8270D	Instrument operating parameters	Daily	Per SOP	Recalibrate/stop for service on failure	RTI/GCMSSVOC Analyst	8270D_072312_R12
GC ECD	Daily/Regular as specified	SW846 8081A	Instrument operating parameters	Daily	Per SOP	Recalibrate/stop for service on failure	RTI/GCSVOC Analyst	8081_8082_072312_R9
GC ECD	Daily/Regular as specified	SW846 8151A	Instrument operating parameters	Daily	Per SOP	Recalibrate/stop for service on failure	RTI/GCHPLC Analyst	8151_072012_R6
ICP-OES	Daily/Regular as specified	SW846 6010C	Instrument operating parameters	Daily	Per SOP	Recalibrate/stop for service on failure	RTI/ICP-OES Analyst	6010C_042213_R2
ICP/MS	Daily/Regular as specified	SW846 6020A	Instrument operating parameters	Daily	Per SOP	Recalibrate/stop for service on failure	RTI/ICP/MS Analyst	6020_032112_R9
Cetac M-6000a Cetac M6100 w/ASX-260 Auto Sampler	Daily/Regular as specified	SW846 7470A	Instrument operating parameters	Daily	Per SOP	Recalibrate/stop for service on failure	RTI/ Cetac M-6000a Analyst RTI/Cetac M6100 Analyst	7470A_7471B_092310_R6

Notes:
* Analytical performance/acceptance criteria developed in accordance with DoD Quality Systems Manual (QSM) V4.2.

QAPP WORKSHEET #26 & 27: SAMPLE HANDLING, CUSTODY, AND DISPOSAL

Sampling Organization: AMEC Environment & Infrastructure
Laboratory: RTI Laboratories, Inc.
Method of sample delivery (shipper/carrier): Overnight Carrier (FedEx)

Activity	Organization and title or position of person responsible for the activity	SOP reference
Sample labeling	AMEC – Field Manager	AMEC-03
Chain-of-custody form completion	AMEC – Field Manager	AMEC-03
Packaging	AMEC – Field Manager	AMEC-03
Shipping coordination	AMEC – Field Manager	AMEC-03
Sample receipt, inspection, & log-in	RTI Laboratories – Sample Receipt Supervisor	SOP SRC001-A_R5, September 20, 2010
Sample custody and storage	RTI Laboratories – Sample Receipt Supervisor	RTI Laboratory Quality Assurance Plan, June 18, 2012, Revision 12/ SOP SRC001-A_R5, September 20, 2010
Sample disposal	RTI Laboratories – Health and Safety Manager	SOP SRC001-A_R5, September 20, 2010

QAPP WORKSHEET #28A: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION

Matrix: Soil/TCLP Extract
Analytical Group: Metals
Analytical Method: SW6010

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per batch of 20 or less samples	< ½ LOQ	Correct problem, refer to criteria in DoD QSM 4.2, Box D-1. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Lab Analyst/Data Reviewer	Contamination (Accuracy/Bias)	< ½ LOQ
Laboratory Control Spike (LCS)	One per batch of 20 or less samples	80 – 120%	Correct problem, Re-prepare and re-analyze affected samples	Lab Analyst/Data Reviewer	Accuracy	80 – 120%
Matrix Spike (MS)	5% - 1 per batch of 20 or less samples	80 – 120%	Flag data Investigate, consult with client and record matrix issues in case narrative	Data Reviewer	Accuracy	80 – 120%
Matrix Spike Duplicate (MSD)	5% - 1 per batch of 20 or less samples	80 – 120%, RPD <20%	Investigate and record in case narrative	Data Reviewer	Precision and Accuracy	80 – 120%, RPD <20%
Initial Calibration (ICAL)	Daily or on each use	cc >0.995	Correct problem and repeat ICAL	Lab Analyst	Instrument Performance	cc >0.995
Initial Calibration Verification (ICV)	Daily immediately following calibration	90 – 110%	Repeat calibration	Lab Analyst	Instrument Performance	90 – 110%
Continuing Calibration Verification (CCV)	After ICSAB and every 10 samples	90 – 110% of True Value	Repeat CCV and all samples preceding a CCV failure – recalibrate if problem persists	Lab Analyst	Instrument Performance	90 – 110%
ICB	After ICV	<LOD	Stop, repeat – determine cause and correct	Lab Analyst	Contamination (Accuracy/Bias)	<LOD

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
ICSA/ICSAB	After ICB	Non interfering analytes <LOD in ICSA, +/-20% of expected in ICSAB	Stop, repeat – determine cause and correct	Lab Analyst	Accuracy Sensitivity	Non interfering analytes <LOD in ICSA, +/-20% of expected in ICSAB
CCB	After CCV and every 10 samples	<LOD	Stop, repeat – determine cause and correct	Lab Analyst	Contamination (Accuracy/Bias)	<LOD
Serial Dilution/Post Digestion spike	1 per batch of 20 or less samples	RPD <20% % Rec. 80-120%	Investigate and repeat as necessary	Lab Analyst	Bias	RPD <20% % Rec. 80-120%
CRQL	After CCB and at the end of the sample set	80 – 120 %	Investigate, determine cause and correct. Repeat samples analyzed prior to unacceptable CRQL	Lab Analyst	Sensitivity	80 - 120%

Notes:
LOQ = Limit of Quantification
LOD = Limit of Detection
RPD = Relative Percent Difference
MS = Matrix Spike
MSD = Matrix Spike Duplicate
QSM = Quality Services Manual
LCS = Laboratory Control Spike
CRQL =Contract Required Quantification Limit

QAPP WORKSHEET #28B: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION

Matrix: TCLP Extract
Analytical Group: Metals
Analytical Method: SW7470A

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per batch of 20 or less samples	< ½ LOQ	Correct problem, refer to criteria in DoD QSM 4.2, Box D-1. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Lab Analyst/Data Reviewer	Contamination (Accuracy/Bias)	< ½ LOQ
Laboratory Control Spike (LCS)	One per batch of 20 or less samples	80 – 120%	Correct problem, Re-prepare and re-analyze affected samples	Lab Analyst/Data Reviewer	Accuracy	80 – 120%
Matrix Spike (MS)	One per batch of 20 or less samples	80 – 120%	Investigate, consult with client and record matrix issues in case narrative	Data Reviewer	Accuracy	80 – 120%
Matrix Spike Duplicate (MSD)	One per batch of 20 or less samples	80 – 120%, RPD <20%	Investigate and record in case narrative	Data Reviewer	Precision and Accuracy	80 – 120%, RPD <20%
Serial Dilution/Post Digestion spike	1 per batch of 20 or less samples	RPD <20% % Rec. 80-120%	Investigate and repeat as necessary	Lab Analyst	Bias	RPD <20% % Rec. 80-120%
Initial Calibration (ICAL)	Daily or on each use	cc >0.995	Correct problem and repeat ICAL	Lab Analyst	Instrument Performance	cc >0.995

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Initial Calibration Verification (ICV)	Once after each ICAL	90 – 110%	Correct problem, verify second source standard and rerun. If necessary repeat ICAL	Lab Analyst	Instrument Performance	90 – 110%
ICB	After ICV	<LOD	Stop, repeat – determine cause and correct	Lab Analyst	Contamination (Accuracy/Bias)	<LOD
Continuing Calibration Verification (CCV)	Daily before sample analysis and every 10 samples and at end of analytical sequence	90 – 110%	Correct problem and rerun. If necessary repeat ICAL	Lab Analyst	Instrument Performance	90 – 110%
CCB	After CCV and every 10 samples	<LOD	Stop, repeat – determine cause and correct	Lab Analyst	Contamination (Accuracy/Bias)	<LOD
CRQL	Beginning and end of each analytical event	80 – 120 %	Correct problem and re-analyzed samples	Lab Analyst	Sensitivity	80 - 120%

Notes:
LOQ = Limit of Quantification
LOD = Limit of Detection
RPD = Relative Percent Difference
MS = Matrix Spike
MSD = Matrix Spike Duplicate
QSM = Quality Services Manual
LCS = Laboratory Control Spike
CRQL =Contract Required Quantification Limit

QAPP WORKSHEET #28C: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION

Matrix: TCLP Extract
Analytical Group: Pesticides
Analytical Method: SW8081

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per batch of 20 or less samples	< ½ LOQ	Correct problem, refer to criteria in DoD QSM 4.2, Box D-1. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Lab Analyst/Data Reviewer	Contamination (Accuracy/Bias)	< ½ LOQ
Laboratory Control Spike (LCS)	One per batch of 20 or less samples	% Recovery QSM 4.2 Limits	Correct problem, Re-prepare and re-analyze affected samples	Lab Analyst/Data Reviewer	Accuracy	% Recovery QSM 4.2 Limits
Matrix Spike (MS)	One per batch of 20 or less samples	% Recovery QSM 4.2 Limits	Investigate, consult with client and record matrix issues in case narrative	Data Reviewer	Accuracy	% Recovery QSM 4.2 Limits
Matrix Spike Duplicate (MSD)	One per batch of 20 or less samples	RPD QSM 4.2 Limits	Investigate and record in case narrative	Data Reviewer	Precision and Accuracy	RPD QSM 4.2 Limits
Initial Calibration (ICAL)	As needed on unacceptable ICV/CCV	RSD<20% Linear cc>0.995, Quadratic cc>0.99 Consistent with QSM 4.2 Table F-2	Correct problem and repeat ICAL	Lab Analyst	Instrument Performance	RSD<20% Linear cc>0.995, Quadratic cc>0.99 Consistent with QSM 4.2 Table F-2

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Initial Calibration Verification (ICV)	Once after each ICAL	±20% Consistent with QSM 4.2 Table F-2	Correct problem, verify second source standard and rerun. If necessary repeat ICAL	Lab Analyst	Instrument Performance	±20% Consistent with QSM 4.2 Table F-2
Continuing Calibration Verification (CCV)	Daily before sample analysis and every 12 hours of analysis	±20% Consistent with QSM 4.2 Table F-2	Correct problem and rerun. If necessary repeat ICAL	Lab Analyst	Instrument Performance	±20% Consistent with QSM 4.2 Table F-2
PEM	Daily before sample analysis and every 12 hours of analysis	<15% of the total degradation for DDT or Endrin	Perform injection port maintenance	Lab Analyst	Instrument Performance	<15% of the total degradation for DDT or Endrin
CRQL	Each analytical event	80 – 120%	Correct problem and rerun. If necessary repeat ICAL	Lab Analyst	Sensitivity	80 – 120%

Notes:
LOQ = Limit of Quantification
RPD = Relative Percent Difference
MS = Matrix Spike
MSD = Matrix Spike Duplicate
QSM = Quality Services Manual
LCS = Laboratory Control Spike
RLVS=Reporting Limit Verification Standard

QAPP WORKSHEET #28D: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION

Matrix: TCLP Extract
Analytical Group: Herbicides
Analytical Method: SW8151A

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per batch of 20 or less samples	< ½ LOQ	Correct problem, refer to criteria in DoD QSM 4.2, Box D-1. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Lab Analyst/Data Reviewer	Contamination (Accuracy/Bias)	< ½ LOQ
Laboratory Control Spike (LCS)	One per batch of 20 or less samples	% Recovery QSM 4.2 Limits	Correct problem, Re-prepare and re-analyze affected samples	Lab Analyst/Data Reviewer	Accuracy	% Recovery QSM 4.2 Limits
Matrix Spike (MS)	One per batch of 20 or less samples	% Recovery QSM 4.2 Limits	Investigate, consult with client and record matrix issues in case narrative	Data Reviewer	Accuracy	% Recovery QSM 4.2 Limits
Matrix Spike Duplicate (MSD)	One per batch of 20 or less samples	RPD QSM 4.2 Limits	Investigate and record in case narrative	Data Reviewer	Precision and Accuracy	RPD QSM 4.2 Limits
Initial Calibration (ICAL)	As needed on unacceptable ICV/CCV	RSD<20% cc>0.995 Consistent with QSM 4.2 Table F-2	Correct problem and repeat ICAL	Lab Analyst	Instrument Performance	RSD<20% cc>0.995 Consistent with QSM 4.2 Table F-2

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Initial Calibration Verification (ICV)	Once after each ICAL	±20% Consistent with QSM 4.2 Table F-2	Correct problem, verify second source standard and rerun. If necessary repeat ICAL	Lab Analyst	Instrument Performance	±20% Consistent with QSM 4.2 Table F-2
Continuing Calibration Verification (CCV)	Daily before sample analysis and every 12 hours of analysis	±20% Consistent with QSM 4.2 Table F-2	Correct problem and rerun. If necessary repeat ICAL	Lab Analyst	Instrument Performance	±20% Consistent with QSM 4.2 Table F-2
RLVS	Each analytical event	70 – 130%	Correct problem and re-analyzed samples	Lab Analyst	Sensitivity	70 – 130%

Notes:
LOQ = Limit of Quantification
RPD = Relative Percent Difference
MS = Matrix Spike
MSD = Matrix Spike Duplicate
QSM = Quality Services Manual
LCS = Laboratory Control Spike
RLVS=Reporting Limit Verification Standard

QAPP WORKSHEET #28E: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION

Matrix: TCLP Extract
Analytical Group: VOCs
Analytical Method: SW8260

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Trip Blank	One per shipping cooler	< ½ LOQ	Data reviewer/validator will consider	Data Reviewer	Contamination (Accuracy/Bias)	< ½LOQ
Method Blank	One per batch of 20 or less samples	< ½ LOQ	Correct problem, refer to criteria in DoD QSM 4.2, Box D-1. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Lab Analyst/Data Reviewer	Contamination (Accuracy/Bias)	< ½ LOQ
Laboratory Control Spike (LCS)	One per batch of 20 or less samples	% Recovery QSM 4.2 Limits	Correct problem, Re-prepare and re-analyze affected samples	Lab Analyst/Data Reviewer	Accuracy	% Recovery QSM 4.2 Limits
Matrix Spike (MS)	One per batch of 20 or less samples	% Recovery QSM 4.2 Limits	Investigate, consult with client and record matrix issues in case narrative	Data Reviewer	Accuracy	% Recovery QSM 4.2 Limits
Matrix Spike Duplicate (MSD)	One per batch of 20 or less samples	RPD QSM 4.2 Limits	Investigate and record in case narrative	Data Reviewer	Precision and Accuracy	RPD QSM 4.2 Limits
Initial Calibration (ICAL)	As needed on unacceptable ICV/CCV	Consistent with QSM 4.2 Table F-4	Correct problem and repeat ICAL	Lab Analyst	Instrument Performance	Consistent with QSM 4.2 Table F-4

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Initial Calibration Verification (ICV)	Once after each ICAL	Consistent with QSM 4.2 Table F-4	Correct problem, verify second source standard and rerun. If necessary repeat ICAL	Lab Analyst	Instrument Performance	Consistent with QSM 4.2 Table F-4
Continuing Calibration Verification (CCV)	Daily before sample analysis and every 12 hours of analysis	Consistent with QSM 4.2 Table F-4	Correct problem and rerun. If necessary repeat ICAL	Lab Analyst	Instrument Performance	Consistent with QSM 4.2 Table F-4
Internal Standards	Each Sample and QC Sample	Area -50% - +100%	Re-analyze to confirm matrix interferences and note on Case Narrative	Lab Analyst	Sensitivity	Area -50% - +100%
RLVS	Each analytical event	70 – 130%	Correct problem and re-analyzed samples	Lab Analyst	Sensitivity	70 – 130%

Notes:
LOQ = Limit of Quantification
RPD = Relative Percent Difference
MS = Matrix Spike
MSD = Matrix Spike Duplicate
QSM = Quality Services Manual
LCS = Laboratory Control Spike
RLVS=Reporting Limit Verification Standard

QAPP WORKSHEET #28F: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION

Matrix: TCLP Extract
Analytical Group: SVOCs
Analytical Method: SW8270

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per batch of 20 or less samples	< ½ LOQ	Correct problem, refer to see criteria in DoD QSM 4.2, Box D-1. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Lab Analyst/Data Reviewer	Contamination (Accuracy/Bias)	< ½ LOQ
Laboratory Control Spike (LCS)	One per batch of 20 or less samples	% Recovery QSM 4.2 Limits	Correct problem, Re-prepare and re-analyze affected samples	Lab Analyst/Data Reviewer	Accuracy	% Recovery QSM 4.2 Limits
Matrix Spike (MS)	One per batch of 20 or less samples	% Recovery QSM 4.2 Limits	Investigate, consult with client and record matrix issues in case narrative	Data Reviewer	Accuracy	% Recovery QSM 4.2 Limits
Matrix Spike Duplicate (MSD)	One per batch of 20 or less samples	RPD QSM 4.2 Limits	Investigate and record in case narrative	Data Reviewer	Precision and Accuracy	RPD QSM 4.2 Limits
Initial Calibration (ICAL)	As needed on unacceptable ICV/CCV	Consistent with QSM 4.2 Table F-4	Correct problem and repeat ICAL	Lab Analyst	Instrument Performance	Consistent with QSM 4.2 Table F-4

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Initial Calibration Verification (ICV)	Once after each ICAL	Consistent with QSM 4.2 Table F-4	Correct problem, verify second source standard and rerun. If necessary repeat ICAL	Lab Analyst	Instrument Performance	Consistent with QSM 4.2 Table F-4
Continuing Calibration Verification (CCV)	Daily before sample analysis and every 12 hours of analysis	Consistent with QSM 4.2 Table F-4	Correct problem and rerun. If necessary repeat ICAL	Lab Analyst	Instrument Performance	Consistent with QSM 4.2 Table F-4
Internal Standards	Each Sample and QC Sample	Area -50% - +100%	Re-analyze to confirm matrix interferences and note on Case Narrative	Lab Analyst	Sensitivity	Area -50% - +100%
RLVS	Beginning and end of each analytical event	70 – 130%	Correct problem and re-analyzed samples	Lab Analyst	Sensitivity	70 – 130%

Notes:
LOQ = Limit of Quantification
RPD = Relative Percent Difference
MS = Matrix Spike
MSD = Matrix Spike Duplicate
QSM = Quality Services Manual
LCS = Laboratory Control Spike
RLVS =Reporting Limit Verification Standard

QAPP WORKSHEET #29: PROJECT DOCUMENTS AND RECORDS

Sample Collection and Field Records			
Record	**Generation**	**Verification**	**Storage location/archival**
Field logbook(s)	AMEC Field Manager	AMEC Project Manager	Project File
Chain-of-Custody Forms			
Sample labels			
Contractor Daily QC Reports			
Deviations			
Corrective Action Reports			
Correspondence			
Sample location coordinates			
Shipping Records			

Project Assessments			
Record	**Generation**	**Verification**	**Storage location/archival**
Field audit checklists	AMEC QC Manager	AMEC Project Manager	Project File
Data verification checklists	AMEC QC Manager		
Data validation report	AMEC Chemist		
Data usability assessment report	AMEC Chemist		

Laboratory Records			
Record	**Generation**	**Verification**	**Storage location/archival**
Sample Receipt	RTI Laboratories	AMEC Project Manager	Project File
Data Analysis Report	RTI Laboratories		

QAPP WORKSHEET #31, 32 & 33: ASSESSMENTS AND CORRECTIVE ACTION

Assessments:

Assessment Type	Responsible Party & Organization	Number/Frequency	Estimated Dates	Assessment Deliverable	Deliverable due date
Quality Control Audit	AMEC	Once	TBD	Audit Report	TBD

Assessment Response and Corrective Action:

Assessment Type	Responsibility for Responding to Assessment Findings	Assessment Response Documentation	Timeframe for Response	Responsibility for Implementing Corrective Action	Responsible for Monitoring Corrective Action Implementation
Operational Readiness Review	AMEC Project Manager	Checklist or logbook entry	Immediately to within 24 hours of review	AMEC Project Manager	AMEC QC Manager
Field Observations/ Deviations from Technical Management Plan	AMEC Project Manager	Logbook or Field Change Request	Immediately to within 24 hours of deviation	AMEC Field Manager and Technical Manager	AMEC QC Manager
Laboratory Technical Systems/ Performance Audits	AMEC Project Manager and RTI Project Manager	Corrective Action Report	ASAP after identification	RTI Project Manager	AMEC QC Manager

QAPP WORKSHEET #34: DATA VERIFICATION AND VALIDATION INPUTS

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved QAPP	**X**	**X**
2	Contract	**X**	
4	Field SOPs	**X**	
5	Laboratory SOPs	**X**	
Field Records			
6	Field logbooks	**X**	**X**
7	Equipment calibration records	**X**	**X**
8	Chain-of-Custody Forms	**X**	**X**
9	Sampling diagrams/surveys	**X**	**X**
10	Drilling logs	**X**	**X**
11	Geophysics reports	**X**	**X**
12	Relevant Correspondence	**X**	**X**
13	Change orders/deviations	**X**	**X**
14	Field audit reports	**X**	**X**
15	Field corrective action reports	**X**	**X**
Analytical Data Package			
16	Cover sheet (laboratory identifying information)	**X**	**X**
17	Case narrative	**X**	**X**
18	Internal laboratory chain-of-custody	**X**	**X**
19	Sample receipt records	**X**	**X**
20	Sample chronology (i.e. dates and times of receipt, preparation, & analysis)	**X**	**X**
21	Communication records	**X**	**X**
22	Project-specific PT sample results	**X**	**X**
23	LOD/LOQ establishment and verification	**X**	**X**
24	Standards Traceability	**X**	**X**
25	Instrument calibration records	**X**	**X**
26	Definition of laboratory qualifiers	**X**	**X**
27	Results reporting forms	**X**	**X**
28	QC sample results	**X**	**X**
29	Corrective action reports	**X**	**X**
30	Raw data	**X**	**X**
31	Electronic data deliverable	**X**	**X**

QAPP WORKSHEET #35: DATA VERIFICATION PROCEDURES

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Field logbooks	Field notes will be reviewed periodically to determine completeness, appropriateness, ease of understanding, etc., of information recorded. Upon completion of field work, logbooks will be placed in the project files.	Internal	AMEC Project Manager or designee
Chain-of-custody forms	Chain-of-custody forms will be reviewed against the samples packed in the specific cooler prior to shipment. Original chain-of-custody forms will be sent with the samples to the laboratory, while a copy is retained for the project files.	Internal	AMEC Project Manager or designee
Sample receipt and log-ins	Sample receipt and log-in summaries will be reviewed to determine potential receipt issues that may impact data quality and for consistency with the chain-of-custody forms.	Internal	AMEC or RTI Project Manager (or designee)
Laboratory analytical data package prior to release	Data packages will be reviewed/verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	External	RTI
Laboratory analytical data package	Data packages will be reviewed by AMEC. The data will undergo a Level IV validation protocol.	Internal	AMEC Project Manager or designee
Data validation report	Data validation reports will be reviewed by the AMEC Project Manager and Technical Manager.	Internal	AMEC Project Manager or designee
Electronic data	Electronic laboratory data and field data will be reviewed for consistency with the hardcopy information.	Internal	AMEC Project Manager or designee
Data validation report	The validated analytical results will be compiled in a tabulated summary. Entries will be reviewed/verified against hardcopy information.	Internal	AMEC Project Manager or designee

QAPP WORKSHEET #36: DATA VALIDATION PROCEDURES

Analytical Group/Method:	Metals by 6010C
Data deliverable requirements:	Level IV data package and ERPIMS deliverable
Analytical specifications:	3050_070212_R10_v1 6010C_110812_R0 and 3050_070212_R10_v1 6010C_110812_R0
Measurement performance criteria:	WS 12
Percent of data packages to be validated:	100%
Percent of raw data reviewed:	100%
Percent of results to be recalculated:	10%
Validation procedure:	NFG for Inorganic Superfund Data Review
Validation code (*see attached table):	S3VM (90%) S4VM (10%)
Electronic validation program/version:	NA

Validation Code	Validation Label	Description/Reference
S3VM	Stage 3 Validation Manual	EPA 540-R-08-005
S4VM	Stage 4 Validation Manual	EPA 540-R-08-005
NV	Not Validated	EPA 540-R-08-005

AMEC chemists will perform validation on the data associated with this QAPP. Data will be validated 90% S3VM and 10% S4VM. Data validation will be performed in accordance with the DoD Quality System Manual, and patterned after the USEPA CLP National Functional Guidelines (NFGs) for Inorganic Superfund Data Review (USEPA, 2010), and QC criteria specified in this document.

S3VM and S4VM data validation follows the EPA protocols and CLP criteria as set forth in the functional guidelines for evaluating inorganic (USEPA, 2010) analyses. These guidelines apply to full data packages that include raw data (e.g., instrument spectra and chromatograms), backup documentation for calibration standards, analysis run logs, and dilution factors). Calculations are checked for QC samples and routine field samples (including field duplicates, field blanks, and equipment blanks). For data that undergoes S4VM validation, quantified analytical data calculations are also checked. To assure that detection limits and data values are appropriate, an instrument performance, method of calibration, and calibration standards are evaluated.

Analytical data may be qualified based on data validation reviews. Qualifiers will be consistent with the applicable USEPA NFG, and will be used to provide data users with an estimate of the level of uncertainty associated with the qualified result.

Data validation results will be evaluated with respect to the attached qualifiers to determine data usability issues, if any. The following qualifiers may be assigned during the validation process.

J – estimated concentration
N – presumed identity
U – not detected (e.g., not present based on blank contamination)
UJ – sample detection limit is estimated.

Data validation will be patterned after CLP NFG. The objectives, evaluations, and actions employed during the data validation process will follow those outlined in the NFG. Differences between NFG and project validation procedures will include review items and data validation criteria. The laboratory will be permitted to provide CLP-like forms in lieu of true CLP forms. The data validation criteria will not adhere to NFG but will be based on method criteria for preservation, holding times, instrument tuning, calibration, instrument performance checks, internal standard responses, serial dilutions, and target compound identification; laboratory-specified criteria for surrogate, laboratory control samples, laboratory duplicates, and matrix spikes; and the validator's professional judgment.

QAPP WORKSHEET #37: DATA USABILITY ASSESSMENT

The quality and usability of data obtained during the project will be determined by examining and inspecting various site/field logbooks, laboratory data packages, and data validation reports; and verifying that the sampling procedures and analytical results were obtained following the applicable protocols and satisfy project requirements, and can be relied upon for performing the determining the attainment of project quality objectives. The data assessment will determine possible effects on the data that result from project requirement failures (i.e., data quality), and their actual adequacy to fulfill the site-specific Quality Assurance (QA)/QC requirements (i.e., data usability).

Efforts to evaluate and verify attainment of project requirements will enable data users to understand any usability limitations associated with project data. Procedures used to assess QA/QC objectives will be in accordance with the appropriate analytical methods, which were originally selected based on ability to meet project goals.

The data quality/usability and reconciliation evaluations will be performed by personnel with the appropriate training and/or experience to perform these reviews/evaluations. Evaluations will be performed by personnel with the appropriate training and/or experience to perform these evaluations. The results of the data quality/usability evaluation and project goal reconciliation will be presented in the AAR.

Precision

Results of all laboratory duplicates will be presented separately in tabular format for each analysis. For each duplicate pair, the relative percent difference (RPD) will be calculated for each analyte whose original and duplicate values are either greater than or equal to the quantitation limit. The RPDs will be checked against the measurement performance criteria presented on Worksheet #12. The RPDs exceeding criteria will be identified on the tables. Additionally, the RPD of each analyte will be averaged across all duplicate pairs whose original and duplicate values are both greater than or equal to the quantitation limit, and the combined overall average RPD for each analysis will be calculated for the laboratory duplicates. For each triplicate IS sample, the % Relative Standard Deviation will be calculated for each analyte and will be checked against the measurement performance criteria presented on Worksheet #12 (<20%). A discussion will follow summarizing the results of the laboratory precision. Any conclusions about the precision of the analyses will be drawn and any limitations on the use of the data will be described.

Accuracy/Bias

Results for all laboratory method blanks and instrument blanks will be presented separately in tabular format for each analysis. The results for each analyte will be checked against the measurement performance criteria presented on Worksheet #12. Results for analytes that exceed criteria will be identified on the tables. A discussion will follow summarizing the results of the laboratory accuracy/bias. Any conclusions about the accuracy/bias of the analyses based on contamination will be drawn and any limitations on the use of the data will be described.

Completeness

Completeness is defined as the percentage of laboratory measurements judged to be valid on a method-by-method basis. In addition to valid results (data not rejected), broken and/or spilled samples, and any other problems that may compromise sample representativeness are included in the assessment of completeness. Valid data are defined as all data and/or qualified data considered to meet the DQOs for this project. Data completeness is expressed as percent complete and should be ≥ 90 percent. The goal for meeting analytical holding times is 100 percent. At the end of each sampling event, the completeness of the data will be assessed. If any data omissions are apparent, the parameter in question will be resampled and/or reanalyzed, if feasible. Laboratory results will be monitored as they become available to assess laboratory performance and its effect on data completeness requirements.

Comparability

Comparability expresses the confidence with which data from one sample, sampling round, site, laboratory, or project can be compared to those from another. Comparability during sampling is dependent upon sampling program design and time periods. Comparability during analysis is dependent upon analytical methods, detection limits, laboratories, units of measure, and sample preparation procedures. Comparability is determined on a qualitative rather than quantitative basis. For this project, comparability of all data collected will be ensured by adherence to standard sample collection procedures, standard field measurement procedures, and standard reporting methods, including consistent units. For example, concentrations will be reported in a manner consistent with general industry practice (e.g., soil data will be reported on a dry-weight basis). In addition, to support the comparability of fixed-base laboratory analytical results with those obtained from previous or future testing, all samples will be analyzed by USEPA-approved methods, where available. The USEPA-recommended maximum permissible sample holding times (Worksheet #19) for organic and inorganic parameters will not be exceeded. All analytical standards will be traceable to standard reference materials. Instrument calibrations will be performed in accordance with USEPA method specifications, and will be checked at the frequency specified for the methods. The results of these analyses can then be compared to analyses by other laboratories and/or to analyses for other sites addressed by this investigation.

Representativeness

Representativeness expresses the extent to which collected data define site contamination. Where appropriate, sample results will be statistically characterized to determine the degree to which the data accurately and precisely represent a characteristic of a population, parameter variation at a sampling point, a process, or an environmental condition. Sample collection, handling, preservation, and analytical procedures are designed to obtain the most representative sample possible. Representative samples will be achieved by the following:

- Collection of samples from locations representing site conditions;
- Use of appropriate sample preservation techniques;
- Use of appropriate sampling procedures, including proper equipment;
- Use of appropriate analytical methods for the required parameters and PQLs; and,

- Analysis of samples within the required holding times.

Sample representativeness is also affected by the portion of each sample chosen for analysis. The laboratory will adequately homogenize all samples prior to taking aliquots for analysis to ensure that the reported results are representative of the sample received.

Sensitivity

The concentration of any one target compound that can be detected and/or quantified is a measure of sensitivity for that compound. Sensitivity is instrument-, compound-, method-, and matrix-specific. The subcontract laboratory will flag (as an estimate, "J" flag) and report target compounds detected below the reporting limit down to the MDL in an effort to meet applicable project decision-making criteria. Raw data collected in the field will be verified and included in the final report. Data verification and validation procedures employed during this project will ensure data collected meet project DQOs and assure a reasonable basis for decision making.

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ATTACHMENT A

STANDARD OPERATING PROCEDURES

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SOIL SAMPLING
AMEC-01

1.0 PURPOSE

The purpose of this technical procedure is to describe the methodology for collecting soil samples in order to document the areal and vertical extent of contaminated soil, and to determine the geotechnical, physical, and chemical properties of the soil.

2.0 SCOPE

This procedure applies to all AMEC personnel and subcontractors who collect or otherwise handle samples of surficial or subsurface soil.

3.0 REFERENCES

ASTM International (ASTM), 1999, *Standard Method for Penetration Test and Split-Barrel Sampling of Soils*, Method D-1586-99, Philadelphia, Pennsylvania.

ASTM International (ASTM), 1994, *Standard Practice for Thin-Walled Tube Sampling of Soils*, Method D-1587-94, Philadelphia, Pennsylvania. International (ASTM), 1995, *Standard Practice for Ring-Lined Barrel Sampling of Soils*, Method D-3550-84 (1995)e1, Philadelphia, Pennsylvania.

Barth, D.S. and B.J. Mason. 1984. *Soil Sampling Quality Assurance User's Guide.* EPA-600/4-84-043.

Environmental Protection Agency. 1984. *Characterization of Hazardous Waste Sites - A Methods Manual, Available Sampling Methods.* Volume II, 2nd Edition. EPA-600/4-84-076.

Mason, B.J. 1983. *Preparation of Soil Sampling Protocol: Techniques and Strategies.* EPA-600/4-83-020.

Hewitt, Alan D., et al. 2007. *Protocols for Collection of Surface Soil Samples at Military Training and Testing Ranges for the Characterization of Energetic Munitions Constituents*. U.S. Army Corps of Engineers. ERDC/CRREL TR-07-10.

4.0 DEFINITIONS

Borehole - Any hole drilled or hydraulically driven into the subsurface for the purpose of identifying lithology, collecting soil samples, and/or installing monitoring wells.

Core Sampler – A metal tube (probe rod), generally 4- to 5-feet long by 2.25- to 3.25-inch OD, typically utilized along with drive rods and a polyvinyl chloride (PVC) liner that is used to collect soil cores utilizing a direct-push rig. Inside the probe rods are smaller diameter, center rods

affixed with a solid drive tip that seals the lower end of the probe rods during pushing. After reaching the target depth, advancement is halted and the center rods and drive tip are removed, which opens the bottom end of the probe rods. A sample liner is attached to the rod string and is lowered to the bottom of the push rods, and the assembly is then advanced to collect the soil sample within the liner. The center rod string is withdrawn from the probe rods, and the liner is removed to access the recovered soil core. The process of direct-pushing and soil core recovery may be repeated within the same boring until reaching total boring depth.

Composite soil sample – a combination of soil aliquots collected at various locations, or at various depths at a single location. Analysis of composite samples yields a value representing an average over the various sampled sites or depths from which individual samples were collected.

Discrete soil sample – a discrete aliquot from a distinct sampling interval (of a specific sample size) that is representative of one specific location at a specific point in time.

Drilling Jars – A set pair of linked, heat-treated steel bars. The jars may be attached to a wireline sampling string incorporating a split spoon or other impact sampler. The jars are used to drive the sampler into the soil ahead of the bottom of the borehole

Split-Spoon Sampler – A steel tube, split in half lengthwise, with the halves held together by threaded collars at either end of the tube. This device can be driven into resistant (semiconsolidated) materials using a drive weight or drilling jars mounted in the drilling rig. A standard split-spoon sampler (used for performing standard penetration tests) is 2 inches in outside diameter and 1-3/8 inches in inside diameter. This standard spoon typically is available in two common lengths, providing either 20-inch or 26-inch internal longitudinal clearance for obtaining 18-inch or 24-inch long samples, respectively. Six-inch long sleeves (tubes) of brass, stainless steel, or plastic are commonly placed inside the sampler to collect and retain soil samples. A five-foot long split-spoon sampler is also available. A California modified split-spoon sampler is also commonly used. The design is similar to the standard split-spoon except the outside diameter is 2 1/2 inches and the inside diameter is 2 inches.

Shelby Tube Sampler – A thin-walled metal tube used to recover relatively undisturbed samples. These tubes are available in various sizes, ranging from 2 to 5 inches in outside diameter and 18 to 54 inches in length. A stationary piston device is included in the sampler to reduce sampling disturbance and increase sample recovery.

5.0 GENERAL

Collecting soil samples is an important site characterization activity. Soil samples are used to determine the nature and extent of contamination, to identify hazardous substance source

areas, and to determine the geotechnical, hydrogeologic, physical, and chemical properties of a site. Soil sampling strategies will be determined and documented before initiating sampling. Field conditions at the site may preclude collection at one or more predetermined sampling locations. Additional soil sampling may be required if unexpected subsurface conditions are observed during the course of the sampling. Proper sampling techniques, proper selection of sampling equipment, and proper decontamination procedures will eliminate cross-contamination and the introduction of contaminants from external sources. Soil conditions can vary widely at a hazardous waste site. Such variations can affect the rate of contaminant migration through the soil. Therefore, it is important that detailed records be maintained during sampling, particularly with respect to the sample location, depth, color, odor, lithology, hydrogeology, and readings derived from field monitoring equipment. Surface and shallow subsurface soil samples shall be described by soil horizons, unless otherwise specified by the work plan.

6.0 RESPONSIBILITIES

Project Manager

The Project Manager shall provide the project work plan, which shall include the sampling requirements, locations and depths for the project.

Field Manager

The Field Manager shall ensure that soil samples are collected according to this technical procedure. The Field Manager shall also be required to make rational and justifiable decisions when deviations from this procedure are necessary because of field conditions or unforeseen problems.

Field Personnel

Field personnel assigned to subsurface soil sampling activities during drilling or probing are responsible for completing their tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the Project Manager or the Field Manager.

7.0 PROCEDURES

7.1 Equipment

Equipment used to collect surficial or subsurface soil samples may include, but is not limited to, the following items:

- Stainless steel spoons/trowels;
- Stainless steel hand auger;

- Stainless steel split spoon, split barrel, or continuous sampler;
- Stainless steel bowls/pans;
- Field logbook and boring log;
- Waterproof and permanent marker;
- Paper towels or Kim wipes;
- Aluminum foil;
- Appropriate decontamination equipment;
- Appropriate personnel protective equipment and safety equipment as specified in the Health and Safety Plan;
- Sample cooler with ice;
- Sample jars and labels;
- Bubble wrap;
- Chain-of-Custody forms;
- Munsell Soil Color charts;
- Grain size charts;
- Hand lens;
- Brass sleeves;
- Brass caps;
- Ziplock freezer bags;
- Incremental Sampling specific coring tool, if applicable; and,
- Two stainless steel deionized water spraying devices.

7.2 Decontamination

Before collecting any soil samples, all sampling devices shall be decontaminated. If dedicated or disposable equipment is used, it will be rinsed with deionized water. Mobile decontamination supplies will be provided so that equipment can be decontaminated in the field. Each piece of sampling equipment shall be decontaminated before initiation of sampling operations and between each sample location and interval. Decontamination solutions shall be replenished between each site. Spent decontamination fluids will be containerized.

7.3 Incremental Sampling

Incremental Samples (IS) shall be collected using an increment specific coring tool in accordance with the U. S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory (ERDC/CREEL) incremental sampling approach. The CRREL IS approach is based on a systematic random (random grid) sampling design to obtain a sample or replicate/triplicate sample(s) of approximately 1kg (1000g) mass to characterize the average concentration of Munitions Constituents (MCs) within a chosen sampling unit. ISs will

be collected from a specified depth and sampling unit boundaries as determined in the site-specific work plan or Sampling and Analysis Plan (SAP). Under no circumstances will an IS be split or sub-sampled during field activities. The entire sample collected shall be submitted in one new, clean polyethylene bag for analysis. Homogenization for this sample type is not necessary.

The general procedure for Incremental Sampling uses a sampling unit for sample collection as presented in Figure 7-1. Sampling unit sizes for military training ranges typically range from 10 x 10 m (100 m^2) to 50 x 50 m (2500 m^2). Each sampling unit, the number and size of increments to be collected, and the sampling depth shall be specified in the site-specific work plan.

Position boundary limit flags at each corner of the selected area. Along two opposite sides, place nine flags at even intervals (e.g., 1 m intervals for a 10 x 10 m sampling unit or 5 m intervals for a 50 x 50 m sampling unit) to define 10 lanes. Set or mark the sampling tool for the appropriate depth as specified in the work plan. For greater depths and larger number of increments, use a smaller diameter sampling tool so as not to build samples that weigh much more than 1 kg. Samples representing each sampling unit will typically be comprised of between a minimum of 30 and 100 incremental plugs, depending on the size of the design unit. The number of plugs collected shall be recorded in the logbook. Each IS will be collected in a systematic random grid within each sampling unit. Per sampling unit, exact sample locations will be established by entering each sampling unit at a randomly selected corner.

Using the flags to visualize the 100 sub-units, start in one corner of the sampling area and acquire an increment near the middle of the sub-grid and every third one thereafter for a 33-increment sample, and every other for a 50-increment sample. This should appear as a serpentine sampling pattern ending at the opposite corner of the sampling unit from where sampling was started (Figure. 7-1).

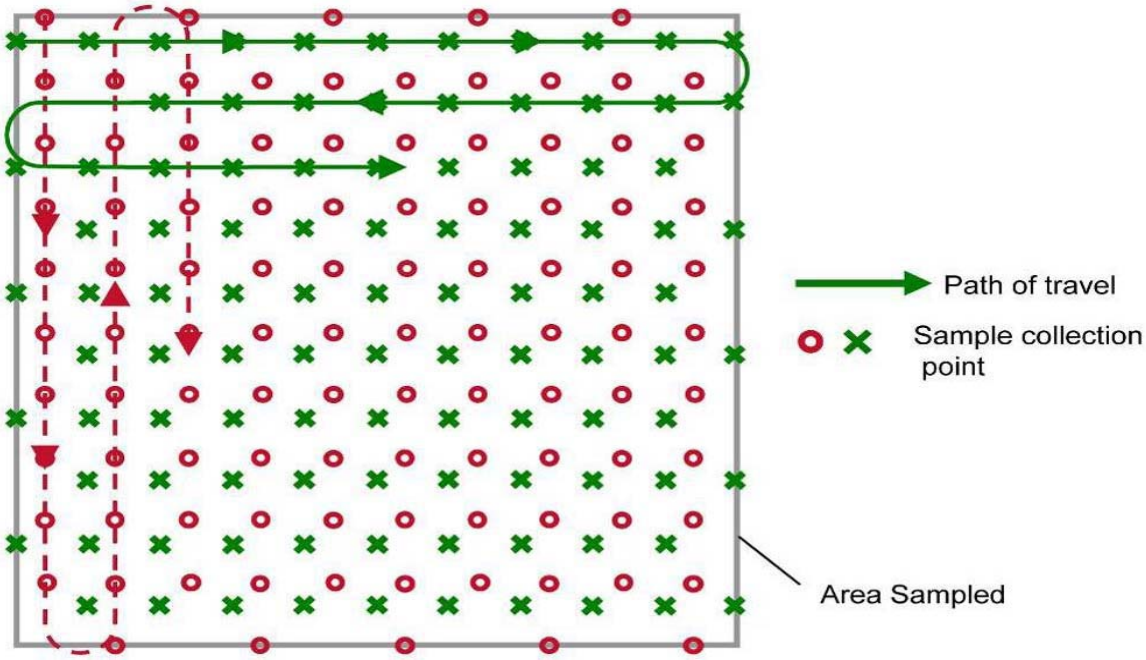
When replicate field samples are taken, flags should be positioned at the appropriate intervals on all four sides of the sampling area, creating a visual sub-grid pattern. The replicate samples should be collected starting at a sub-grid offset from the original position, or if every sub-grid is a collection point, then a random position should be selected within that sub-grid and repeated throughout the sampling unit.

When sampling units are rectangular, the conversions for the spacing (steps) between increment collection points are fairly straightforward to calculate. However, with other shapes, it is recommended that the perimeter be marked and flags be pre-positioned at an estimated interval across the middle of the sampling unit in two perpendicular lines. Then a trial run (no sample collection) is performed to quickly establish the distance between increment collection points to achieve the desired number of increments, while using the flags inside the sampling

unit as guides. The spacing between these flags should provide grid markers to assist with judging where the increments are to be collected.

The field logbook should include a drawing of the sampling unit, the grid pattern, and the sample locations. Additionally, deviations from the work plan (e.g., changes to the grid size or the number of incremental plugs per sampling unit) shall be recorded in the field logbook.

Figure 7-1. Generalized Incremental Sampling Strategy



7.4 Surface Soil Sampling

Any surface vegetation will be removed before sampling with a decontaminated shovel or sampling spoon. Surface soil samples may be collected as either discrete or composite samples. Each surface soil sample will be collected using either a stainless steel spoon or trowel. The sampler, wearing clean disposable nitrile gloves, will remove pebbles, roots, etc. from the mixture as the sample is collected. Each sample will be collected by thoroughly homogenizing material from the zero to 6-inch below ground surface depth interval (unless other depth intervals are specified in the work plan). A decontaminated stainless steel scoop or trowel will be used to remove a thin layer of soil from the area that comes into contact with the shovel (if used to gain a specific sampling depth). A second decontaminated stainless steel spoon or trowel will then be used to collect the soil sample.

Each soil sample fraction collected will be thoroughly mixed using the sampling spoon or trowel. The homogenized material will then be divided among the appropriate sample containers. The sample containers will then be sealed tightly. Care should be taken to ensure the container (bowl, pan, etc.) used for homogenization and the sampling utensils do not

interfere with the analytes of interest (e.g., an aluminum pan should not be used for soil samples submitted for inorganic analyses; only stainless steel bowls are allowed).

All personnel who collect or handle the soil samples will wear disposable nitrile gloves to prevent cross-contamination and provide personal protection. New gloves shall be donned for sample collection at each location, or whenever gloves are torn or otherwise compromised.

Each composite sample will be collected by placing equal amounts (or aliquots) of soil collected from multiple locations into a decontaminated collection container. The aliquots will then be homogenized using a spoon or trowel. The homogenized material will then be divided equally among the appropriate sample containers. The sample containers will then be sealed tightly. If a composite sample is collected for analysis of VOCs, an aliquot of soil from each composite location will be placed directly into the sample container before homogenization.

7.5 Subsurface Soil Sampling

7.5.1 Split-Spoon Sampling

Split-spoon samples for chemical analysis are usually obtained in brass, plastic, or stainless steel sleeves. The type of sleeve to be used if appplicable, along with the length and type of sampler, will be stated in the project work plans. The split-spoon sampler is connected to the drill rod string or a wireline sampling string and is driven by a drive hammer (140 or 340 pound, depending on the size of the sampler) or drilling jars into the undisturbed soil ahead of the bottom of the borehole. The procedure for collecting samples from the split-spoon sampler will be outlined in the project work plans. The standard procedure is described below.

- Calibrate all field analytical and health and safety monitoring equipment according to the instrument manufacturer's specifications. Calibration results will be recorded on the appropriate form(s) as specified by the project-specific work plans. Instruments that cannot be calibrated according to the manufacturer's specifications will be removed from service and tagged.
- Wear the appropriate personal protective equipment as specified in the project work plans and the applicable drilling method SOP.
- Between each sampling location and prior to each sampling run, decontaminate the sampler, sleeves, and other nondisposable sampling equipment as described in SOP AMEC-06.
- Advance the borehole to the desired depth or target horizon where the sampling run is to begin.
- When the desired sampling depth or target horizon is reached, remove the drill bit or plug from inside the drive casing or augers.

- Insert the sleeves into the split-spoon sampler (if determined necessary), connect the halves, and screw together the rear threaded collar and front drive shoe. Attach the split-spoon sampler to the bottom end of the drill rod string or wireline sampling string. Set up and attach the specified weight hammer, if used.
- Drive the sampler into the soil at the bottom of the borehole. Record the type of sampler assembly and hammer weight on the Boring Log and/or other appropriate form(s), as specified in the project work plans. To minimize off-gassing of the volatiles, the sampler should not be driven until the sampling team is ready to process the sample.
- When conducting penetration testing, observe and record on the Drilling Log the number of hammer blows/ft.
- Pull the drill rod or wireline sampling string up from the bottom of the borehole and remove the sampler.
- Remove the drive shoe and rear collar from the sampler and open the split barrel.
- If sleeves are used, remove the sleeves one at a time, starting with the sleeve adjoining the drive shoe. Observe and record the amount of sample recovery on the Boring Log. Any observed field problems associated with the sampling attempt (e.g., refusal) or lack of recovery should be noted on the Drilling Log.
- If sleeves are used, select sleeve(s) to be submitted for laboratory analysis. Sample sleeve selection should be based on four factors: judgement that the sample represents relatively undisturbed intact material, not slough; proximity to the drive shoe; minimal exposure to air; lithology; and obvious evidence of contamination. Place Teflon® film over each end of sleeves to be submitted for chemical analysis and seal each end with plastic end caps. Place custody tape over each end cap so that any attempt to remove the cap will break the tape. If sleeves are not used and VOC or TPH GRO analysis are planned, collect these samples immediately followed by SVOC samples until all sample containers are filled. The soil core should also be visually recorded on a Soil Boring Log.
- Appropriately label and number each sleeve or soil sample container to be submitted for analysis. The label will be filled out using waterproof ink and will contain, at a minimum, the following information:
  - Project number;
  - Boring number;
  - Sample number;
  - Bottom depth of sleeve, if applicable;
  - Date and time of sample collection;
  - Parameters for analysis; and,

- Sampler's initials.

- Document the sampling event on the Soil Sample Collection Field Sheet or an equivalent form as specified in the project work plans. At a minimum, this log will contain:
  - Project name and number;
  - Date and time of the sampling event;
  - Drilling and sampling methods;
  - Sample number;
  - Sample location;
  - Boring number;
  - Sample depth;
  - Sample description;
  - Unusual events; and,
  - Signature or initials of the sampler.

- Appropriately preserve, package, handle, and ship the sample in accordance with the procedures outlined in SOP AMEC-03 and the project work plans. The samples shall also be maintained under proper chain of custody. Samples stored on-site will be subject to the provisions of SOP AMEC-03.

- Where required by the project work plans, remove the soil from one of the remaining sleeves or split-spoon and place in a seam-sealing, polyethylene bag for organic vapor screening. Place the bag in the sunlight (warm) for at least five minutes, then using an organic vapor probe (e.g., portable photoionization detector, flame ionization detector, or other appropriate instrument), monitor the soil for organic vapors. Record the reading on the Boring Log, the Soil Sample Collection Field Sheet, and any other form(s) specified in the project work plans.

- Repeat this sampling procedure at the intervals specified in the project work plans until the bottom of the borehole is reached and/or last sample collected.

7.5.2 Thin Walled or Shelby Tube Sampling

A thin-walled tube, or Shelby tube sampler may be used to collect relatively undisturbed soil samples. The procedure for collecting soil samples using a Shelby tube sampler should be outlined in the project work plans. The standard procedure is described below.

- Calibrate all field analytical and health and safety monitoring equipment.
- Wear the appropriate personal protective equipment.
- Between each sampling location and prior to each sampling run, decontaminate the sampler and other sampling equipment as described in SOP AMEC-06.

- Advance the borehole to the desired depth or target horizon where the sampling run is to begin.
- Connect the sampling tube to the drill rod string and advance the tube to the bottom of the boring. The tube is then pushed about 2 to 2.5 feet into the soil with a continuous, rapid motion without impact or twisting.
- Pull the drill rod strip up from the bottom of the borehole and remove the sampling tube from the string. Observe and record the amount of sample recovery and any associated problems as discussed in Section 4.3.11.
- Place Teflon® film over each end of the tube if it is to be submitted for chemical analysis and seal the ends with plastic end caps. Place custody tape over each end cap so that any attempt to remove the cap will break the tape. With a waterproof marker, write a "T" for top on the trailing end and a "B" for bottom on the leading end of the tube.
- Appropriately label and number the tube as described in Section 7.5.1.
- Document the sampling event on the Soil Sample Collection Field Sheet as discussed in Section 7.5.1.
- Appropriately preserve, package, handle and ship the sample in accordance with the procedures outlined in SOP AMEC-03and the project work plans. The samples shall also be maintained under proper chain of custody protocols. Samples stored on-site will be subject to the provisions of SOP AMEC-03.
- Repeat this sampling procedure at the intervals specified in the project work plans until the bottom of the borehole is reached and/or last sample collected.

7.5.3 Core Sampling

A core sampler may be used to collect subsurface soil samples. The procedure for collecting soil samples using a core sampler should be outlined in the project work plans. The standard procedure is described below.

- Calibrate all field analytical and health and safety monitoring equipment.
- Wear the appropriate personal protective equipment.
- Between each sampling location and prior to each sampling run, decontaminate the sampler and other sampling equipment as described in SOP AMEC-06.
- Advance the probe rods equipped with a solid drive tip to the desired depth or target horizon where the sampling run is to begin. After reaching the target depth, the center rods and drive tip are removed and a new PVC liner is attached to the center rod string.
- Once the liner and center rods are inserted into the probe rods, the assembly is advanced to collect the soil sample within the liner. The assembly is pushed about 4 to

5 feet into the soil with a continuous, rapid motion. At shallow depths and/or in soft soils, the assembly may be advanced without impact from the drive hammer. At greater depths and in harder substrates impact from the drive hammer is likely required to advance the sampling assembly. The liner and center rods are withdrawn from the probe rods, noting which end of the liner is up.

- The DPT contractor will cut the liner and present it to the geologist/engineer for inspection and sample collection. Upon receiving the liner, the field geologist/engineer will observe and record the amount of sample recovery and any associated problems as discussed in Section 7.5.1.
- Sample selection should be based on five factors: judgment that the sample represents relatively undisturbed intact material, not slough; proximity to the drive shoe; minimal exposure to air; lithology; and obvious evidence of contamination. If VOC or TPH GRO analysis is planned, collect these samples immediately followed by SVOC samples until all sample containers are filled. The soil core should also be visually recorded on a Soil Boring Log.
- Appropriately label and number each soil sample container to be submitted for analysis. The label will be filled out using waterproof ink and will contain, at a minimum, the following information:
  - Project number;
  - Boring number;
  - Sample number;
  - Date and time of sample collection;
  - Parameters for analysis; and,
  - Sampler's initials.
- Document the sampling event on the Soil Sample Collection Field Sheet or an equivalent form as specified in the project work plans. At a minimum, this log will contain:
  - Project name and number;
  - Date and time of the sampling event;
  - Drilling and sampling methods;
  - Sample number;
  - Sample location;
  - Boring number;
  - Sample depth;
  - Sample description;
  - Unusual events; and,
  - Signature or initials of the sampler.

- Appropriately preserve, package, handle, and ship the sample in accordance with the procedures outlined in SOP AMEC-03 and the project work plans. The samples shall also be maintained under proper chain of custody. Samples stored on-site will be subject to the provisions of SOP AMEC-03.
- Where required by the project work plans, remove remaining soil from the PVC liner and place in a seam-sealing, polyethylene bag for organic vapor screening. Place the bag in the sunlight (warm) for at least five minutes, then using an organic vapor probe (e.g., portable photoionization detector, flame ionization detector, or other appropriate instrument), monitor the soil for organic vapors. Record the reading on the Boring Log, the Soil Sample Collection Field Sheet, and any other form(s) specified in the project work plans.
- Repeat this sampling procedure at the intervals specified in the project work plans until the bottom of the borehole is reached and/or last sample collected.

Groundwater Sampling
AMEC-02

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines and procedures for use by field personnel in the collection and documentation of groundwater samples for chemical analysis. Proper collection procedures are necessary to assure the quality and integrity of all groundwater samples. Additional specific procedures and requirements will be provided in the project work plans, as necessary.

2.0 REFERENCES

ASTM International, 2007, Standard Guide for Sampling Ground-Water Monitoring Wells, D 4448-01 (Reapproved 2007).

Barcelona et al, 1985, Practical Guide for Groundwater Sampling, Illinois State Water Survey, Champaign, Illinois, ISWS Contract Report 374, November.

U.S. Environmental Protection Agency (EPA), 1987, Compendium of Superfund Field Operations Methods, EPA 540/P-87/001a, OSWER 9355.0-14, September.

EPA, 1988, EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA, Interim Final OSWER Directive 9355.3-01, August.

EPA, 1992, EPA RCRA Groundwater Monitoring: Draft Technical Guidance, November.

3.0 DEFINITIONS

Bladder Pump – A bladder pump is an enclosed cylindrical tube containing a flexible membrane bladder. Well water enters the bladder through a one-way check-valve at the bottom. Gas is forced into the annular space (positive displacement) surrounding the bladder through a gas supply line. The gas displaces the well water through a one-way check-value at the top. The water is brought to the surface through a water discharge line. Gas (air or nitrogen) is provided by compressors or cylinders.

Peristaltic Pump – A peristaltic pump is a self-priming, low volume pump consisting of a rotor and ball bearing rollers. Tubing placed around the rotors is squeezed by the rotors as they revolve. The squeezing produces a wavelike contractual movement that causes water to be

drawn through the tubing. The peristaltic pump is limited to sampling at depths of less than 25 feet.

Electric Submersible Pump – An electric submersible pump is an enclosed cylindrical tube containing a motor with rotary attachments. Well water enters the cylinder through a one-way check valve. Electrical power to the motor causes rotors or impellers to turn and displace the groundwater.

Bailer – A bailer is an enclosed cylindrical tube containing a floating ball check-valve at the bottom. Lowering the bailer into water causes the ball to float allowing water to enter the cylinder. Raising the bailer through the water causes the ball to settle, creating a seal to trap the water so that it can be brought to the surface.

Dedicated Groundwater Monitoring Equipment – Dedicated groundwater monitoring equipment is used to purge and sample only one well. The equipment is installed and remains in the well for the duration of the monitoring program. Dedicated equipment does not need to be decontaminated between sampling events.

4.0 PROCEDURE

This section contains both the responsibilities and procedures involved with groundwater sampling. Proper groundwater sampling procedures are necessary to insure the quality and integrity of the samples. The details within this SOP should be used in conjunction with project work plans. The project work plans will generally provide the following information:

- Sample collection objectives;
- Locations of groundwater samples to be collected;
- Numbers and volumes of samples to be collected;
- Types of chemical analyses to be conducted for the samples;
- Specific quality control (QC) procedures and sampling required;
- Any additional groundwater sampling requirements or procedures beyond those covered in this SOP, as necessary; and,
- At a minimum, the procedures outlined in this SOP for groundwater sampling will be followed.

4.1 RESPONSIBILITIES

Project Manager

The Project Manager is responsible for ensuring that all sample collection activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC).

Field Manager

The Field Manager is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The Field Manager is also responsible for implementation of corrective action (i.e., retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing nonconformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to surface and shallow subsurface soil sampling activities are responsible for completing their tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the Project Manager or Field Manager.

4.2 GROUNDWATER SAMPLING REQUIREMENTS

4.2.1 Equipment Selection and Sampling Considerations

Purging and sampling equipment is constructed from a variety of materials. The most inert material (e.g., Teflon®, stainless steel), with respect to known or anticipated contaminants in the well(s), will be used whenever possible. The various types of purging and sampling equipment available for groundwater sampling are described in *ASTM Standard Guide for Sampling Groundwater Monitoring Wells, D 4448-01* (ASTM, 2007) or *Collection of Groundwater Samples at Known or Suspected Groundwater Contaminated Sites* or *Compendium of Superfund Field Operations Methods* (EPA, 1987).

If non-dedicated sampling is to be used and the contaminant histories of the wells are known, it is advisable to establish a sampling order starting with the least contaminated well and progressing to the most contaminated last.

4.2.2 Groundwater Purging and Sampling with a Bladder Pump

Pre-sample purging and sampling should be conducted in accordance with the project work plans. The standard procedure for purging and sampling using a bladder pump is in agreement with procedures described in the *Compendium of Superfund Field Operations Methods* (EPA, 1987) and will be conducted as described below.

- Inspect the equipment to ensure that it is in good working order.
- Calibrate all field analytical test equipment (e.g., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity and temperature) according to the instrument manufacturers' specifications or scope-specific work plan. Calibration results will be recorded on the appropriate form(s) as specified by the project work plans. Instruments that cannot be calibrated according to the manufacturers' specifications will be removed from service and tagged.
- An exception to the daily calibration requirements will be made in the case of the water level meters. These instruments will be calibrated at the beginning of the project and then every six months using a steel surveyors tape.
- If non-dedicated equipment is being used, decontaminate. During decontamination, the equipment should again be inspected for damage and, if present, repaired or replaced with undamaged equipment.
- Visually inspect the well to ensure that it is undamaged, properly labeled, and secured. Damage or other conditions that may affect the integrity of the well will be recorded on the Field Activity Daily Log and brought to the attention of the Site Manager.
- Uncap the well and monitor the air space immediately above the open casing per the health and safety plan. Observe if any air is flowing into or out of the casing. In the event such conditions are observed, they should be noted on the Water Sample Collection Field Sheet.
- Obtain a static depth to water level measurement. If the total well depth has not been verified within the past year, obtain a total well depth measurement. Calculate the volume of water in the well (cased well volume) as follows:

$$\pi\left(\frac{d}{2}\right)^{2}(h_1 - h_2) \times 7.48 = \text{cased well volume (in gallons)}$$

Where:

d = inside diameter of well casing (in feet)

h_1 = depth of well from top of casing (in feet)

h_2 = depth to water from top of casing (in feet)

- Record static water level, total well depth, and volume calculations on the sample collection field sheet.
- If using non-dedicated equipment, lower the pump and associated tubing and/or lines into the well. The pump intake should be located near the middle of the screen interval and the depth of the pump intake will be recorded on the field form. For low yielding wells it may be necessary to gently lower the pump during purging to follow the declining water level in the well.
- Attach the compressor or cylinder to the controller and the controller to the gas supply line, making sure that the compressor is downwind of the monitoring well. Attach the sampling tube to the discharge supply line. Adjust the pressure/discharge cycle on the controller.
- Begin purging. Collect and dispose of purge water in accordance with the criteria specified by the project work plans.
- Physical parameters (i.e., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity and temperature) of the purge water will be measured when purging begins, after each well casing volume, and then periodically throughout the purging procedure. These measurements will be recorded on Water Sample Collection Field Sheet. Purging is considered complete when a minimum of three casing volumes have been removed and water quality indicator parameters have stabilized (i.e., three consecutive readings are within tolerances specified in Table 4-1) (ASTM, 2007; EPA, 1992 and Barcelona et al, 1985). If stability is not reached within the

removal of three cased well volumes then purging is continued until a maximum of five cased well volumes have been removed.

Table 4-1

Parameter	Units	Requirement
pH	Standard Units	± 0.1
Specific Conductivity	Micromhos/centimeter (umho/cm, or µS/cm)	± 3 percent
Temperature	Degrees Celcius (ºC)	± 0.5 ^{o}C
Oxidation-Reduction Potential (ORP)	Millivolts (mV)	± 10 percent
Dissolved Oxygen	Milligrams/liter (mg/L)	± 10 percent
Turbidity	Nephelometric Turbidity Units (NTUs)	± 10 percent, but less than 5 NTUs

- For slowly recharging wells, the parameters may not stabilize before the well casing is emptied, even when using low flow rates. In this case, purging will be considered complete when one well volume (well casing plus filter pack volume) has been purged from the well and the well goes dry.

- The well will be allowed to recharge, and sampling must be initiated within 24-hours of purging. The depth to the water level in the well will be measured and recorded immediately prior to sample collection. If the volume of water in the recharged well is not sufficient to completely fill all required sample containers, then sample collection may follow multiple well recharge events within 48 hours after completion of purging. All sample containers for a given analytical method (e.g., EPA 8330) must be concurrently and completed filled following a single recharge event. If VOC analysis is required, the sample aliquot should be collected during the first sample collection event (i.e., first recharge volume). The date and time of each sample collection will be recorded.

- Inspect the sampling bottles (obtained from the analytical laboratory prior to the sampling event) to be used to ensure that they are appropriate for the samples being collected, are undamaged, and have had the appropriate types and volumes of preservatives added. The types of sample containers to be used and sample preservation requirements will be provided in the project work plans.

- Turn on the pump and adjust the pressure/discharge cycle on the pump controller so that the water will flow smoothly and without agitation into the sample containers.

- Collect the sample directly into the provided sample bottle (container), allowing the discharge to flow gently down the inside of the bottle, minimizing aeration of the sample. Completely fill the bottle; however, samples collected for metals and general water chemistry analysis should be filled to the base of the bottleneck.

- The samples should be collected in the order of volatility, collecting the most volatile samples first, followed by the least volatile samples. The volatile samples should be collected during one full discharge cycle. Do not partially fill a volatile sample during one cycle and complete the filling during the next cycle.

- Samples collected for metals analysis will be filtered if the groundwater turbidity is greater than 5 NTUs; these samples will generally be collected last. Samples requiring filtering will be passed through a 0.45 micron membrane filter in the field using an in-line filter or a disposable vacuum filter unit, or a non-acidified sample may be submitted to the laboratory for filtering prior to acidification (if acidification is required for the analytes of interest). If needed, an alternate filter mesh may be stipulated in the project work plans. Filtered sample results for metals analyses will be reported as dissolved metals.

- Cap the bottle and attach custody tape across the cap so that any attempt to remove the sample or open the sample bottle will be evident.

- Document the sampling event on the Water Sample Collection Field Sheet.

- As soon as possible after sample collection, place the sample in a separate, appropriately sized, airtight, seam sealing, polyethylene bag (i.e., Ziploc®). Seal the bag, removing any excess air. Place the bagged sample inside the shipping container.

- Handle and ship the sample according to the procedures outlined in SOP AMEC-03, following appropriate chain of custody procedures. Samples stored temporarily on site will be maintained per SOP AMEC-03.

4.2.3 Groundwater Purging and Sampling with a Peristaltic Pump

Purging and sampling will be conducted per the project work plans. The standard procedure for groundwater purging and sampling using a peristaltic pump is in agreement with procedures

described in the *Compendium of Superfund Field Operations Methods* (EPA, 1987) and will be conducted as described below.

- Inspect the equipment to ensure that it is in good working order.
- Calibrate all field analytical test equipment (e.g., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity and temperature) according to the instrument manufacturers' specifications or scope-specific work plan. Calibration results will be recorded on the appropriate form(s) as specified by the project work plans. Instruments that cannot be calibrated according to the manufacturers' specifications will be removed from service and tagged.
- Conduct equipment decontamination; however, the old Tygon™ tubing used in the pump head should not be decontaminated. New tubing should be used for each well.
- Visually inspect the well to ensure that it is undamaged, properly labeled, and secured. Damage or other conditions that may affect the integrity of the well will be recorded on the Field Activity Daily Log and brought to the attention of the Site Manager.
- Uncap the well and monitor the air space immediately above the open casing per the health and safety plan. Observe if any air is flowing into or out of the casing. In the event such conditions are observed, they should be noted on the Water Sample Collection Field Sheet.
- Obtain a static water level measurement and calculate the cased well volume as discussed in Section 4.2.2.
- Connect new Tygon™ tubing to the rotor head of the pump motor and tighten until snug.
- Run a short section of the tubing from the discharge side of the pump head to a collection vessel.
- Insert the free end of the influent tubing into the well and lower it to the middle of the well screen. The depth of the tubing intake will be recorded on the field form. For low yielding wells it may be necessary to gently lower the tubing intake during purging to follow the declining water level in the well.
- Begin and conduct purging.

- Physical parameters (i.e., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity and temperature) of the purge water will be measured when purging begins, after each well casing volume, and then periodically throughout the purging procedure. These measurements will be recorded on Water Sample Collection Field Sheet. Purging is considered complete when a minimum of three casing volumes have been removed and water quality indicator parameters have stabilized (i.e., three consecutive readings are within tolerances specified in Table 4-1) (ASTM, 2007; EPA, 1992 and Barcelona et al, 1985). If stability is not reached within the removal of three cased well volumes then purging is continued until a maximum of five cased well volumes have been removed. For slowly recharging wells, the parameters may not stabilize before the well casing is emptied, even when using low flow rates. In this case, purging will be considered complete when one well volume (well casing plus filter pack volume) has been purged from the well and the well goes dry.

- The well will be allowed to recharge, and sampling must be initiated within 24-hours of purging. The depth to the water level in the well will be measured and recorded immediately prior to sample collection. If the volume of water in the recharged well is not sufficient to completely fill all required sample containers, then sample collection may follow multiple well recharge events within 48 hours after completion of purging. All sample containers for a given analytical method (e.g., EPA 8330) must be concurrently and completed filled following a single recharge event. If VOC analysis is required, the sample aliquot should be collected during the first sample collection event (i.e., first recharge volume). The date and time of each sample collection will be recorded.

- Inspect the sampling bottles (obtained from the analytical laboratory prior to the sampling event) to be used to ensure that they are appropriate for the samples being collected, are undamaged, and have had the appropriate types and volumes of preservatives added. The types of sample containers to be used and sample preservation requirements will be provided in the project work plans.

- Turn on and adjust the rotor speed of the pump so that the water will flow smoothly and without agitation into the sample bottles.

- Collect the sample directly into the provided sample bottle (container), allowing the discharge to flow gently down the inside of the bottle, minimizing aeration of the sample. Completely fill the bottle; however, samples collected for metals and general water chemistry analyses should be filled to the base of the bottleneck.

- The samples should be collected in the order of volatility, collecting the most volatile samples first, followed by the least volatile samples. The volatile samples should be collected during one full discharge cycle. Do not partially fill a volatile sample during one cycle and complete the filling during the next cycle.

- Samples collected for metals analysis will be filtered if the groundwater turbidity is greater than 5 NTUs; these samples will generally be collected last. Samples requiring filtering will be passed through a 0.45 micron membrane filter in the field using an in-line filter or a disposable vacuum filter unit, or a non-acidified sample may be submitted to the laboratory for filtering prior to acidification (if acidification is required for the analytes of interest). If needed, an alternate filter mesh may be stipulated in the project work plans. Filtered sample results for metals analyses will be reported as dissolved metals.

- Cap the bottle and attach custody tape across the cap so that any attempt to remove the sample or open the sample bottle will be evident.

- Document the sampling event on the Water Sample Collection Field Sheet.

- Appropriately seal, store, handle, and ship the samples per SOP AMEC-03.

4.2.4 Groundwater Purging and Sampling with an Electric Submersible Pump

Purging and sampling will be conducted in accordance with the project work plans. The standard procedure for purging and sampling using a submersible pump is in agreement with procedures described in the *Compendium of Superfund Field Operations Methods* (EPA, 1987) and is described below.

- Inspect the equipment to ensure that it is in good working order.

- Calibrate all field analytical test equipment (e.g., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity and temperature) according to the instrument manufacturers' specifications or scope-specific work plan. Calibration results will be recorded on the appropriate form(s) as specified by the project work plans. Instruments that cannot be calibrated according to the manufacturers' specifications will be removed from service and tagged.

- If non-dedicated equipment is being used, decontaminate. During decontamination, the equipment should again be inspected for damage and, if present, repaired or replaced with undamaged equipment.

- Visually inspect the well to ensure that it is undamaged, properly labeled, and secured. Damage or other conditions that may affect the integrity of the well will be recorded on the Field Activity Daily Log and brought to the attention of the Site Manager.

- Uncap the well and monitor the air space immediately above the open casing per the health and safety plan. Observe if any air is flowing into or out of the casing. In the event such conditions are observed, they should be noted on the Water Sample Collection Field Sheet.

- Obtain a static water level measurement and calculate the cased well volume per Section 4.2.2.

- If using non-dedicated equipment, lower the pump and associated lines into the well. The pump intake should be located near the middle of the screen interval and the depth of the pump intake will be recorded on the field form. For low yielding wells it may be necessary to gently lower the pump during purging to follow the declining water level in the well.

- Place the generator downwind of the well. Start the generator, and then plug the pump into the generator.

- Begin purging. Physical parameters (i.e., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity and temperature) of the purge water will be measured when purging begins, after each well casing volume, and then periodically throughout the purging procedure. These measurements will be recorded on Water Sample Collection Field Sheet. Purging is considered complete when a minimum of three casing volumes have been removed and water quality indicator parameters have stabilized (i.e., three consecutive readings are within tolerances specified in Table 4-1) (ASTM, 2007; EPA, 1992 and Barcelona et al, 1985). If stability is not reached within the removal of three cased well volumes then purging is continued until a maximum of five cased well volumes have been removed. For slowly recharging wells, the parameters may not stabilize before the well casing is emptied, even when using low flow rates. In this case, purging will be considered complete when one well volume (well casing plus filter pack volume) has been purged from the well and the well goes dry.

- The well will be allowed to recharge, and sampling must be initiated within 24-hours of purging. The depth to the water level in the well will be measured and recorded immediately prior to sample collection. If the volume of water in the recharged well is not sufficient to completely fill all required sample containers, then sample collection may follow multiple well recharge events within 48 hours after completion of purging. All sample containers for a given analytical method (e.g., EPA 8330) must be concurrently and completed filled following a single recharge event. If VOC analysis is required, the sample aliquot should be collected during the first sample collection event (i.e., first recharge volume). The date and time of each sample collection will be recorded.

- Inspect the sampling bottles (obtained from the analytical laboratory prior to the sampling event) to be used to ensure that they are appropriate for the samples being collected, are undamaged, and have had the appropriate types and volumes of preservatives added. The types of sample containers to be used and sample preservation requirements will be provided in the project work plans.

- Turn on and adjust the flow rate of the pump by using the check-valve on the discharge line so that the water will flow smoothly and without agitation into the sample bottles.

- Collect the sample directly into the provided sample bottle (container), allowing the discharge to flow gently down the inside of the bottle, minimizing aeration of the sample. Completely fill the bottle; however, samples collected for metals and general water chemistry analyses should be filled to the base of the bottleneck.

- An electric submersible pump is not recommended for collecting VOC samples.

- Samples collected for metals analysis will be filtered if the groundwater turbidity is greater than 5 NTUs; these samples will generally be collected last. Samples requiring filtering will be passed through a 0.45 micron membrane filter in the field using an in-line filter or a disposable vacuum filter unit, or a non-acidified sample may be submitted to the laboratory for filtering prior to acidification (if acidification is required for the analytes of interest). If needed, an alternate filter mesh may be stipulated in the project work plans. Filtered sample results for metals analyses will be reported as dissolved metals.

- Cap the bottle and attach custody tape across the cap so that any attempt to remove the sample or open the sample bottle will be evident.

- Document the sampling event on the Water Sample Collection Field Sheet.

- Appropriately seal, store, handle and ship the samples per SOP AMEC-03.

4.2.5 Groundwater Purging and Sampling with a Bailer

Purging and sampling will be conducted in accordance with the project work plans. The standard procedure for purging and sampling with a bailer is in agreement with procedures described in the *Compendium of Superfund Field Operations Methods* (EPA, 1987) and is described below.

- Inspect the equipment to ensure that it is in good working order.

- Calibrate all field analytical test equipment (e.g., pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity and temperature) according to the instrument manufacturers' specifications or scope-specific work plan. Calibration results will be recorded on the appropriate form(s) as specified by the project work plans. Instruments that cannot be calibrated according to the manufacturers' specifications will be removed from service and tagged.

- Decontaminate purging and sampling equipment.

- Visually inspect the well to ensure that it is undamaged, properly labeled, and secured. Damage or other conditions that may affect the integrity of the well will be recorded on the Field Activity Daily Log and brought to the attention of the Site Manager.

- Uncap the well and monitor the air space immediately above the open casing per the health and safety plan. Observe if any air is flowing into or out of the casing. In the event such conditions are observed, they should be noted on the Water Sample Collection Field Sheet.

- Obtain a static water level measurement and calculate the cased well volume per Section 4.2.2.

- Secure the bailer to a five foot length of Teflon® coated stainless bailer wire with a bowline knot or clip. Attach the bailer wire to bailing line or chain.

- Begin purging by slowly lowering the bailer into the groundwater. Allow the floating ball valve to seat, and slowly retrieve the bailer. Repeat this procedure to purge the well.

Collect, transport, and dispose of purge water in accordance with the criteria specified in the project work plans.

- During purging, the descent of the bailer should be controlled to prevent freefall inside the well. In the event the bailer encounters an obstruction inside the well, no attempts may be made to push the bailer beyond the obstruction. If the bailer becomes lodged in the well, the line should not be pulled with such force that it would part from the bailer. Such conditions should also be noted in the Field Activity Daily Log and brought to the immediate attention of the Field Manager.

- The well will be allowed to recharge, and sampling must be initiated within 24-hours of purging. The depth to the water level in the well will be measured and recorded immediately prior to sample collection. If the volume of water in the recharged well is not sufficient to completely fill all required sample containers, then sample collection may follow multiple well recharge events within 48 hours after completion of purging. All sample containers for a given analytical method (e.g., EPA 8330) must be concurrently and completed filled following a single recharge event. If VOC analysis is required, the sample aliquot should be collected during the first sample collection event (i.e., first recharge volume). The date and time of each sample collection will be recorded.

- Inspect the sampling bottles (obtained from the analytical laboratory prior to the sampling event) to be used to ensure that they are appropriate for the samples being collected, are undamaged, and have had the appropriate types and volumes of preservatives added. The types of sample containers to be used and sample preservation requirements will be provided in the project work plans.

- Lower the sample collection bailer and submerge into the water column as above. Retrieve the bailer and insert a bottom-emptying device into the bailer so that the water will flow smoothly and without agitation into the sample bottles.

- Collect the sample water directly into the provided sample bottles (containers), allowing the discharge to flow gently down the inside of the bottles, minimizing aeration of the sample. Completely fill the bottles; however, samples collected for metals and general water chemistry analyses should be filled to the base of the bottleneck.

- The samples should be collected in the order of volatility, collecting the most volatile samples first, followed by the least volatile samples. The volatile samples should be

collected during one full discharge cycle. Do not partially fill a volatile sample during one cycle and complete the filling during the next cycle.

- Samples collected for metals analysis will be filtered if the groundwater turbidity is greater than 5 NTUs; these samples will generally be collected last. Samples requiring filtering will be passed through a 0.45 micron membrane filter in the field using an in-line filter or a disposable vacuum filter unit, or a non-acidified sample may be submitted to the laboratory for filtering prior to acidification (if acidification is required for the analytes of interest). If needed, an alternate filter mesh may be stipulated in the project work plans. Filtered sample results for metals analyses will be reported as dissolved metals.

- Cap the bottle and attach custody tape across the cap so that any attempt to remove the sample or open the sample bottle will be evident.

- Document the sampling event on the Water Sample Collection Field Sheet.

- Appropriately seal, store, handle, and ship the samples per SOP AMEC-03.

SAMPLE HANDLING AND CUSTODY
AMEC-03

1.0 PURPOSE

The purpose of this technical procedure is to delineate protocols for sample handling and custody.

2.0 SCOPE

This procedure applies to all AMEC personnel and subcontractors collecting environmental samples.

3.0 REFERENCES

U.S. Environmental Protection Agency (EPA), Office of Emergency and Remedial Response, EPA/540/R-96/0, Dec 96 -*Sampler's Guide to the Contract Laboratory Program.*

EPA, Office of Emergency and Remedial Response, EPA/540/R-941/013, Feb 94 - *User's Guide to the Contract Laboratory Program.*

AFCEE (U.S. Air Force Center for Environmental Excellence. 2000 (September). Quality Program Plan. AFC-J23-35Q85101-M3-0002. Prepared by Jacobs Engineering Group Inc. for AFCEE/MMR Installation Restoration Program, Otis Air National Guard Base, MA.

American Society for Testing and Materials. 1996. Standard Guide for Sampling Chainof-Custody Procedures. D 4840-95.

4.0 DEFINITIONS

Custody – physical possession or control. A sample is under custody if it is in possession or under control so as to prevent tampering or alteration of its characteristics.

Sample Label – a record attached to samples to ensure legal documentation of traceability.

Chain-of-Custody Record – legal documentation of custody of sample materials and instructions for analytical laboratory.

5.0 GENERAL

An essential part of the sampling activities of any environmental project is assuring the integrity of the sample from collection to data reporting. Sample labels and Chain-of-Custody forms are used to document identification and handling of samples from the time of collection through the completion of chemical analysis. In some projects, analytical data may be used in litigation. Accountability of the history of a sample must be available to demonstrate that the data are a true representation of the environment. The chain-of-custody record is used as evidence in

legal proceedings to demonstrate that a sample was not tampered with or altered in any way that may bias the analytical accuracy of the laboratory results. It is extremely important that chain-of-custody records be complete, accurate and consistent.

6.0 RESPONSIBILITIES

6.1 Project Manager

The Project Manager is responsible for overall compliance with this technical procedure.

6.2 Field Manager

The Field Manager shall ensure that the samples are correctly collected, labeled, tracked by chain-of-custody, and stored until they are delivered directly to the shipper or laboratory (i.e., on-site or off-site).

6.3 Sample Collector

The Sample Collector shall ensure the samples are correctly collected, labeled, tracked by chain-of-custody, and stored until they are delivered directly to the Sample Shipper or laboratory (i.e., on-site or off-site). The Sample Collector shall maintain custody of the samples until they are relinquished to the Sample Shipper or laboratory. The Sample Collector shall be responsible for informing the Sample Shipper of sampling conditions and if any of the samples are potentially hazardous. (NOTE: The Sample Collector and Sample Shipper can be the same person.)

6.4 Sample Shipper

The Sample Shipper shall pack the sample shipping coolers, ensure that the chain-of-custody forms are correct, and ship and/or deliver the samples to the laboratory. The Sample Shipper shall determine which samples are potentially hazardous and ship them accordingly.

7.0 PROCEDURE

7.1 Sample Custody

Sample custody procedures are designed to ensure that sample integrity is maintained from collection to final disposition. A critical aspect of sound sample collection and analysis protocols is the maintenance of strict chain-of-custody procedures as described in this technical procedure. Chain-of-custody procedures include tracking and documentation during sample collection, shipment, and laboratory processing. A sample is considered to be in an individual's custody if it is (1) in the physical possession of the responsible party; (2) in view of the responsible party after being in their possession (3) secured to prevent tampering; or (4) placed in a designated, secure area that is controlled and restricted by the responsible party.

Custody will be documented throughout all sampling activities on the chain-of-custody record for each day of sampling. This record will accompany the samples from the site to the laboratory. All personnel with sample custody are required to sign, date, and note on the record the time when receiving and relinquishing samples from their immediate custody. Any discrepancies will be noted at this time. Samples will be shipped to subcontractor laboratories via overnight air courier. Bills of lading will be used as custody documentation during this time and will be retained as part of the permanent sample custody documentation. In some cases, samples may be hand delivered to the laboratory; hand delivery will be noted on the chain-of-custody form. The subcontractor laboratory is responsible for sample custody once samples are received.

7.2 Sample Labels

A label will be attached to all sample containers at the time of sample collection. The label will contain the following information:

- Unique chain-of-custody control number;
- Analyses requested; and,
- Preservative used.

When the sample collection is complete; the *Sample Collector* fills in the following information in indelible ink:

- Date and time of sample collection; and,
- Sampler's initials.

Once complete; the label will be covered with clear tape, unless using waterproof labels, and prepared for shipment.

7.3 Chain-of-Custody Record

Chain of custody forms will be used to document the integrity of all samples. To maintain a record of sample collection, transfer of samples between personnel, shipment of samples, and receipt of samples at the laboratory, chain of custody forms will be filled out for each sample/analysis at each sampling location. The chain of custody forms shall include the following information:

- Project name and project number if applicable;
- Name and address of laboratory to receive the samples;
- Chain-of-custody control number;
- Sample type, sample method;
- Location ID, sample ID;

- Matrix code;
- Analyses requested;
- Field QC for MS/MSD, if applicable;
- Container type, size and number;
- Preservatives used;
- Turn-around-time for laboratory analysis; and,
- Comments to Laboratory or Sample Collector, if applicable.

The *Sample Collector* will enter the following information using indelible black or blue ink:

- Sampler's initials;
- Date of collection;
- Time of collection (24-hour format);
- Depths, if applicable;
- Pump/equipment number, if applicable; and,
- Void reason, if applicable.

The Sample Collector shall verify the chain of custody record is complete, accurate in all aspects, and consistent with all other sample documentation (e.g., number of samples, sample labels, field logs). The Sample Collector will sign the "Sampled By" and "Relinquished By" fields on the Chain of custody record, marking the date and time custody is transferred to the Sample Shipper or other authorized person.

The *Sample Shipper* will perform the following duties:

- Obtain the signature of the Sample Collector to transfer sample custody;
- Record the carrier service and airbill number on the chain of custody;
- Sign and enter the date and time relinquished to the shipper; and,
- Prepare the samples for shipment from the field to the laboratory.

The Sample Shipper or sample custodian will sign the "Received By" box, marking the date and time of receipt of the samples from the Sample Collector or other sample custodian. Every transfer of physical custody shall be documented on the chain-of-custody record.

Any corrections to the chain of custody form entries will be made by a single-line strike mark through the incorrect item, and then entering the correct entry adjacent to the strikeout item. Corrections will be initialed and dated by the person making the change. After the form has been inspected and determined to be complete, the sample shipper will sign, date, and note the time of transfer and will reference a shipper tracking number on the form. The chain of custody form will be placed in a Ziploc plastic bag and placed inside the cooler after the sample packer has detached or made an appropriate copy of the form. Field copies of the completed

chain of custody forms maintained in project files.

7.4 Overnight Sample Storage

In some cases, samples that cannot be shipped immediately to a laboratory must be temporarily stored in an AMEC controlled sample refrigerator until arrangements can be made for delivery. The sample custodian shall place samples in the refrigerator (samples and signed chain of custody record(s) in Ziploc bags) and secure the refrigerator with a unique, keyed lock, restricting access to one custodian at a time. A temperature blank must accompany samples overnight.

Samples temporarily stored in the refrigerator must be received by the custodian that placed them in storage, and in turn, may be "relinquished to" the appropriate laboratory, the Sample Shipper or another sample custodian. Each transfer of custody shall be recorded on the appropriate chain of custody form(s).

8.0 RECORDS

Distribution of the chain of custody record:

- Original sealed in a plastic bag and taped inside the top of the shipping container; and,
- Copies to the Project Manager.

Drilling, Development, and Heavy Equipment Decontamination
AMEC-06

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines for use by field personnel in the decontamination of drilling, development, and heavy equipment. The details within this SOP are applicable as general requirements for drilling and heavy equipment decontamination, and should also be used in conjunction with project work plans.

2.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 1987, *Compendium of Superfund Field Operations Methods*, EPA 540/P-87/001a, OSWER 9355.0-14, September.

U.S. Environmental Protection Agency (EPA), 1988, *EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA*, Interim Final OSWER Directive 9355.3-01, August.

U.S. Environmental Protection Agency (EPA), 1991, *Management of Investigation Derived Wastes During Site Inspections*, EPA 540/G-191/009, May.

3.0 DEFINITIONS

Heavy Equipment – Drill rigs, excavators, dozers, back-hoes, trucks, or other similar type machinery used to drill soil borings, break concrete, excavate soil or other similar type activity.

Laboratory Grade Detergent – A standard brand of laboratory-grade detergent, such as "Alconox" or "Liquinox."

Potable Water – Water dispensed from a municipal water system or well used and approved for drinking.

4.0 PROCEDURE

4.1 Responsibilities

Compliance with this procedure is the responsibility of project management and field personnel. This SOP and the project work plans should be reviewed before implementing drilling, development, and heavy equipment decontamination at the project site.

The Project Manager has the responsibility for ensuring that decontamination of drilling and heavy equipment is properly performed through staff training and by maintaining quality assurance/quality control (QA/QC).

The Field Manager has the responsibility for periodic review of procedures and documentation associated with the decontamination of drilling and heavy equipment. If perceived variances occur, the Field Manager is also responsible for issuing notices of nonconformances and requesting corrective actions. Additionally, the Field Manager will perform inspections and monitoring of the decontamination activities.

Project staff assigned to drilling, development, trenching, or construction activities are responsible for ensuring that subcontractors or equipment operators properly decontaminate drilling, development, and heavy equipment associated with those tasks. Project staff are also responsible for documenting the decontamination activities in a field log and/or appropriate form(s) as specified in the project work plans.

4.2 General

This section provides requirements for the construction of a temporary decontamination facility for drilling, development, and heavy equipment and the decontamination procedures to be followed. The project work plans will provide specific information regarding:

- Types of equipment requiring decontamination under this SOP;
- Location of the decontamination station;
- Types and/or specifications on materials to be used in the fabrication of the decontamination station; and,
- Types of materials and additional details on the procedures to be used in the decontamination process.

Field personnel associated with construction of the decontamination station or decontamination of drilling or heavy equipment must read both this SOP and the project work plans prior to implementation of related decontamination activities.

4.3 Decontamination Facility

A decontamination facility will be set up in an area exclusively for decontamination of drilling, well development, and/or heavy equipment. Decontamination of drilling, development, and heavy equipment will be conducted within the station.

At a minimum, the station will be constructed such that all rinsates, liquid spray, soil, debris, and other decontamination wastes are fully contained and may be collected for appropriate waste management and disposal. The facility may be as simple as a bermed pad lined with polyethylene sheeting with an impermeable sump for collecting rinse water. More sophisticated designs involving self-contained metal decontamination pads in combination with bermed polyethylene sheeting may also be used, depending on project-specific requirements. These requirements along with specific equipment and construction specifications for the decontamination facility will be provided in the project work plans.

4.4 Decontamination of Downhole Equipment

Downhole drilling and development equipment (including but not limited to drill pipe, drive casing, drill rods, bits, tools, nondisposable bailers, etc.) will be thoroughly decontaminated before mobilization to each site and between borings or wells at each site or as required in the project work plans. The standard procedure will be performed as described below. Decontamination will be performed in accordance with this SOP and the project work plans.

- Appropriate personal protective equipment (as specified in the project work plans) must be worn by all personnel involved with the task to limit personal exposure.
- Equipment caked with drill cuttings, soil, or other material will initially be scraped or brushed. The scrapings will be containerized and appropriately disposed.
- Equipment will then be sprayed with potable water using a hot water, high pressure washer.
- Washed equipment will then be rinsed with potable water.
- Decontaminated downhole equipment (such as drill pipe, drive casing, bits, tools, bailers, etc.) will be placed on clean plastic sheeting to prevent contact with contaminated soil and allowed to air dry. If equipment is not used immediately, it will be covered or wrapped in plastic sheeting to minimize airborne contamination.

- Decontamination activities will be documented by the Site Superintendent, lead geologist, or lead engineer in the field log and/or appropriate form(s), as specified in the project work plans.

4.5 Decontamination of Heavy Equipment

Heavy equipment (e.g., drill rigs, development rigs, backhoes, trucks, and other earthmoving equipment) will be decontaminated between drilling sites or inside the contaminant reduction area prior to entering and leaving an exclusion zone. Decontamination will be performed in accordance with the project work plans. The standard procedure will be performed as described below.

- Appropriate personal protective equipment will be worn by all personnel involved in the task, in order to limit personal exposure.
- Heavy equipment caked with drill cuttings, soil, or other material will be initially scraped or brushed to remove bulk soil.
- Heavy equipment will then be moved to the decontamination pad and sprayed with potable water using a high pressure washer.
- Heavy equipment will then be rinsed with potable water.
- During the decontamination effort, fluid systems should be inspected for any leaks or problems, which might potentially result in an inadvertent release at the site, thereby contributing to the volume of waste or contamination. Any identified problems should be immediately repaired and documented on the FADL. Decontamination of heavy equipment should be performed before moving equipment between SWMUs/AOCs or before leaving the site.
- Decontamination activities will be documented in the field log and/or appropriate form(s), as specified in the project work plans.
- Between boreholes at the same site, the back-end of the drilling rigs will be washed with potable water until surfaces are visibly free of soil buildup.

Borehole Abandonment
AMEC-07

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines and procedures for field personnel to use in the supervision of borehole or soil boring abandonment and groundwater monitoring well abandonment activities. Additional specific borehole and well abandonment procedures and requirements will be provided in the project work plans.

2.0 DEFINITIONS

Borehole Abandonment – The process whereby boreholes or soil borings are grouted or sealed following completion of drilling, sampling and/or logging.

3.0 PROCEDURE

This section contains responsibilities, procedures and requirements for borehole abandonment. Abandonment procedures to be used at a particular site must incorporate project-specific regulatory requirements. Consequently, the project work plans will identify the following:

- Abandonment objectives,
- Boreholes to be abandoned,
- Specific procedures for borehole abandonment beyond those covered in this SOP; and,
- Applicable site-specific regulatory requirements for borehole abandonment.

3.1 Responsibilities

Project Manager

The Project Manager is responsible for ensuring that all abandonment activities are conducted and documented in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC).

Field Manager

The Field Manager is responsible for periodically observing field activities and review of field generated documentation associated with this SOP. The Field Manger is also responsible for the implementation of corrective action (i.e., retraining personnel, additional review of work plans and SOPs, variances to the abandonment requirements, issuing nonconformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to borehole and well abandonment activities are responsible for completing their tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from the procedures to the Project Manager or Field Manager.

3.2 Abandonment of Boreholes

After drilling, logging and/or sampling, boreholes should be backfilled by the method required by the applicable agency and described in the project work plans. This typically consists of backfilling to the surface with bentonite chips, pellets or bentonite-cement grout. If bentonite chips or pellets are used, they should be added to the borehole in two feet lifts and hydrated with water from a potable water supply. This process should be repeated until the entire borehole is plugged using no less than five gallons water per ten feet of borehole. If bentonite grout is used the following guidelines should be followed:

- Bentonite should be thoroughly mixed into the grout and within the percentage range specified in the work plans. If not otherwise specified in the work plans, the cement-bentonite grout mixture should be of the following proportions: 94 pounds of Portland cement, 5 pounds of powdered bentonite and a maximum of 8 gallons of water. The grout is usually tremied into the hole; however, for selected boreholes (e.g., shallow borings well above the water table) at certain sites, the grout may be allowed to free fall. In either case, care must be taken to ensure the grout does not bridge, forming gaps or voids in the grout column.

- The volume of the borehole should be calculated and compared to the grout volume used during grouting to aid in verifying that bridging did not occur.

- When using a tremie to place grout in the borehole, the bottom of the tremie should be submerged into the grout column and withdrawn slowly as the hole fills with grout. If

allowing the grout to free fall (and not using a tremie), the grout should be poured slowly into the boring. The rise of the grout column should also be visually monitored or sounded with a weighted tape.

- If the method used to drill the boring utilized a drive casing, the casing should be slowly extracted during grouting such that the bottom of the casing does not come above the top of the grout column.

- During the grouting process, the drilling hands performing the task should be supervised to assure that potentially contaminating material (oil, grease, or fuels from gloves, pumps, hoses, et. al) does not enter the grout mix and that personnel are properly wearing personal protective equipment as specified in the project Health and Safety Plan.

- Following grouting, barriers should be placed over grouted boreholes as the grout is likely to settle in time, creating a physical hazard. Grouted boreholes will typically require at least a second visit to “top off” the hole.

- The surface hole condition should match the pre-drilling condition (asphalt, concrete, or smoothed flush with native surface), unless otherwise specified in the project work plans.

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APPENDIX C

MPPEH INSPECTION STANDARD OPERATING PROCEDURE AND INSTRUMENT CALIBRATION FORM

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MAGNETOMETER/METAL DETECTOR CHECK SHEET

SITE:			**CONTRACT:**	
TEAM#:			**TEAM LEADER:**	
INSTRUMENT TYPE:			**SERIAL#:**	
DATE	**OPERATIONAL CHECK**	**SAT**	**UNSAT**	REMARKS

1.0 RESPONSIBILITIES AND PROCEDURES.

AMEC will comply with the following procedures for processing Material Potentially Presenting an Explosive Hazard (MPPEH) for final disposition. The objective of these procedures is to ensure that an inspection procedure of the exterior and interior surfaces of all recovered MPPEH is in place to ensure these items do not present an explosive hazard. AMEC's responsibilities and procedures will be contained, or referenced, in the project work plan.

1.2 Unexploded Ordnance (UXO) Sweep Personnel:

Will only mark suspected items and will not be allowed to perform any assessment of a suspect item to determine its status.

1.3 Unexploded Ordnance (UXO) Tech I:

Can tentatively identify a located item as MPPEH, followed by a required confirmation by a UXO Tech II or III.

1.4 UXO Technician II will:

1.4.1 Perform a 100% inspection of each item as it is recovered and determine the following:

- Is the item a UXO, a DMM, munitions debris, or range related debris?
- Does the item contain explosives hazards or other dangerous fillers?
- Does the item require detonation?
- Does the item require demilitarization (demil) or venting to expose dangerous fillers?
- Does the item require draining of engine fluids, illuminating dials and other visible liquid hazardous, toxic or radiological waste (HTRW) materials?

1.4.2 Segregate items requiring demilitarization or venting procedures from those items ready for certification.

1.4.3 Items found to contain explosives hazards or other dangerous fillers will be processed in accordance with applicable procedures.

1.5 UXO Technician III (UXO Team Leader) will:

1.5.1 Perform a 100% re-inspection of all recovered items to determine if free of explosives hazards or other dangerous fillers and engine fluids, illuminating dials and other visible liquid HTRW materials?

1.5.2 Supervise detonation of items found to contain explosive hazards or other dangerous fillers and venting/demilitarization procedures.

1.5.3 Supervise the consolidation of MPPEH for containerization and sealing. Munitions Debris and Range-related Debris will be segregated.

1.6 UXO Quality Control Specialist (UXOQCS) will:

1.6.1 Conduct daily audits of the procedures used by UXO teams and individuals for processing MPPEH.

1.6.2 Perform and document random sampling (by pieces, volume or area) of all MPPEH collected from the various teams to ensure no items with explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials are identified as munitions debris or range-related debris as required for completion of the Requisition and Turn-in Document, DD Form 1348-1A.

1.7 UXO Site Safety Officer (UXOSO) will:

1.7.1 Ensure the specific procedures and responsibilities for processing MPPEH for certification as munitions debris or range-related debris specified in the work plan are being followed.

1.7.2 All procedures for processing MPPEH are being performed safely and consistent with applicable regulations and the approved Work Plan.

1.8 Senior UXO Supervisor (SUXOS) will:

1.8.1 Be responsible for ensuring work and Quality Control (QC) Plans specify the procedures and responsibilities for processing MPPEH for final disposition as munitions debris or range-related debris.

1.8.2 Ensure a Requisition and Turn-in Document, DD Form 1348-1A is completed for all munitions debris and range-related debris to be transferred for final disposition.

1.8.3 Perform random checks to satisfy that the munitions debris and range-related debris is free from explosive hazards necessary to complete the Form, DD 1348-1A.

1.8.4 Certify all munitions debris and range-related debris as free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials.

1.8.5 Be responsible for ensuring that inspected debris is secured in a closed, labeled and sealed container to prevent commingling and documented as follows;

- The container will be closed and clearly labeled on the outside with the following information: The first container will be labeled with a unique identification that will start with USACE/Installation Name/AMEC's Name/0001/Seal's unique identification and continue sequentially.

- The container will be closed in such a manner that a custody seal must be broken in order to open the container. A seal will bear the same unique identification number as the container or the container will be clearly marked with the seal's identification if different from the container.

- A documented description of the container will be provide by AMEC with the following information for each container; contents, weight of container; location where munitions or range-related debris was obtained; AMEC's name, names of certifying and verifying individuals; unique container identification; and seal identification, if required.

AMEC in a separate section of the final report will also provide these documents.

2.0 MPPEH CERTIFICATION AND VERIFICATION.

2.1 AMEC will ensure that MPPEH is properly inspected in accordance with the procedures in section 1.0 above. Only personnel who are qualified UXO personnel in accordance with DDESB TP18 will perform these inspections. The SUXOS will certify and the USACE OE Safety Specialist will verify that the debris is free of explosive hazards.

2.2 DD Form 1348-1A will be used as certification/verification documentation. All DD 1348-1As must clearly show the typed or printed names of the AMEC's SUXOS and the USACE OE Safety Specialist, organization, signature, and AMEC's home office and field office phone number(s) of the persons certifying and verifying the debris as free of explosive hazards.

2.2.1 Local directives and agreements may supplement these procedures. Coordination with the local concerns will identify any desired or requested supplementation to these procedures.

2.2.2 In addition to the data elements required and any locally agreed to directives, the DD 1348-1A must clearly indicate the following for scrap metal:

- Basic material content (Type of metal; e.g., steel or mixed)
- Estimated weight
- Unique identification of each of the containers and seals stated as being turned over.
- Location where munitions debris or range-related debris was obtained.
- Seal identification, if different from the unique identification of the sealed container.

2.2.3 The following certification/verification will be entered on each DD 1348-1A for turn over of munitions debris or range-related debris and will be signed by the SUXOS and the USACE OE Safety Specialist. This statement will be used on

any ranges where Range Related Debris is being processed along with munitions debris:

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

2.2.4 The following certification/verification will be entered on each 1348-1A for turn over of munitions debris and will be signed by the SUXOS and the USACE OE Safety Specialist on properties where only munitions debris is being processed:

> *"This certifies and verifies that the material listed has been 100 percent inspected and to the best of our knowledge and belief, are inert and/or free of explosives or related materials."*

3.0 MAINTAINING THE CHAIN OF CUSTODY AND FINAL DISPOSITION.

3.1 AMEC, in coordination with the Corps of Engineers and other DoD clients, will arrange for maintaining the chain of custody and final disposition of the certified and verified materials. The certified and verified material will only be released to an organization that will:

3.1.1 Upon receiving the unopened labeled containers each with its unique identified and unbroken seal ensuring a continued chained of custody, and after reviewing and concurring with all the provided supporting documentation, sign for having received and agreeing with the provided documentation that the sealed containers contained no explosive hazards when received. This will be signed on company letterhead and stating that the contents of these sealed containers will not be sold, traded or otherwise given to another party until the contents have been smelted and are only identifiable by their basic content.

3.1.2 Send notification and supporting documentation to the sealed container-generating contractor documenting the seal containers have been smelted and are now only identifiable by their basic content.

3.1.3 This document will be incorporated by AMEC into the final report as documentation for supporting the final disposition of munitions debris and range-related debris.

3.1.4 If the chain of custody is broken, the affected MPPEH must undergo a second 100 percent inspection, a second 100 percent re-inspection, and be documented to verify its explosives safety status (identified as either munitions debris or range related debris).

3.2 Material that has been documented as safe in no longer considered MPPEH as long as the chain of custody remains intact. A legible copy of inspection, re-inspection, and documentation must accompany the material through final disposition and be maintained for a period of 3 years thereafter.

4.0 MATERIAL THAT IS STILL MPPEH AFTER INSPECTION.

Material that is still MPPEH after inspection may be released only to a qualified receiver. The following must be accomplished prior to release of the property:

4.1 Ensure that MPPEH that has been documented as hazardous is only transferred or released to those entities that:

4.1.1 Have the licenses and permits required to receive, manage, or process the materials.

4.1.2 Have technical experts about the known or suspected explosive hazards associated with the MPPEH.

4.1.3 Are qualified to receive, manage, and process MPPEH in accordance with DoD Instruction 4140.62 (see Attachment B for the DoD Instruction).

4.1.4 Have personnel who are:

- Experienced in the management and processing of hazardous materials equivalent to the MPPEH.

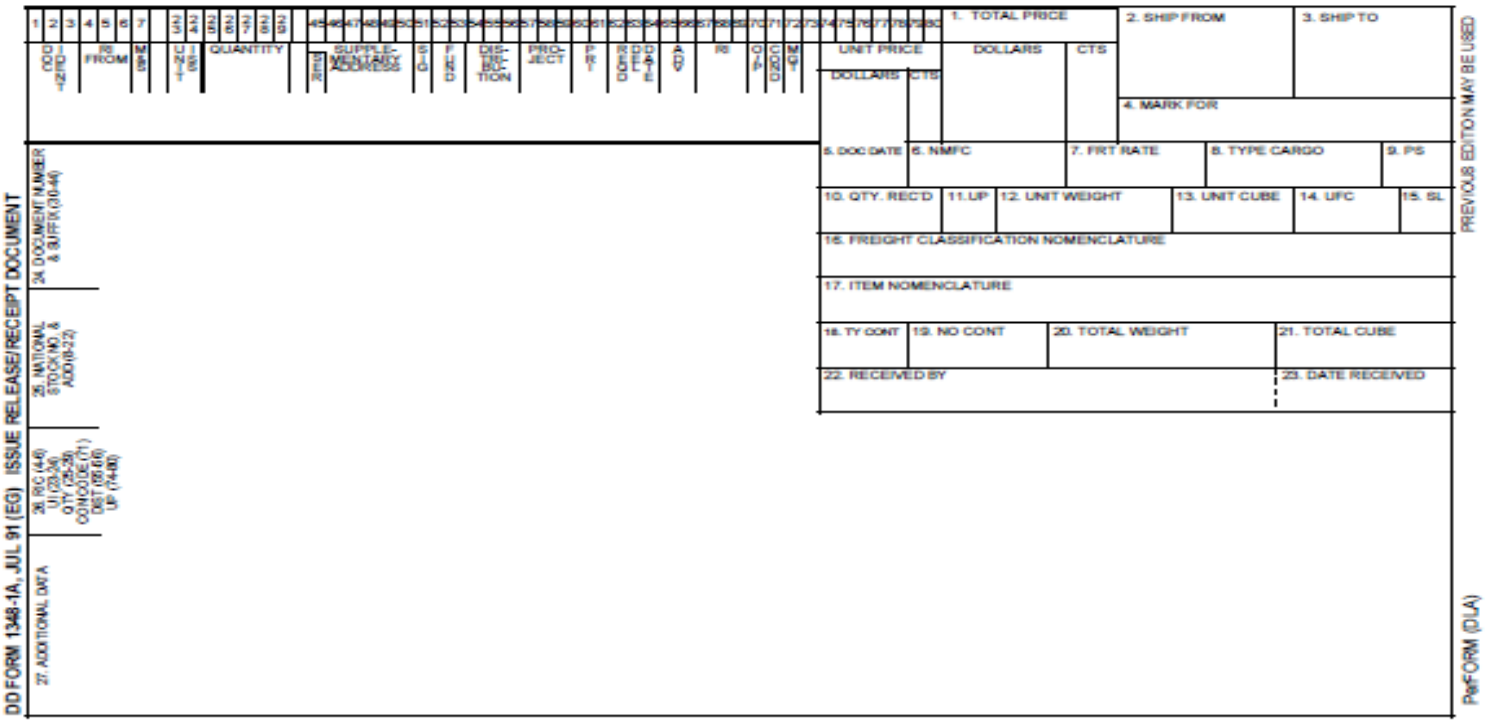
- Trained and experienced in the identification and safe handling of used and unused military and/or any potential explosive hazards that may be associated with the specific MPPEH.

4.2 The receiver must be advised of all of the potential hazards associated with the MPPEH and agree to receive and process the material IAW with DoD Instruction 4141.62.

4.3 All MPPEH shipments over public transportation routes must comply with DoD guidance that implements hazardous material transportation regulations.

4.4 Ensure that chain of custody and accountability records are maintained through final disposition of MPPEH. A legible copy of inspection, re-inspection, and documentation must accompany MPPEH through final disposition and be maintained for a period of 3 years thereafter.

ATTACHMENT A
Requisition and Turn-in Document
DD Form 1348-1



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ATTACHMENT B

DoD INSTRUCTION 4140.62

November 25, 2008

MATERIAL POTENTIALLY PRESENTING AN EXPLOSIVE HAZARD (MPPEH)

Department of Defense

INSTRUCTION

NUMBER 4140.62
November 25, 2008

USD(AT&L)

SUBJECT: Material Potentially Presenting an Explosive Hazard

References: See Enclosure 1

1. PURPOSE. This Instruction:

a. Reissues DoD Instruction (DoDI) 4140.62 (Reference (a)) in accordance with the authority in DoD Directives (DoDDs) 4140.1 and 5134.01 (References (b) and (c)) to update policy and responsibilities for the management and disposition of material potentially presenting an explosive hazard (MPPEH).

b. Authorizes other publications related to and supporting MPPEH including, but not limited to, a DoD Manual for the management and disposition of MPPEH.

2. APPLICABILITY. This Instruction:

a. Applies to OSD, the Military Departments, the Office of the Chairman of the Joint Chiefs of Staff and the Joint Staff, the Combatant Commands, the Office of the Inspector General of the Department of Defense, the Defense Agencies, the DoD Field Activities, and all other organizational entities within the Department of Defense (hereafter referred to collectively as the "DoD Components").

b. Applies to all MPPEH, material documented as an explosive hazard (MDEH), and material documented as safe (MDAS) under the control of the Department of Defense and its contractors, to the extent provided in contracts.

c. Does not apply to the transfer within or release from DoD control of military munitions that are to be used for their intended purpose. (See Glossary for definition of "transferred within or released from DoD control.")

d. Does not apply to persons outside of the Department of Defense other than defense contractors as provided in contracts.

3. DEFINITIONS. See Glossary.

4. POLICY. It is DoD policy to:

a. Manage MPPEH in a manner that supports operational readiness and mission requirements in accordance with DoDD 3200.15 (Reference (d)) and in compliance with supply chain materiel management policies (Reference (b)), explosives safety standards (DoD 6055.09-STD (Reference (e))), and environmental requirements (DoDD 4715.1E; DoDI 4715.4; DoDI 4715.6; and subpart M of part 266 of title 40, Code of Federal Regulations (References (f) through (i))), to the extent applicable.

b. By contract or other legal agreement, require compliance with MPPEH management procedures by all non-DoD entities that possess, manage, process, or provide disposition of MPPEH or MDEH for the Department of Defense.

c. As part of the MPPEH management process, manage:

(1) MDEH in such a manner as to prevent it from being:

(a) Commingled with MPPEH or MDAS.

(b) Misidentified as MPPEH or MDAS once the explosive hazards it presents have been determined.

(2) MDAS in such a manner as to prevent it from being:

(a) Commingled with MPPEH or MDEH.

(b) Misidentified as MPPEH or MDEH once it has been determined to be safe.

5. RESPONSIBILITIES. See Enclosure 2.

6. PROCEDURES. Enclosure 3 provides procedures for military munitions acquisition programs and for the management of MPPEH, including implementing guidance and demilitarization requirements.

7. RELEASABILITY. UNLIMITED. This Instruction is approved for public release. Copies may be obtained through the Internet from the DoD Issuances Web Site at http://www.dtic.mil/whs/directives.

8. EFFECTIVE DATE. This Instruction is effective immediately.

John J. Young, Jr.
Under Secretary of Defense for
Acquisition, Technology, and Logistics

Enclosures
1. References
2. Responsibilities
3. Procedures
Glossary

TABLE OF CONTENTS

ENCLOSURE 1

REFERENCES

(a) DoD Instruction 4140.62, "Management and Disposition of Material Potentially Presenting an Explosive Hazard (MPPEH)," December 3, 2004 (hereby canceled)
(b) DoD Directive 4140.1, "Supply Chain Materiel Management Policy," April 22, 2004
(c) DoD Directive 5134.01, "Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L))," December 9, 2005
(d) DoD Directive 3200.15, "Sustainment of Ranges and Operating Areas (OPAREAs)," January 10, 2003
(e) DoD 6055.09-STD, "DoD Ammunition and Explosives Safety Standards," February 29, 2008
(f) DoD Directive 4715.1E, "Environment, Safety, and Occupational Health (ESOH)," March 19, 2005
(g) DoD Instruction 4715.4, "Pollution Prevention," June 18, 1996
(h) DoD Instruction 4715.6, "Environmental Compliance," April 24, 1996
(i) Subpart M of part 266 of title 40, Code of Federal Regulations
(j) DoD 4100.39-M, "Federal Logistics Information System (FLIS) Procedures Manual – Glossary and Volumes 1-16," current edition
(k) DoD Directive 5160.65, "Single Manager for Conventional Ammunition (SMCA)," August 1, 2008
(l) DoD 4160.21-M-1, "Defense Demilitarization Manual," October 1, 1991
(m) DoD 4145.26-M, "DoD Contractors' Safety Manual for Ammunition and Explosives," March 13, 2008
(n) DoD Instruction 5160.68, "Single Manager for Conventional Ammunition (SMCA): Responsibilities of the SMCA and the Military Services," December 22, 2003
(o) DoD Explosives Safety Board Technical Paper 18, "Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel," December 20, 2004
(p) DoD 5100.76-M, "Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives," August 12, 2000
(q) DoD Instruction 6055.07, "Accident Investigation, Reporting, and Record Keeping," October 3, 2000
(r) Sections 2577 and 4690(c) of title 10, United States Code

ENCLOSURE 2

RESPONSIBILITIES

1. UNDER SECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY, AND LOGISTICS (USD(AT&L)). The USD(AT&L) shall oversee performance of the responsibilities specified in this Instruction, to include directing the Director, Defense Logistics Agency (DLA), to establish and approve demilitarization and disposition requirements for MPPEH, MDEH, and MDAS.

2. DEPUTY UNDER SECRETARY OF DEFENSE FOR INSTALLATIONS AND ENVIRONMENT (DUSD(I&E)). The DUSD(I&E), under the authority, direction, and control of the USD(AT&L), shall:

a. Have overall responsibility for and oversight of environmental, safety (including explosives safety), and occupational health matters related to implementation of this Instruction.

b. In coordination with the Deputy Under Secretary of Defense for Logistics and Material Readiness (DUSD(L&MR)), develop:

(1) MPPEH management procedures, including procedures for managing material for which the explosives safety status has been determined.

(2) Qualification standards for the DoD Components and personnel involved in storing, handling, processing (i.e., collecting, securing, sorting, segregating, inspecting, decontaminating, and demilitarizing), and transporting MPPEH.

(3) Qualification standards for non-DoD entities or individuals involved in processing MPPEH to which this Instruction applies.

c. Monitor implementation of this Instruction and issue additional guidance and direction as necessary.

3. DUSD(L&MR). The DUSD(L&MR), under the authority, direction, and control of the USD(AT&L), shall:

a. Ensure uniform implementation of MPPEH management procedures.

b. Monitor the effectiveness and efficiency of logistics systems related to implementation of this Instruction.

c. Ensure that DoD 4100.39-M (Reference (j)) provides cataloging data and turn-in requirements for used or demilitarized military munitions.

4. DIRECTOR, DEFENSE RESEARCH AND ENGINEERING (DDR&E). The DDR&E, under the authority, direction, and control of the USD(AT&L), shall act as the OSD proponent for technology that is required to:

a. Detect the presence of explosives on MPPEH and determine the composition of those explosives to allow a determination of whether any explosives present pose an explosive hazard.

b. Improve MPPEH processing.

5. DIRECTOR, DLA. The Director, DLA, under the authority, direction, and control of the DUSD(L&MR), shall, in coordination with the Military Services and the U.S. Army as the Single Manager for Conventional Munitions (SMCA) pursuant to DoDD 5160.65 (Reference (k)), establish demilitarization requirements for MPPEH, MDEH, and MDAS according to DoD 4160.21-M-1 (Reference (l)).

6. HEADS OF THE DoD COMPONENTS. The Heads of the DoD Components shall:

a. Comply with the requirements of this Instruction.

b. Control and manage MPPEH and MDEH to prevent its unauthorized use, transfer, or release.

c. Ensure the management of MPPEH, MDEH, and MDAS complies with supply chain materiel management policies (Reference (b)), explosives safety standards (Reference (e)), and environmental requirements (References (f) through (i)).

d. Ensure MPPEH management procedures are applied and MPPEH holding areas are included in local facility threat assessments.

e. Implement this Instruction and subsequent implementing guidance by providing necessary procedures, programs, and funds.

f. Establish a certification program that requires DoD Component personnel who have responsibilities associated with MPPEH, MDEH, and the determination of MDAS to meet the qualifications and requirements established in section 2 of Enclosure 3.

g. Ensure that contracts or other legal agreements with non-DoD entities for MPPEH possession, management, and processing require non-DoD entities to comply with MPPEH management procedures and DoD 4145.26-M (Reference (m)).

h. Ensure that the storage, handling, processing, and transportation of MPPEH and MDEH comply with the standards in Reference (e).

i. Coordinate with the Director, DLA, to establish demilitarization requirements for MPPEH, MDEH, and MDAS.

7. SECRETARY OF THE ARMY. The Secretary of the Army, as the SMCA, shall:

a. Dispose of and demilitarize military munitions within the DoD munitions management system. (See Reference (l) and DoDI 5160.68 (Reference (n)).)

b. Provide procedures to demilitarize unused SMCA-managed military munitions (Class V items) while complying with policy for demilitarization, disposal, and trade security.

8. CHAIR, DoD EXPLOSIVES SAFETY BOARD (DDESB). The DDESB Chair shall direct the DDESB in the development and recommendation of supplemental explosives safety standards for all activities associated with MPPEH and MDEH for submission through the DUSD(I&E) to the USD(AT&L) for approval.

ENCLOSURE 3

PROCEDURES

1. MILITARY MUNITIONS ACQUISITION PROGRAMS. Program managers for military munitions acquisition programs shall, in conformance with the MPPEH management procedures in section 2 of this enclosure, ensure that the program planning, design, and implementation include requirements to:

a. Eliminate or reduce, to the extent practical, potential explosive and environmental hazards remaining on or in used military munitions and associated material.

b. Document the expected level of explosive residue and other munitions' constituents that remain on used or demilitarized military munitions (e.g., cartridge casings, discarding sabots).

c. For MPPEH generated from munitions use, define specific demilitarization and disposal procedures that comply with applicable DoD explosives safety standards, trade security controls, and demilitarization requirements.

d. Seek continuous improvement in technology and procedures used to identify, manage, and process MPPEH through research, development, testing, and evaluation programs.

2. MPPEH MANAGEMENT PROCEDURES. MPPEH management procedures shall:

a. Establish a process that ensures unknown explosive hazards are not present when transferring MPPEH, MDEH, or MDAS within the Department of Defense, transferring MDEH to a qualified receiver, or releasing MDAS to the public.

(1) Visual inspections may be used when safety can be assured, but are not always sufficient for providing assurance that MPPEH does not present an explosive hazard. Other DDESB-approved means (e.g., thermal treatment) may have to be used to ensure that a release or transfer does not present an explosive hazard to a receiver. Demilitarization procedures established by DLA, the DoD Components, or the SCMA shall address when visual inspection is appropriate and the procedures that may be used to inspect or process MPPEH. Documentation requirements for inspections or processes conducted on MPPEH shall be included in the management procedures.

(2) For munitions debris and range-related debris, consideration shall be given to use of a closed-circuit process managed by a single entity that maintains a chain of custody from collection through release from DoD control as MDAS.

b. Require that the explosives safety status of material to be transferred within or released from DoD control be assessed and documented as either safe or as having known or suspected explosive hazards based on one of the following two conditions:

(1) After a 100-percent inspection and an independent 100-percent reinspection.

(2) After processing by a DDESB-approved means with an appropriate post-processing inspection.

c. Ensure that MPPEH and MDEH are transferred or released only to those DoD Components and personnel or non-DoD entities or individuals that:

(1) Have the licenses and permits required to receive, manage, and process the materials.

(2) Have technical expertise about the known or suspected explosive hazards associated with the MPPEH or MDEH being received.

(3) Are qualified to receive, manage, and process MPPEH or MDEH in accordance with this Instruction and any implementing guidance.

(4) Have personnel who are:

(a) Experienced in the management and processing of materials with explosive hazards equivalent to the MPPEH or MDEH being received.

(b) Trained and experienced in the identification and safe handling of used and unused military munitions and any potential explosive hazards that may be associated with the specific MPPEH or MDEH being received.

d. Require an explosives risk evaluation before allowing the DoD Components or non-DoD entities or individuals to receive, manage, or process MPPEH or MDEH. This explosives risk evaluation process will evaluate the adequacy of the receiver's management controls (e.g., training, oversight, record keeping) and operations (e.g., processing methods, equipment, storage facilities).

e. Ensure that only MDAS is released to the public.

f. Verify that a documented evaluation indicates that the receiver of MPPEH or MDEH meets the requirements of paragraph 2.c. of this enclosure prior to the transfer within or release from DoD control of such material. Personnel who inspect, process, or document material as safe or hazardous according to paragraph 2.b. of this enclosure shall:

(1) Be trained in:

(a) Recognition and safe handling of used and unused military munitions and specific types of MPPEH. When appropriate, such personnel shall be qualified according to DDESB Technical Paper 18 (Reference (o)) or trained in accordance with DoD Component policy and guidance for training and qualifying personnel who handle military munitions.

(b) Demilitarization and trade security controls and procedures that apply to MPPEH, MDEH, and MDAS that is to be released from DoD control.

(c) Identification, management (e.g., marking, segregating, securing), and processing (e.g., flash burning, complying with hazardous material and hazardous waste transportation regulations) requirements that apply to specific types of MPPEH or MDEH.

(2) Demonstrate or provide proof of adequate training and experience in the recognition and safe handling of used and unused military munitions and other MPPEH and in the processing of MPPEH.

(3) Be certified, in writing, by the DoD Component directly responsible for controlling the transfer or release of MPPEH, MDEH, or MDAS, as being technically qualified according to the standards provided in this Instruction and in DoD Component procedures for management of MPPEH to perform such functions and, in the case of contractor personnel, be certified in conformance with contract requirements.

(4) Inspect and reinspect, or process and inspect, and document material as either MDEH or MDAS.

g. Ensure the chain of custody remains intact through release from DoD control by ensuring that MPPEH awaiting documentation of its explosives safety status, MDEH, and MDAS are not commingled.

h. Ensure that containers and holding areas for material being processed are secured and clearly marked as to:

(1) The hazards, if any, that may be present.

(2) The inspection and reinspection (or processing and inspection) and documentation of the explosives safety status of the material present.

i. Require explosives safety siting approval for locations (MPPEH or MDEH processing points) used for MPPEH processing operations (e.g., consolidation, inspection, sorting, storage, transfer, release) in accordance with Reference (e) and DoD Component implementing regulations.

j. Minimize the quantity and time MPPEH is accumulated and retained at any location. (Under some circumstances the accumulation of MPPEH, including "speculative accumulation," or its movement from either an operational range or the site of use, could require its management as waste military munitions under applicable Federal or State requirements.)

k. Ensure that chain of custody is maintained until MDEH or MDAS is released from DoD control. A legible copy of the documentation of the determination of the material's explosives safety status shall accompany the material when it is transferred out of DoD control. This documentation shall be maintained by the generating DoD Component for a period of at least 3 years thereafter or any longer period required by DoD Component regulations. MDEH and MDAS are no longer considered to be MPPEH as long as the chain of custody remains intact.

(1) Documentation of the determination of the material's explosives safety status must state either that the material does not present an explosive hazard and is consequently safe from

release from DoD control. If a DoD Component or one of its contractors breaks the chain of custody, all affected material must undergo one of the processes in subparagraphs 3.d.(1) and 3.d.(2) and be redocumented according to the results to reestablish its explosives safety status.

(1) A second 100-percent inspection and a second independent 100-percent reinspection.

(2) Reprocessing by a DDESB-approved means with appropriate post-processing reinspection.

e. Ensure that any material transferred within or released from DoD control that presented an unintentional explosive hazard to either a qualified receiver or the public is investigated and reported.

(1) All such releases shall be reported to the releaser's chain of command or to the contracting officer's representative.

(2) Releases that present a condition or situation requiring immediate action to protect DoD personnel or the public and that meet the reporting criteria in DoD 5100.76-M (Reference (p)) shall be reported in accordance with Reference (p) with a copy provided to the DUSD(I&E).

(3) Explosives incidents or accidents shall be reported in accordance with DoDI 6055.07 (Reference (q)).

f. Ensure that commands and organizations, when possible, manage and process (e.g., sort, vent, inspect, segregate, secure) MPPEH on the operational range or at the point of use to minimize handling and transport prior to processing and to facilitate disposition. (The movement of some MPPEH from either the operational range or the site of use could require its management as waste military munitions under applicable Federal or State requirements in certain circumstances.)

g. Ensure that commands and organizations seek to minimize transfer of explosive residue or munitions constituents from MPPEH into the environment during the management and disposition process.

h. Ensure that commands and organizations use DDESB or equivalent DoD Component-approved procedures to vent all internal cavities of MPPEH before transfer or release as part of the disposition process. This requirement is waived when the receiver meets the requirements of paragraph 2.c. and, when applicable, paragraph 2.d. of this enclosure. When internal cavities are not vented, the qualified receiver must be notified in writing of their existence and of the potential explosive hazards.

i. Ensure that commands and organizations that manage MPPEH recognize that much of the material considered to be MPPEH has salvage value, that this value shall be recovered to the extent required by the Department of Defense and applicable laws and regulations, and that funds realized from the sale of recyclable materials must be credited to the appropriate accounts according to section 2577 or section 4690(c) of title 10, United States Code (Reference (r)).

j. Ensure that shipments of MDEH and MDAS over public transportation routes comply with Reference (e) and DoD guidance that implements hazardous material transportation regulations, to the extent applicable.

k. For MPPEH transferred within or released from DoD control, ensure that the determination of whether material is hazardous waste or hazardous material, and its subsequent management, complies with all applicable Federal or State requirements.

4. DEMILITARIZATION REQUIREMENTS. Demilitarization requirements developed pursuant to paragraphs 5 and 6.i. of Enclosure 2 shall address:

a. Used military munitions and associated material.

b. Containers and packaging materials for military munitions.

c. Equipment used to manufacture, produce, maintain, renovate, demilitarize, or dispose of military munitions.

GLOSSARY

PART I. ABBREVIATIONS AND ACRONYMS

DDESB	Department of Defense Explosives Safety Board
DDR&E	Director, Defense Research and Engineering
DLA	Defense Logistics Agency
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DUSD(I&E)	Deputy Under Secretary of Defense for Installations and Environment
DUSD(L&MR)	Deputy Under Secretary of Defense for Logistics and Material Readiness
MDAS	material documented as safe
MDEH	material documented as an explosive hazard
MPPEH	material potentially presenting an explosive hazard
SMCA	Single Manager for Conventional Munitions
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology, and Logistics

PART II. DEFINITIONS

Unless otherwise noted, these terms and their definitions are for the purpose of this Instruction.

explosive hazard. Defined in Reference (e).

MDAS. MPPEH that has been assessed and documented as not presenting an explosive hazard and for which the chain of custody has been established and maintained. This material is no longer considered to be MPPEH.

MDEH. (Formerly referred to as material documented as hazardous, or MDAH.) MPPEH that cannot be documented as MDAS, that has been assessed and documented as to the maximum explosive hazards the material is known or suspected to present, and for which the chain of custody has been established and maintained. This material is no longer considered to be MPPEH. (The MDEH characterization only addresses the explosives safety status of the material. See paragraph 3.k. of Enclosure 3.)

MPPEH. Material owned or controlled by the Department of Defense that, prior to determination of its explosives safety status, potentially contains explosives or munitions (e.g., munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris) or potentially contains a high enough concentration of explosives that the material presents an explosive hazard (e.g., equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated with munitions

production, demilitarization, or disposal operations). Excluded from MPPEH are munitions within the DoD-established munitions management system and other items that may present explosion hazards (e.g., gasoline cans and compressed gas cylinders) that are not munitions and are not intended for use as munitions.

transferred within or released from DoD control. A receiver has acknowledged receipt of MDEH or MDAS material by signed documentation (e.g., DD Form 1348-1A, "Issue Release/Receipt Document," or an equivalent document) and has taken physical custody of the MDEH or MDAS from the Department of Defense.

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APPENDIX D

FIELD FORMS

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DAILY QUALITY CONTROL REPORT

Project Name:
Contract Number:
Delivery Order:
Site Location:
Date:
AMEC Contact:

Activities Conducted:

Equipment Calibrations:

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date	Comments

DRILLING LOG

CLIENT					HOLE NUMBER		
DRILL SUBCONTRACTOR					SHEET of	SHEETS	
PROJECT / PROJECT NUMBER				MANUFACTURER'S DESIGN OF DRILL			
NAME OF DRILLER(S)				SITE NAME			
SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT				HOLE LOCATION			
				SURFACE ELEVATION			
				DATE STARTED		DATE COMPLETED	
OVERBURDEN THICKNESS		DEPTH DRILLED INTO ROCK		TOTAL DEPTH OF HOLE		DEPTH OF GROUNDWATER ENCOUNTERED	
DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED				OTHER WATER LEVEL MEASUREMENTS (SPECIFY)			
GEOTECHNICAL SAMPLES		DISTURBED		UNDISTURBED		TOTAL NUMBER OF CORE BOXES	
SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS		OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	TOTAL CORE RECOVERY
DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL		OTHER (SPECIFY)	SIGNATURE OF INSPECTOR		
LOCATION SKETCH/COMMENTS						SCALE	

SITE NAME	HOLE NO.

DRILLING LOG (CONTINUATION SHEET)

DISTRICT	HOLE NUMBER
PROJECT / PROJECT NUMBER	INSPECTOR
SHEET of SHEETS	

ELEV (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	HNU SCREENING RESULTS (PPM) (d)	PUSH / SAMPLE INTERVAL (e)	ANALYTICAL SAMPLE NO (f)	USCS (g)	REMARKS (h)

SITE NAME

HOLE NO.

amec

Environment & Infrastructure

Chain of Custody Record/Analysis Request

Temperature of samples upon lab arrival: _____

Issuing AMEC Office:

AMEC Office Address: 9725 Cogdill Road
Knoxville, TN 37932

Project Name:

Job No.:

Project Manager:

Phone No.: (865) 671-6774

Sampler (s):

Laboratory Name/Address:

Contact:

Phone:

Fax:

Station ID	Sample ID	Time Collected	Date Collected	Sample Type (reg, dup, eqb, ms, msd)	Matrix (soil, sed, gw, sw)	Depth	ANALYSIS										NOTES
Preservative (HCl, HNO_3, Ice, etc.)																	
Total # of Containers																	

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	Comments:
Signature:	Signature:	Signature:	
Printed Name:	Printed Name:	Printed Name:	
Firm:	Firm:	Firm:	
Date/Time:	Date/Time:	Date/Time:	

GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: _____ **Project No.:** _____

Location: _____ **Personnel:** _____

Weather Conditions: _____ **Measuring Device:** Water Level Indicator / Inter-phase probe

Remarks: _____

Well Number	Date	Time	Total Well Depth (feet)*	Water Level Indicator Reading (feet)*	Free Product (feet)*	Comments

* All measurements to the nearest 0.01 foot

GROUNDWATER SAMPLE LOG SHEET

Facility Name: _____
Project No.: _____
Well Depth: _____
Depth to Water: _____
Water Column: _____
Well Casing Diameter & Material: _____
One Casing Volume: _____
Three Casing Volumes: _____
Start Purge: _____
End Purge: _____
Total Purge TIme: _____

Well ID: _____
Date: _____
Weather: _____

PURGE DATA:

Time	Pumping Rate (L/min)	Water Level (ft)	Volume Pumped (L)	pH	S.C. (uS/cm)	Temp. (^{o}C)	Turbidity (NTU)	DO (mg/L)	Salinity	ORP (mV)

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected

OBSERVATIONS / NOTES:

Quality Samples:

MS/MSD:
Duplicate ID No.:

Signature(s):

Calibration Form

Project Name:
Project Number:
Investigation Site:

	Before Calibration						After Calibration						
Date/Time (24hr)	pH (SU)	Conductivity (mS/m)	Turbidity (NTU)	Temp (C)	Salinity (%)	ORP/Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	Temp (C)	Salinity (%)	ORP/Eh (mV)	Initials of Person Calibrating

Sample Collection Log

Project Name: _____
Project Number: _____
Investigation Site: _____
Sample Number: _____

Collection Date: _____
Collection Time: _____
COC Number: _____

Soil Samples
Sample Interval bgs (ft): _____
Headspace Reading (ppm): _____
Purpose: **Chemical** **Geotechnical**
Sample Composited after VOC Collection: **YES** **NO**

Sample Analytical Parameter	Analytical Method

Collected by: _____
Logged by: _____
Reviewed by: _____

DESCRIPTION:
_____
_____
_____
_____

Sample Location Sketch/Comments:

VARIANCE REQUEST FORM

Variance #:	**DATE**	
LOCATION:	**Client Representative:**	

1. Description (items involved, submit sketch, if applicable): (Use Continuation Sheet if Necessary)

2. Reason for Change (Use Continuation Sheet is Necessary)

3. Recommended Disposition (Submit sketch, if applicable): (Use Continuation Sheet if Necessary)

Preparer of Variance Form (Print name and sign)	Preparer's Title	Date
AMEC Project Manager (Print name and sign)	Accepted (Y/N)	Date
AMEC Quality Manager (Print name and sign)	Accepted (Y/N)	Date
ANG Project Manager (Print name and sign)	Accepted (Y/N)	Date

XRF Calibration Form

Site Name: _____ City, State: _____

Project No: _____ Client Name: _____ Cost Code: _____

1. Initial Calibration Data: Date: _____ Check XRF Clock

Is XRF warm-up >15 Min? **Yes** **No** Time: _____ Agree? **Yes** **No**

Internal calibration complete? **Yes** **No** Comments: _____

Record energy resolution: _____eV_____ Source Strength: _____mCi

---

2. Start-of-Day Calibration: Note: Cd-109 will be used for Pb, Cu calibration; Am-241 will be used for Sb.

Sources Used (check all that apply): ☐ Cd-109 ☐ Fe-55 ☐ Am-241

Blank - SiO_2, Count: _____sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	<DLs Accept?
Pb	<25		
Cu	<50		
Ni	<70		

Other metals: Zn(<40) _____, As (<30) ____,

Hg(<35) ____, Cr(<300) ____

Moderate Lead-NIST 2711, Count: ___sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	% RPD Accept?
Pb	1,162		
Cu	114		
Ni	<70		

Other metals: Zn(350.4) _____, As (105) ____,

Hg(<35) ____, Cr(<300) ____

Low Lead-NIST 2586, Count: ___sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	% RPD Accept?
Pb	432		
Cu	81 *		
Ni	75 *		

Other metals: Zn(352) _____, As (18.9) ____,

Hg(<35) ____, Cr(301) ____

High Lead-NIST 2710, Count: ___sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	% RPD Accept?
Pb	5,532		
Cu	2,950		
Ni	14.3		

Other metals: Zn(6,952) _____, As (626) ____,

Hg(32.6) ____, Cr(<300) ____

Comments: * Not a NIST certified value.

XRF Calibration Form (continued)

Site Name: _____ City, State: _____

Project No: _____ Client Name: _____ Cost Code: _____

3a. Continuing Calibration Data: Date: _____ Check XRF Clock.

Is XRF warm-up >15 Min? **Yes** **No** Time: _____ Agree? **Yes** **No**

Internal calibration complete? Yes No Comments: _____

Record energy resolution: _____eV_____ Source Strength: _____mCi

---

3b. Continuing Calibration Data: Date: _____ Check XRF Clock.

Is XRF warm-up >15 Min? **Yes** **No** Time: _____ Agree? **Yes** **No**

Internal calibration complete? **Yes** **No** Comments: _____

Record energy resolution: _____eV_____

XRF Calibration Form (continued)

Site Name: _____ City, State: _____

Project No: _____ Client Name: _____ Cost Code: _____

4. End-of-Day Calibration: Date: _____ Check XRF Clock

Is XRF warm-up >15 Min? **Yes** **No** Time: _____ Agree? **Yes** **No**

Internal calibration complete? **Yes** **No** Comments: _____

Record energy resolution: _____eV Source Strength: _____mCi

Blank - SiO_2, Count: _____sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	<DLs Accept?
Pb	<25		
Cu	<50		
Ni	<70		

Other metals: Zn(<40) _____, As (<30) ____, Hg(<35) ____, Cr(<300) ____

Moderate Lead-NIST 2711, Count: ___sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	% RPD Accept?
Pb	1,162		
Cu	114		
Ni	<70		

Other metals: Zn(350.4) _____, As (105) ____, Hg(<35) ____, Cr(<300) ____

Low Lead-NIST 2586, Count: ____sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	% RPD Accept?
Pb	432		
Cu	81 *		
Ni	75 *		

Other metals: Zn(352) _____, As (18.9) ____, Hg(<35) ____, Cr(301) ____

High Lead-NIST 2710, Count: ____sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	% RPD Accept?
Pb	5,532		
Cu	2,950		
Ni	14.3		

Other metals: Zn(6,952) _____, As (626) ____, Hg(32.6) ____, Cr(<300) ____

Comments: * Not a NIST certified value.

Form Completed By:

_____

Signature Date

XRF Sample Collection Form

Site Name: _____ State: ____

Location ID		Sampling Data		Prep			XRF Data		Conc (ppm)					Split to	Other
Location	No.	Date	Time	Pan	Lab	Frag?	Read No.	Count (sec)	Pb	Std	Cu	Std	Other Metals	Lab	Comments

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APPENDIX E

ACCIDENT PREVENTION PLAN

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FINAL

ACCIDENT PREVENTION PLAN FOR THE NON-TIME CRITICAL REMOVAL ACTION

174th ATTACK WING
NEW YORK AIR NATIONAL GUARD
HANCOCK FIELD AIR NATIONAL GUARD BASE
SYRACUSE, NEW YORK

MILITARY MUNITIONS RESPONSE PROGRAM
CONTRACT NO. W9128F-10-D-0059-0001

Prepared for:

Air National Guard Readiness Center
Joint Base Andrews, Maryland

Prepared and presented by:

US Army Corps of Engineers, Omaha District
CENWO-PM-HA
1616 Capitol Avenue, Suite 9000
Omaha, Nebraska

DECEMBER 18, 2013

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ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
AMEC	AMEC Environment & Infrastructure, Inc.
ANSI	American National Standards Institute
APP	Accident Prevention Plan
BEIs®	Biological Exposure Indices
bgs	below ground surface
bpm	beats per minute
CFR	Code of Federal Regulations
CM	Construction Manager
CPR	cardiopulmonary resuscitation
CRZ	contaminant reduction zone
CY	cubic yards
dBA	decibels
°F	degrees Fahrenheit
DPT	direct-push technology
EC	Emergency Coordinator
EMS	emergency medical services
EZ	Exclusion Zone
FM	Field Manager
ft	foot or feet
GFCI	Ground fault circuit interrupters
Hancock Field	Hancock Air National Guard Base
HAZCOM	Hazard Communication
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	high efficiency particulate air
HPS	Hantavirus Pulmonary Syndrome
HSE	Health, Safety, and Environment
IDLH	immediately dangerous to life or health
kV	kilovolt
MD	munitions debris
MEC	munitions and explosives of concern
mg/m^3	milligram(s) per cubic meter
mm	millimeter(s)
MRA	Munitions Response Area

MRS	Munitions Response Site
MSDS	Material Safety Data Sheet
NIOSH	National Institute for Occupational Safety and Health
NRR	Noise Reduction Rating
NTCRA	Non-Time Critical Removal Action
NWS	National Weather Service
OSHA	Occupational Health and Safety Administration
OV	organic vapor
PEL	Permissible Exposure Limit
PID	photo ionization detector
PM	Project Manager
PPE	personal protective equipment
ppm	parts per million
SOP	standard operating procedure
SSHO	Site Safety and Health Officer
TLV	Threshold Limit Value
TWA	Time Weighted Average
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compounds
XRF	x-ray fluorescence

1.0 SIGNATURE SHEET

Prepared by: _____ Date: February 15, 2013

Approved by: _____ Date: February 15, 2013

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2.0 BACKGROUND INFORMATION

2.1 Contractor

AMEC Environment & Infrastructure, Inc. (AMEC)
9725 Cogdill Road
Knoxville, TN 37932
Phone: 865.671.6774
Fax: 865.671.6254

2.2 Contract Number

W9128F-10-D-0059, Task Order 0001

2.3 Project Name

Non-Time Critical Removal Action (NTCRA), Hancock Air National Guard Base (Hancock Field), Syracuse, New York (Figure 2-1).

2.4 Project Description

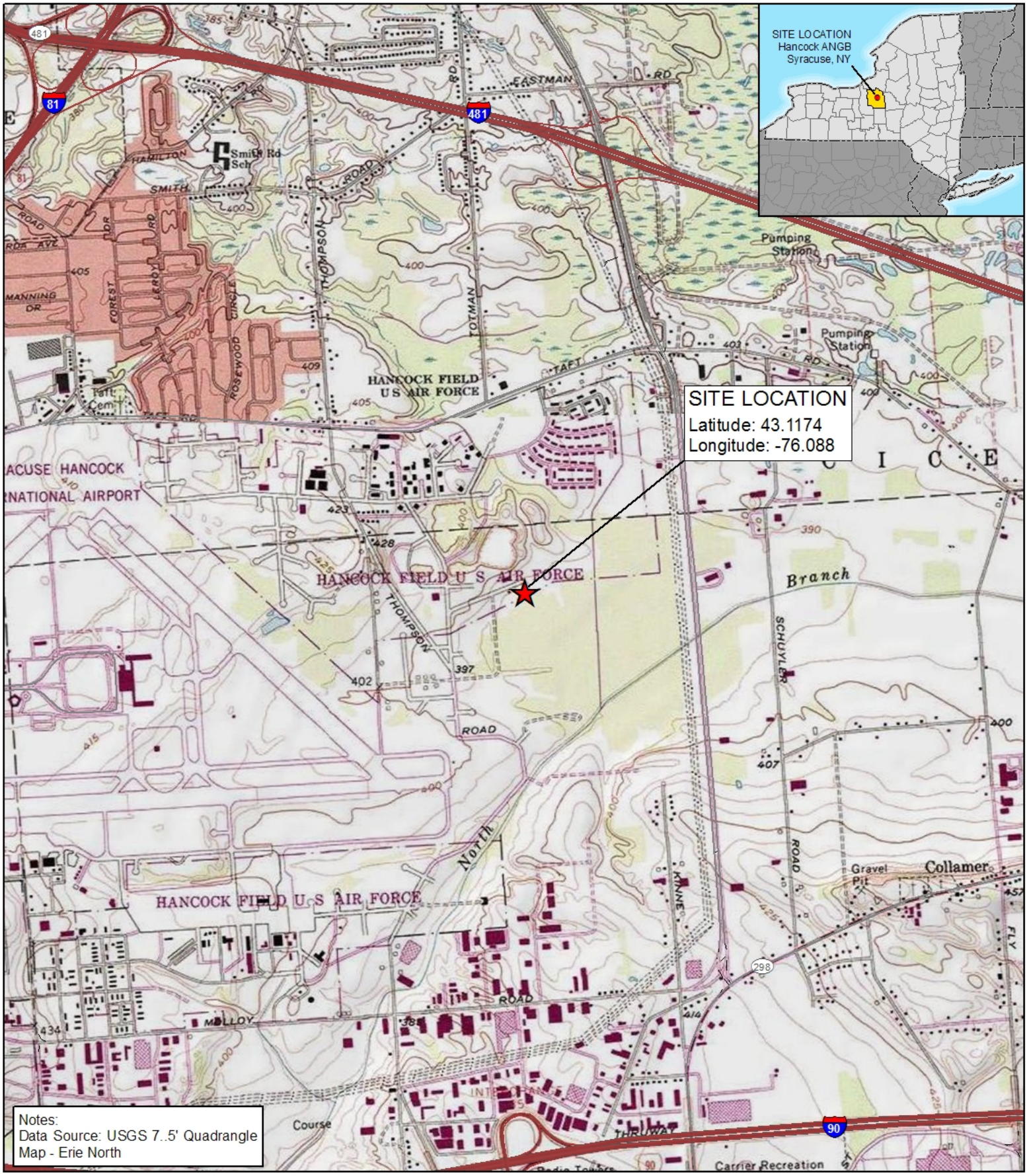
2.4.1 Overview

This project will primarily involve the excavation, transport, and disposal of approximately 1,875 cubic yards (CY) of impacted soil within MRSs SR001 and SR002. In addition, 40-millimeter (mm) practice grenade debris will be removed from the approximately 1.27 acres practice grenade range. The location of Hancock Field and MRSs SR001 and SR002 are shown on Figure 2-2. Site Maps are provided on Figures 2-3 (SR001) and 2-4 (SR002).

2.4.2 Scope of Work

This NTCRA will be conducted during one phase of work. Field activities will include:

- Site preparation (e.g., vegetation removal);
- Visual inspection;
- Demolition of target range structures at MRS SR001 and portions of the Firing-In Buttress at MRS SR002;
- Advancement of seven soil borings using a direct-push technology (DPT) drill rig to install temporary wells;
- Collection of groundwater samples for analysis of total and dissolved antimony, arsenic, copper, iron, and zinc;
- Collection of soil samples from MRSs SR001 and SR002 for waste characterization analyses;



New York Air National Guard
Syracuse, New York

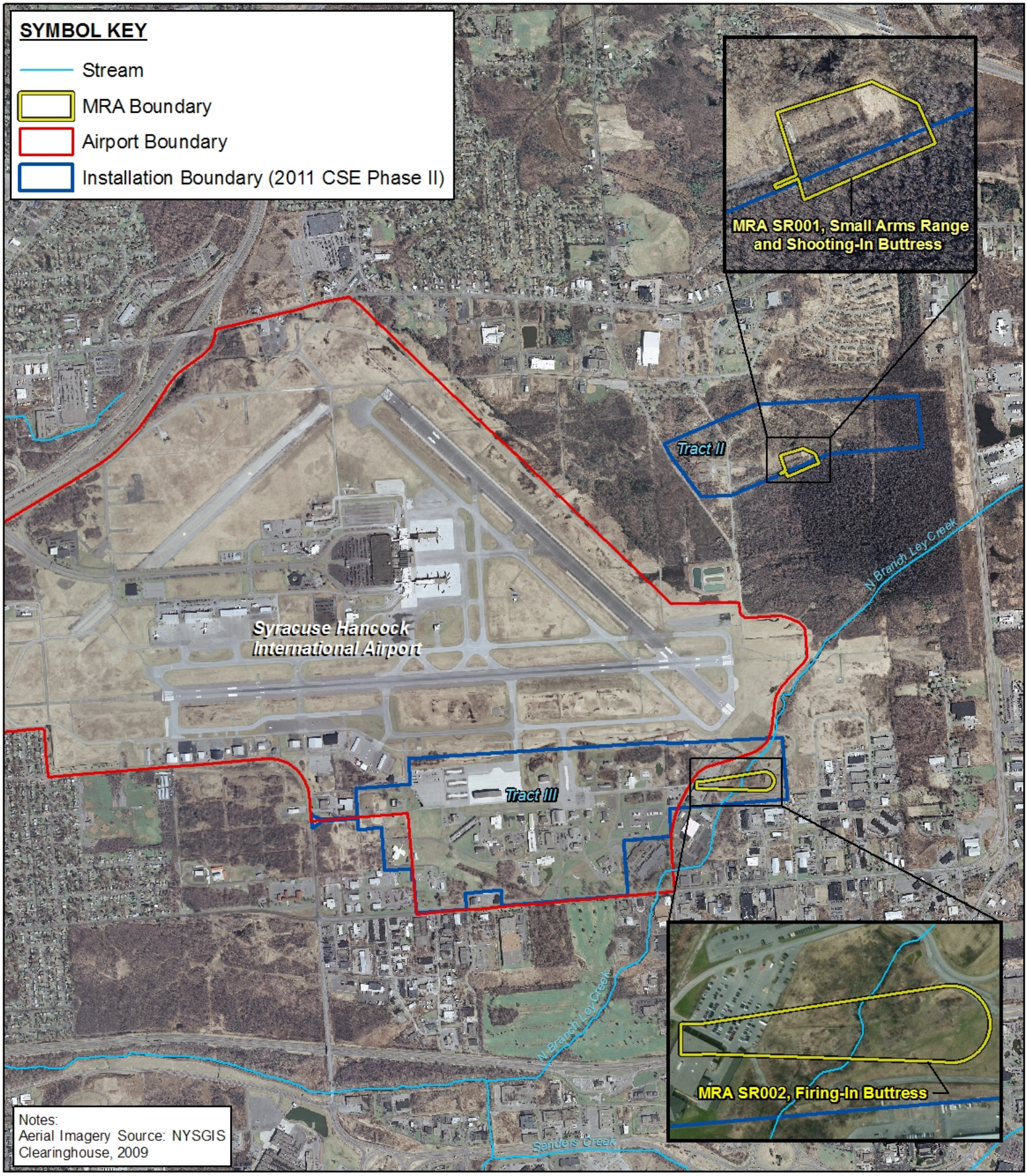
N

FIGURE 2-1
Installation Location Map
Accident Prevention Plan
174th Fighter Wing, Hancock Field Air National Guard Base - Syracuse, NY

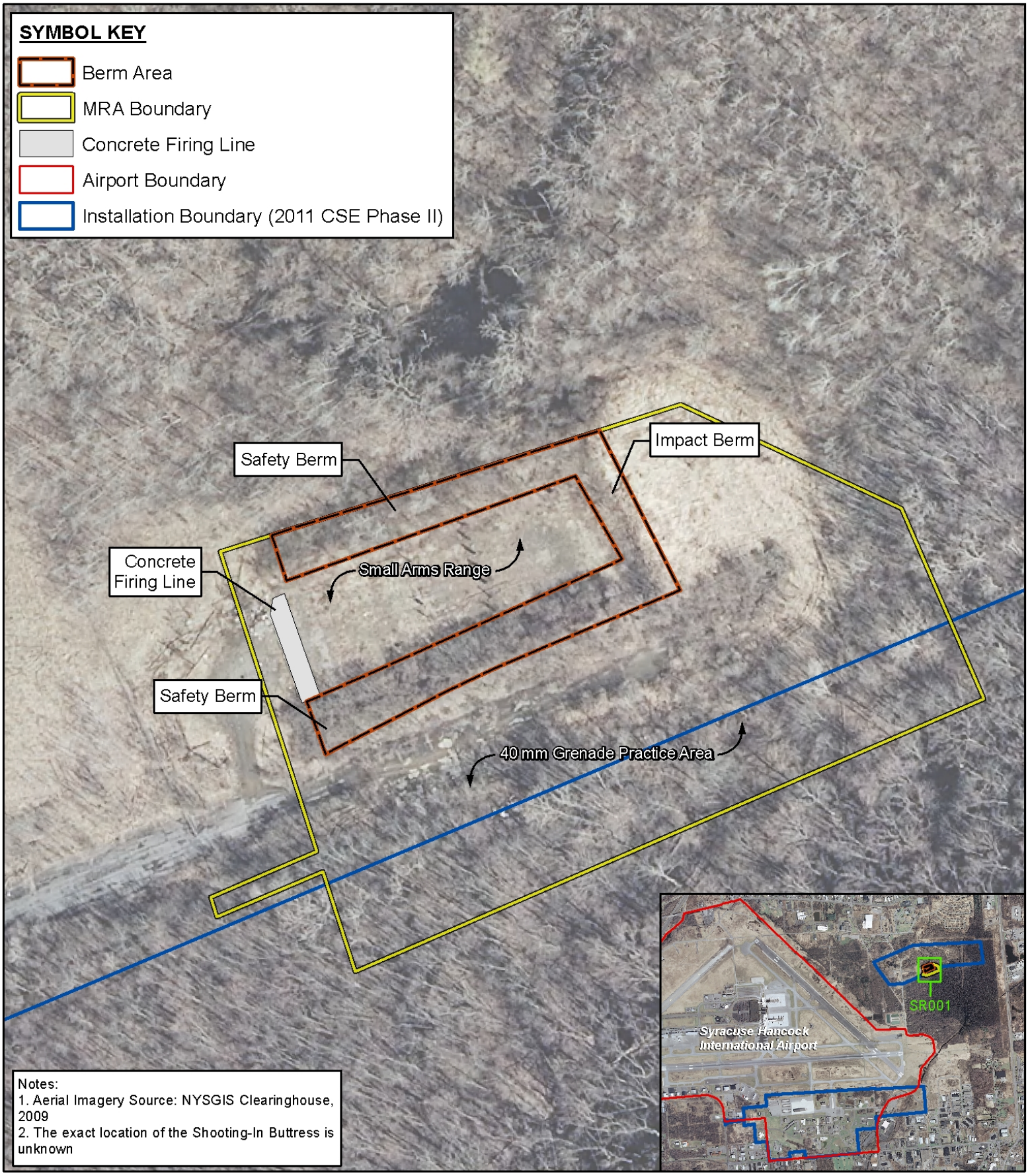
0 0.5 1 2 Kilometers

0 0.25 0.5 1 1.5 Miles

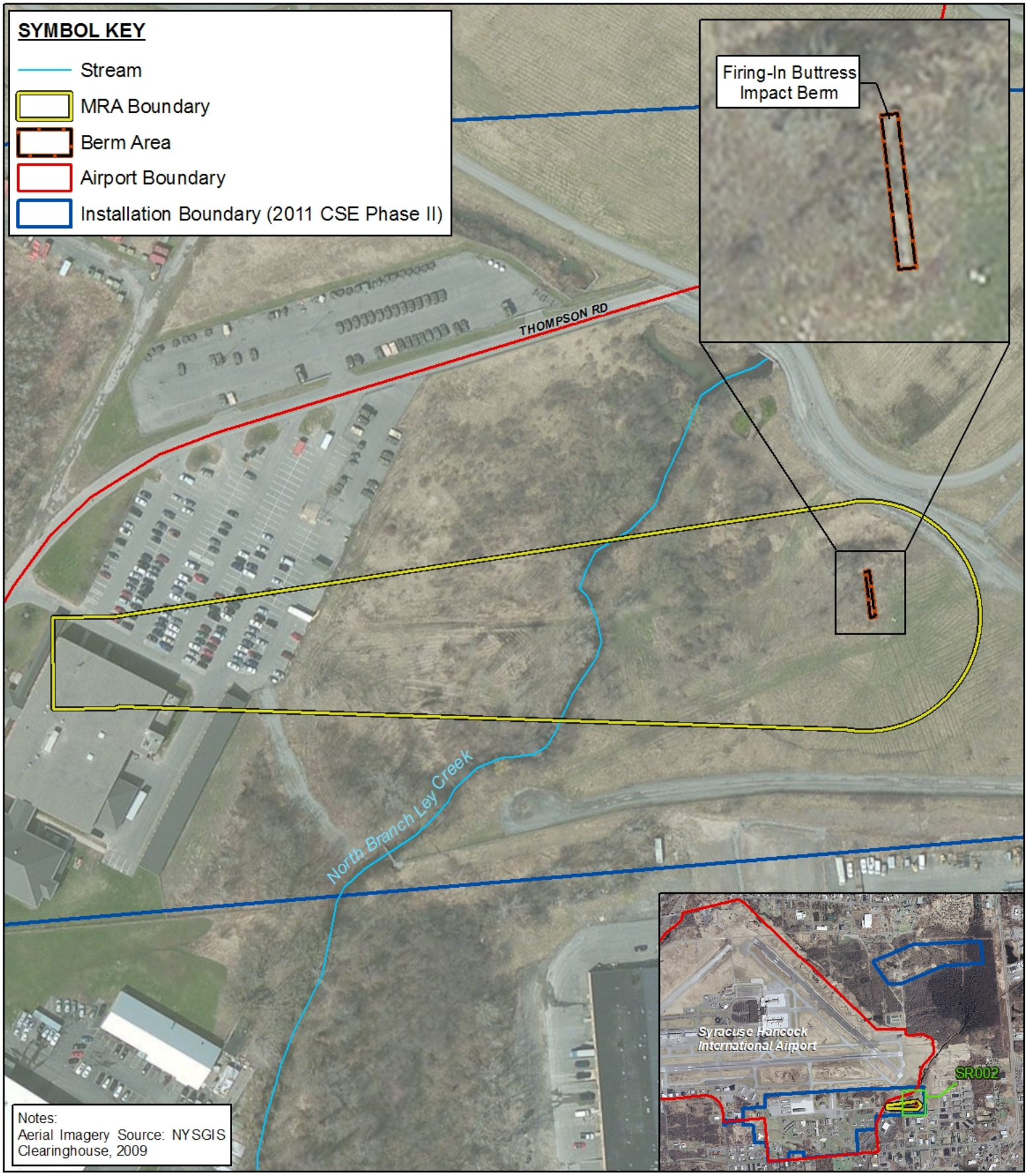
06/25/2012	File: ANG_Hancock_Installation_Loc_APP.mxd	
PROJ: 912810001	Drawn: JBO	2-2



New York Air National Guard Syracuse, New York		N	**FIGURE 2-2** **Site Location Map** Accident Prevention Plan 174th Fighter Wing, Hancock Field Air National Guard Base - Syracuse, NY
0 0.5 1 2 Kilometers 0 0.25 0.5 1 1.5 Miles	06/25/2012	File: ANG_Hancock_Site_Loc_Map_MRS_APP.mxd	
	PROJ: 912810001	Drawn: JBO	2-3



New York Air National Guard **Syracuse, New York**		N	**FIGURE 2-3** **MRA SR001 - Site Map** Accident Prevention Plan 174th Fighter Wing, Hancock Field Air National Guard Base - Syracuse, NY
0 50 100 200 300 400 Feet 0 25 50 100 Meters	03/12/2013	File: ANG_Hancock_Site_Map_SR0001_APP.mxd	
	PROJ: 912810001	Drawn: JBO	2-4



New York Air National Guard
Syracuse, New York

N

FIGURE 2-4
MRA SR002 - Site Map
Accident Prevention Plan
174th Fighter Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 75 150 300 450 600 Feet
0 25 50 100 150 200 Meters

06/25/2012	File: ANG_Hancock_Site_Map_SR0002_APP.mxd	
PROJ: 912810001	Drawn: JBO	2-5

- A technology-aided 40-mm practice grenade debris pickup on approximately 1.27 acres of land to identify and remove identified munitions debris (MD) items that are 1 square inch or larger;
- Excavation, transport, and disposal of approximately 1,875 CY of impacted soil within MRSs SR001 and SR002;
- The collection of confirmation samples, using increment sampling techniques, to verify that the full extent of impacted soil has been removed; and,
- Site restoration.

2.5 Accident Experience

AMEC maintains the experience modification rates from calendar years 2009 through 2012 as detailed below.

Rating Effective Date	Mod Factor
5/1/2012	.53
5/1/2011	.55
5/1/2010	.57
5/1/2009	.61

2.6 Phases of Work Requiring Activity Hazard Analyses

The following work activities have been identified for this project:

- Mobilization/demobilization;
- Vegetation removal;
- Demolition of site structures;
- Advancement of borings and collection of soil samples using DPT;
- Groundwater sampling;
- Technology-aided MD pickup; and,
- Excavation of impacted soil;

At a minimum, each work activity requires the completion of an Activity Hazard Analysis (AHA) to be submitted to the project manager (PM) for approval prior to starting the activity. The approved AHAs are included in Appendix A and will remain accessible on the project site for viewing by site personnel and will be included as part of training during field operations.

Based upon the findings from previous investigations, SR001 and SR002 do not present a munitions and explosives of concern (MEC) risk. However, if MEC items are identified during the soil removal activities or surface debris removal during MPPEH inspection, the USACE PM will be notified to determine the appropriate course of action for the site.

3.0 STATEMENT OF SAFETY AND HEALTH POLICY

AMEC considers effective safety, health, and environmental management to be of prime importance to its business and is committed to continuous improvement in performance in all of these areas. The corporate health and safety policy statement is provided in Appendix B.

AMEC will:

- Employ both the leadership and management structure required to deliver this policy and ensure a complete, unbroken chain of responsibility and accountability for health, safety, and the environment.
- Comply with all relevant legislative requirements and AMEC policy pertaining to health, safety, and the environment as its minimum standard.
- Pursue high standards of health, safety, and environmental management as an integral part of efficient management ensures that all business decision s take proper account of health, safety, and environmental implications.
- Develop, implement, maintain, and monitor a health, safety, and environmental management system consistent with the AMEC Framework.
- Develop procedures that, in particular, provide for:
  - Systems of work that minimize risks to health, safety, and the environment;
  - Workforce engagement and consultation;
  - Suitable arrangements for the selection, use, handling, storage, and transport of articles and substances;
  - Adequate information, instruction, training, and supervision to enable work to be carried out safely and without risk to the environment by persons with the necessary competence;
  - Safe premises and work places, including access to and egress from them;
  - Safe and healthy working environments with adequate hygiene facilities;
  - Designs which fully consider their health, safety, and environmental impact in construction, operation, maintenance, decommissioning, and disposal;
  - Engagement of and consultation with the supply chain;
  - Minimization of polluting emissions to air, land, or water;
  - Efficient use of natural resources;
  - Control of dust, noise, odor, vibration, traffic movement or other nuisance or environmental effects which may harm or cause offence to the local community or environment;

  - Waste minimization and management of waste disposal including recycling where appropriate;
  - Organizational learning with regards to health, safety, and environmental matters; and,
  - Competent safety and occupational health and environmental advice.
- Set and monitor, clear safety, health and environmental performance indicators that encompass both leading and lagging measures, including as a minimum:
  - Accident and frequency rates; and,
  - Attainment of annual safety, health, and environmental objectives.
- Review and, if necessary, revise this policy on an annual basis.

The AMEC President has overall responsibility for implementing this policy and ensuring compliance with all local legislation. It is the responsibility of all employees to implement this policy together by discharging their collective and individual responsibilities, as set out in the AMEC Framework.

4.0 RESPONSIBILITIES AND LINES OF AUTHORITY

4.1 Project Personnel and Responsibilities

Personnel shall be aware of site organization and the responsibilities and qualifications of each organization member. The general responsibilities of project personnel are discussed below.

Project Manager

The PM has overall health and safety responsibility and is responsible for regulatory compliance and the safety and health of employees working on the project. Specific responsibilities include:

- Understanding the safety and health requirements of the contracted tasks, and when necessary, seeks assistance from the Site Safety and Health Officer (SSHO);
- Ensuring that project personnel meet regulatory and medical requirements; and,
- Ensuring prompt reporting of incidents to the SSHO, including the completion of AMEC's Near Miss or Incident Reports (Appendix C).

Field Manager

The Field Manager (FM) is the primary contact for the Project Team. The FM is responsible for ensuring that field personnel, including subcontractors, are in conformance with the Accident Prevention Plan (APP). The FM is responsible for reviewing field reports, and interfacing with the Project Health, Safety, and Environment (HSE) Manager and/or the SSHO regarding resolution of health and safety problems/concerns. The FM will function as the Construction Manager (CM).

The CM is responsible for the administration and implementation of the safety program for the project including the following:

- Adhering to and enforcing the requirements of the APP;
- Providing for the safe operation of facilities, equipment, and vehicles under their control during the project;
- Participating in the completion of investigation and corrective action reports;
- Reviewing the APP, in consultation with the SSHO and Corporate HSE Director;
- Enforcing project rules and procedures for the safe performance of the project team's work, including initiating any required disciplinary actions;
- Taking prudent measures to reduce hazards or to correct unsafe conditions or actions when made aware of such unsafe or potentially unsafe work conditions;

- Directing comprehensive initial kick-off safety meeting and daily tailgate safety meetings to discuss operations and health and safety precautions and review emergency procedures; and,
- Performing the duties of the Emergency Coordinator (EC) during emergencies.

The FM reports to the PM, who has the authority to make appropriate changes or cease work. The FM may also function as the SSHO, as defined below.

Health, Safety, and Environment Director

The AMEC HSE Director will be a primary point of contact for any incidents that arise during work activities.

Site Safety and Health Officer

The SSHO reports to the FM and is responsible for implementing the APP in the field. The SSHO directly advises the FM on all aspects of health and safety on-site and advises the FM of conditions that may require work to be ceased or of any changes in operations in the event that worker or public health or safety is threatened. The SSHO has the authority to correct any situation where noncompliance with the APP is noted and to stop work in cases where an immediate danger is perceived. Specific responsibilities include:

- Conducting a daily tailgate safety meeting;
- Ensure daily inspections of site and planned tasks that will be documented as part of the Safety Inspection (Appendix C);
- Implementing the policies and procedures addressed in the pre-entry safety meeting;
- Procuring and distributing PPE and maintaining documentation of PPE use;
- Upgrading or downgrading levels of protection as described in the APP, or stopping work and ordering personnel to evacuate the site in situations where immediate hazards are identified;
- Notifying the PM and SHE Director of all noncompliance and immediately dangerous situations;
- Initiating emergency action procedure notifications;
- Modifying the APP as dictated by changing site conditions with approval of the PM and SHE Director; and,
- Maintaining documentation as required by the APP, including but are not limited to:
  - Hazard Assessment Forms;
  - Instrument Calibration Forms;
  - Near Miss Reports;

- Incident Reports;
- Safety Inspections Forms;
- Tailgate Meeting Attendance Forms; and,
- Training certificates.

Project Field Team

The Project Field Team is responsible for the completion of various site tasks, complying with aspects of the APP, and reporting any accidents or injuries up through the appropriate chain of command. Specific responsibilities include:

- Following AMEC's Six Safety Essentials and AMEC Global Rules;
- Following AMEC's health and safety management program;
- Adhering to daily safety guidance and practices;
- Following the safe work permit system;
- Reading and compiling with the site-specific APP including attachments, Records of Change, and amendments;
- Attending and participating in the tailgate safety meetings;
- Meets all training, retraining, and medical monitoring requirements;
- Immediately reports injuries, near-misses, suspected exposures, and exposure symptoms to the SSHO or FM;
- Using the buddy system;
- Using safety equipment in accordance with training and instructions;
- Continuously looking for health and safety hazards and unsafe acts and reports them to the SSHO or FM for corrective action;
- Maintaining a high level of safety awareness – when in doubt, follows the safest course of action; refuses unsafe work; and,
- Knowing and observing any medical restrictions placed on his/her activities (such as corrective lenses or lifting limitations) and informing the SSHO of those restrictions.

Whenever AMEC field personnel work at an uncontrolled hazardous waste site under Occupational Safety and Health Administration (OSHA) regulations, the field team is required to be fully trained and medically certified in adherence with 29 Code of Federal Regulations (CFR) 1910.120, 29 CFR 1926.65, and the Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard. One individual will be designated as the FM to direct field activities. All hazardous waste project field personnel are additionally responsible for the following:

- Reasonable health maintenance procedures must be maintained. Employees must realize that some personal habits, such as alcohol consumption, smoking, or controlled substance

abuse, heighten the risks and deleterious effects resulting from exposure to contaminants and may create a hazard to the health and safety of fellow workers. Therefore, working at a hazardous waste site while under the influence of alcohol or controlled substances is strictly forbidden.

- Employees must refrain from activities that would create additional hazards during fieldwork including smoking, eating, chewing tobacco or gum, or drinking in contaminated areas.

4.2 Lines of Authority

Management personnel are responsible for ensuring that all aspects of the workplace, including offices and project locations, are safe and that any risks, hazards, and safety violations brought to their attention are investigated and corrected. Associates and subcontractors are responsible for complying with AMEC's health and safety policies, programs, and standards, and for conducting their work safely and without detriment to themselves, other employees, or property. Compliance with this policy is mandatory. Willful violation of this policy will be considered cause for disciplinary action up to and including termination.

5.0 SUBCONTRACTORS AND SUPPLIERS

5.1 Subcontractor/Supplier Coordination and Control

Oversight of subcontractors and suppliers will be conducted by the FM and the SSHO. The SSHO will screen subcontractors for safety performance and will be responsible for their safety performance during site activities. A copy of the APP will be present and available at the project site at all times.

5.2 Subcontractor/Supplier Safety Responsibilities

Each subcontractor is responsible for compliance with applicable federal, state, local, and AMEC health and safety requirements. Subcontractors who perform work for AMEC under this APP are responsible for the health and safety of their employees. It is the responsibility of individual subcontractors to implement an appropriate health and safety program for their employees that, at a minimum, includes the requirements of this APP. The subcontractor health and safety program will include, as appropriate:

- Compliance with 29 CFR 1910.120 (OSHA) guidelines regarding 40-hour HAZWOPER training and/or 24-hour awareness training;
- Medical monitoring, medical examination for fitness to work including respirator use pursuant to 29 CFR 1910.134, if required,
- Supplying personal protective equipment (PPE) (coveralls, respirators, boots, gloves, etc.) as required by site conditions; and,
- Compliance with 29 CFR 1926 (OSHA Construction Standard).

Copies documenting the above training and programs will be kept on-site by individual contractors and available upon request.

Site visitors are responsible for following the APP and visiting the site in a safe and responsible manner. Subcontractor visitors shall be approved by the PM and coordinated with the AMEC FM. Visitors shall check in with the PM and FM prior to entering the site and utilize a Sign-In/Sign-Out Form (Appendix C).

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6.0 TRAINING

6.1 General Training

The FM and SSHO are responsible for informing site personnel and visitors of the contents of this APP and ensuring that each person signs the APP and Training Acknowledgment Forms (Appendix C) prior to working on-site. Training documentation will be reviewed by the SSHO and filed on-site.

Authorized visitors shall receive a safety briefing from the designated SSHO prior to accessing the site. The safety briefing will inform visitors of the potential hazards and site-specific procedures appropriate to site areas they intend to visit. The briefing shall also include emergency action plan procedures.

6.2 Safety Meetings

Personnel shall be provided continuous health and safety training as appropriate to ensure that work is being performed in a safe manner. The SSHO shall conduct a daily safety meeting to discuss health and safety considerations for each day's activities, pertinent aspects of AHAs, necessary PPE, problems encountered during the previous day, and new operations. Attendance records and meeting notes will be maintained for each day's meeting and will be filed on-site.

6.3 Site-Specific Training

Prior to beginning fieldwork, personnel covered by this APP (e.g., field personnel, subcontractors, authorized visitors, etc.) shall attend the pre-entry briefing covering the contents of this APP. The briefing shall be conducted by the SSHO or designated representative. Attendance shall be documented by the SSHO on the APP Acknowledgement Form (Appendix C). By signing the APP Compliance Agreement Form, personnel acknowledge that they have attended the briefing, understand the potential safety and health hazards as described in this APP, and agree to perform work according to the requirements outlined in this APP. During the APP review, the FM/SSHO will discuss specific tasks to be performed and the objectives of the project. This initial review will be supplemented, as needed, with daily, pre-task reviews, which will include the review of pertinent AHAs (Appendix A); Material Safety Data Sheets (MSDSs) and other applicable documents with intended task participants. The following topics will be addressed during the briefing:

- Names of the SSHO and the designated alternate;
- Safety, health, and other potential hazards;
- Task activities to be performed;

- Hazardous chemicals that may be encountered;
- Monitoring instrumentation;
- Hazard Communication (HAZCOM) Program;
- Physical hazards that may be encountered;
- PPE requirements;
- Proper use of assigned PPE, including respiratory protection if required;
- Action levels requiring upgrade/downgrades;
- Site controls and safety rules;
- Special training requirements and safe work practices;
- Emergency communication signals, codes, and location of telephone numbers;
- Emergency procedures for injuries, fires, and hazardous materials incidents; and,
- Emergency routes.

6.4 Hazard Communication

Employees working with hazardous materials shall receive training in accordance with the HAZCOM Standard, 29 CFR 1926.59. The HAZCOM program elements are addressed in Section 12.3 of this APP.

6.5 First Aid and Cardiopulmonary Resuscitation

At least two field personnel will be currently certified in both basic first aid and cardiopulmonary resuscitation (CPR) by the American Red Cross or equivalent organization. The designated first aid/CPR-trained personnel will also have the required blood-borne pathogen training.

6.6 Mandatory Training and Certifications

In addition to the training and certification detailed above, the following will also be required:

- Personnel operating motor vehicles shall hold a valid operator's license from the state in which they reside.
- Certification and recertification requirements for first aid and CPR are applicable. First Aid and CPR training/certification must be made by a reputable provider, such as the American Red Cross or American Heart Association. Proof of qualifications shall be maintained on-site.
- Following the completion of the 40-hour training, personnel are required to complete annual 8-hour HAZWOPER refresher training. Copies of personnel training certificates shall be provided to the SSHO for inclusion in the site records.

- In addition to the initial 40-hour HAZWOPER training, the PM and SSHO will have completed the 8-hour Supervisor/Manager HAZWOPER training. The course provides managers with specific safety and health responsibilities in accordance with the requirements of 29 CFR 1910.120(e)(4).
- In compliance with OSHA 29 CFR 1926.650 subpart P regulations, training will be required for workers and supervisors who work in excavations. At least one person who is trained as a competent person will be on-site during excavation activities.
- Unexploded Ordnance personnel will meet the requirements of Department of Defense Explosives Safety Board TP-18.

6.7 Emergency Response Training

On-site personnel will be trained on pertinent sections of the emergency response procedures as outlined in the Emergency Response Plan, Section 12.2 of this APP.

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7.0 SAFETY AND HEALTH INSPECTIONS

Upon mobilization, the SSHO will establish an inspection schedule that will efficiently cover the inspection requirements for field operations, as outlined in Table 7-1. The SSHO will be responsible for conducting the required inspections as outlined in Table 7-1 with the support of the FM. Requirements for safety inspections include:

- The SSHO will complete daily safety inspections of active work sites to identify and correct hazards using the Safety Inspection Form (Appendix C).
- Contractor quality control personnel, as part of their quality control responsibilities, shall also conduct and document daily safety inspections.
- The SSHO will record identified safety and health issues and will indicate the deficiencies and actions, timetable, and responsibility for correction of deficiencies. The SSHO will conduct follow-up inspections to correct identified deficiencies and will document these inspections.

Table 7-1. Operation Inspections
Hancock Field Air National Guard Base, Syracuse, New York

Description	Amount	Type	Frequency
Equipment Inspection	1	Visual Observation	Daily
Personal Protection	1	Visual Observation	Daily
Safe Work Practices	1	Visual Observation	Daily
Site Security and Control	1	Visual Observation	Daily
Site Housekeeping	1	Visual Observation	Daily
Emergency Response/First Aid Equipment	1	Visual Observation	Weekly

Before machinery or mechanized equipment is used on-site, it will be inspected in accordance with the manufacturer's recommendations. Tools and machinery will be inspected daily or before each use to identify defects. Machinery containing liquid systems (e.g., fuel, hydraulic, lubrication) will be inspected daily to ensure that liquid-containing systems (e.g., hoses, tubing, hydraulic lines) are in good operating condition and that plugs, stoppers, valves, etc., are properly seated. Daily inspections shall be documented on the Safety Inspection Form. Defective or unsafe machinery must be tagged with "Do Not Use" or "Defective Do Not Use" tags until repaired or otherwise made acceptable. Defective or unsafe equipment must be removed to a secure place to prevent inadvertent use until repaired. Repaired items must be re-inspected by the SSHO before being placed back into service.

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8.0 SAFETY AND HEALTH EXPECTATIONS, INCENTIVE PROGRAMS, AND COMPLIANCE

Our objective is a safety and health program that will reduce the number of injuries and illnesses to an absolute minimum, not merely in keeping with, but also surpassing, the best experience of operations similar to ours. Our goal is zero accidents and injuries.

8.1 Company Safety Vision and Culture

Beyond Zero, AMEC's Vision of Success in Safety, is more than having zero incidents at work. Safety must be integrated into all AMEC operations and taken beyond the workplace into our homes, communities, and our families. If safety stops the moment you leave work, we have not done our job. AMEC is not a company that is prepared to stand still but is committed to the continuous improvement of our health and safety performance.

8.1.1 Safety Policy

The key elements of AMEC's safety policy are:

- Accidents and injuries can be prevented;
- Management and staff are responsible for preventing injuries and occupational illnesses;
- Occupational safety and health is part of every employee's total job performance;
- Working safely is a condition of employment;
- Workplace hazards can be safeguarded;
- Training employees to work safely is essential and is the responsibility of management/supervision; and,
- Prevention of personal injuries and accidents and protection of environment is good business.

8.1.2 AMEC Six Safety Essentials

The Six Safety Essentials are designed to support the safe execution of work in each of our operating locations with the development of a "common set of behaviors" that we can all share. AMEC, in our goal to be recognized as a world-class leader in safety must strive to ensure our daily overall consistency of health and safety standards, leadership, and performance.

Always Take Care

Be observant, take your time, and think safety first. Nothing we do is so important that we cannot take time to do it safely.

Follow the Rules

Safety procedures are designed to stop you from getting hurt. Ignoring them is unacceptable. If a procedure is unclear or unworkable, then you must inform your supervisor.

Do a Risk Assessment

Before starting work, a risk assessment is required for identifying potential hazards and selected control measures must be in place. If you are unsure, ask your supervisor. Risk assessments associated with routine tasks should be re-examined regularly.

You Must Intervene

If you believe your safety, or the safety of others, is being compromised, you have a right and obligation to intervene to stop and correct the work. You have our support to exercise this right without any repercussions.

Manage Any Change

If there is a change or deviation to the planned activity, you must stop the job and re-evaluate the risk assessment and the precautions taken.

Wear the Correct PPE

You must ensure that when you undertake any work, you wear the full PPE correctly as identified in the risk assessment for that specific task.

8.2 AMEC Safety Incentives Program

Safety performance incentives may be awarded based on terms agreed to in the project contract.

8.3 Noncompliance

Associates and subcontractors are responsible for complying with AMEC's health and safety policies, programs, and standards, and for conducting their work safely and without detriment to themselves, other employees, or property. Compliance with this policy is mandatory. Willful violation of this policy will be considered cause for disciplinary action up to and including termination.

8.4 Managers and Supervisors Safety Accountability

AMEC managers are responsible for the health and safety of personnel under their supervision and for managing the risks associated with equipment and facilities under their control. Depending on the complexity of the project, the responsibilities listed below may be delegated to the FM. The PM or FM:

- Has overall responsibility for ensuring compliance with and enforces the applicable health and safety legislation, regulations, and AMEC health and safety and client programs at the project;
- Provides active health and safety leadership by participation, example, and demonstrated interest in the health and safety program;
- Takes prudent measures to reduce hazards or to correct unsafe conditions or actions when made aware of such unsafe or potentially unsafe work conditions;
- Suspends any operation that threatens the health or safety of team members or the surrounding population, and immediately notifying the Corporate HSE Department;
- Follows and actively promotes AMEC Six Safety Essentials and AMEC Global Rules;
- Provides for active worker participation in the project health and safety program; provides information, instruction and training to an employee necessary for the protection of the safety and health of the employee and the environment;
- Advises an employee of the existence of any potential or actual danger to the health or safety of which project management is aware;
- Coordinates AMEC health and safety program on multi-employer project site with the all parties, including the Client, project owner, and subcontractors, depending on AMEC's project role;
- Assesses risks and identifies, prioritizes, and controls hazards on the project, prior to starting work activities and during work activities;
- Establishes the necessary level of health and safety planning for the project and provides for the APP preparation, review, approval and implementation; develops, implements and maintains programs, procedures and practices specific to the project for the protection of the safety and health of the employee, subcontractor, public, and the environment;
- Complies with the APP, in consultation with the SSHO and Corporate HSE Department; supports the SSHO in conducting his/her duties;
- Communicates AMEC health and safety requirements to subcontractors and ensures their compliance;
- Conducts or participates in regular safety inspections and initiates and completes corrective actions for hazards found;
- Conducts periodic safety meetings with AMEC employees and subcontractors, including pre-construction and kick-off meetings;
- Provides and maintains safety services, tools, machinery, equipment, and PPE as required by safety regulations;
- Initiates an effective HAZCOM Program;

- Provides leadership in timely reporting and managing of incidents; organizes and maintains record keeping; investigates incidents to determine root causes, takes appropriate action to prevent a reoccurrence or similar occurrence, and provides leadership in developing and implementing corrective actions;
- Provides for required posting, signage, site control and sanitation;
- Performs the duties of the EC during emergencies; and,
- Identifies hazardous materials to which an AMEC employee, subcontractors, or public may be exposed on a project; where hazardous materials are present, implements the Hazardous Materials Control Program.

9.0 ACCIDENT REPORTING

The purpose of the Incident Investigation Program is to identify the causes of and prevent a reoccurrence of incidents, injuries, and illnesses and to establish a standard for the investigation, recording and reporting of incidents.

Project personnel are required to report all near misses, injuries, illnesses, and accidents to their immediate supervisor. The SSHO will immediately arrange appropriate medical care as required. Once medical care for the injured personnel has been accomplished, the SSHO will prepare an incident report using the appropriate forms [i.e., the U.S. Army Corps of Engineers (USACE) Accident Investigation Report ENG Form 3394 and the AMEC Accident Reporting Form]. These completed forms must be transmitted to the AMEC PM, HSE Coordinator, and the USACE headquarters within 24 hours of the occurrence. Records will be maintained in the project file.

Incidents will be investigated as soon as possible to ensure that important evidence is not destroyed, removed, or forgotten. Investigations will be conducted for the following types of incidences:

- Fatalities;
- Lost time accidents and illnesses;
- Accident and illnesses resulting in medical aid;
- Accidents and illnesses resulting in first aid;
- Accidents resulting in significant damage to property or the environment;
- Near misses;
- Environmental releases or spills;
- Equipment and vehicle damage;
- Other property damage; and,
- Fires.

Investigations are the responsibility of FM. The FM will assemble a team of site people to investigate the incident. The investigation team may consist of:

- Management representative;
- Supervisor; and,
- Safety personnel.

The investigation team will include the legal department in the event of a serious physical injury or fatality.

Note: The AMEC HSE Director shall be a member of the investigation team for all fatal accidents. The director may also attend the investigation of serious incidents at his/her discretion, or at the invitation of the business unit manager.

The Corporate HSE Department (with the legal assistance) will review investigation reports for incidents involving serious physical injury or death before distribution. File the report with the Joint HSE Committee, appropriate business unit management, AMEC Corporate HSE Department, AMEC private legal council, and the appropriate government agencies.

For serious injuries or accidents that occur at a work site, the contractor, subcontractor, or employer responsible for that work site is required to notify the safety regulatory agency of the time, place, and nature of the injury or accident. The injuries or accidents that may require to be reported are:

- An injury or accident that results in death (to be reported within 8 hours);
- Three or more employees injured as a result of a single incident (to be reported within 8 hours);
- Employee admitted into a hospital for 2 or more days as a result of an accident or injury;
- An unplanned or uncontrolled explosion, fire, or flood that causes a serious injury or that has the potential of causing a serious injury;
- The collapse or upset of a crane, derrick, or hoist;
- The collapse or failure of any component of a building or structure necessary for the structural integrity of the building or structure; and,
- If an injury or accident occurs at a work site or any other accident that has the potential of causing serious injury the prime subcontractor or employer responsible for that work site is required to:
  - Carry out an investigation into the circumstances surrounding the serious injury or accident; and,
  - Prepare a report outlining the circumstances of the accident or injury and the corrective actions taken to prevent the situation from happening again.

10.0 MEDICAL SUPPORT

10.1 On-Site Medical Support

The following addresses first aid and medical facilities:

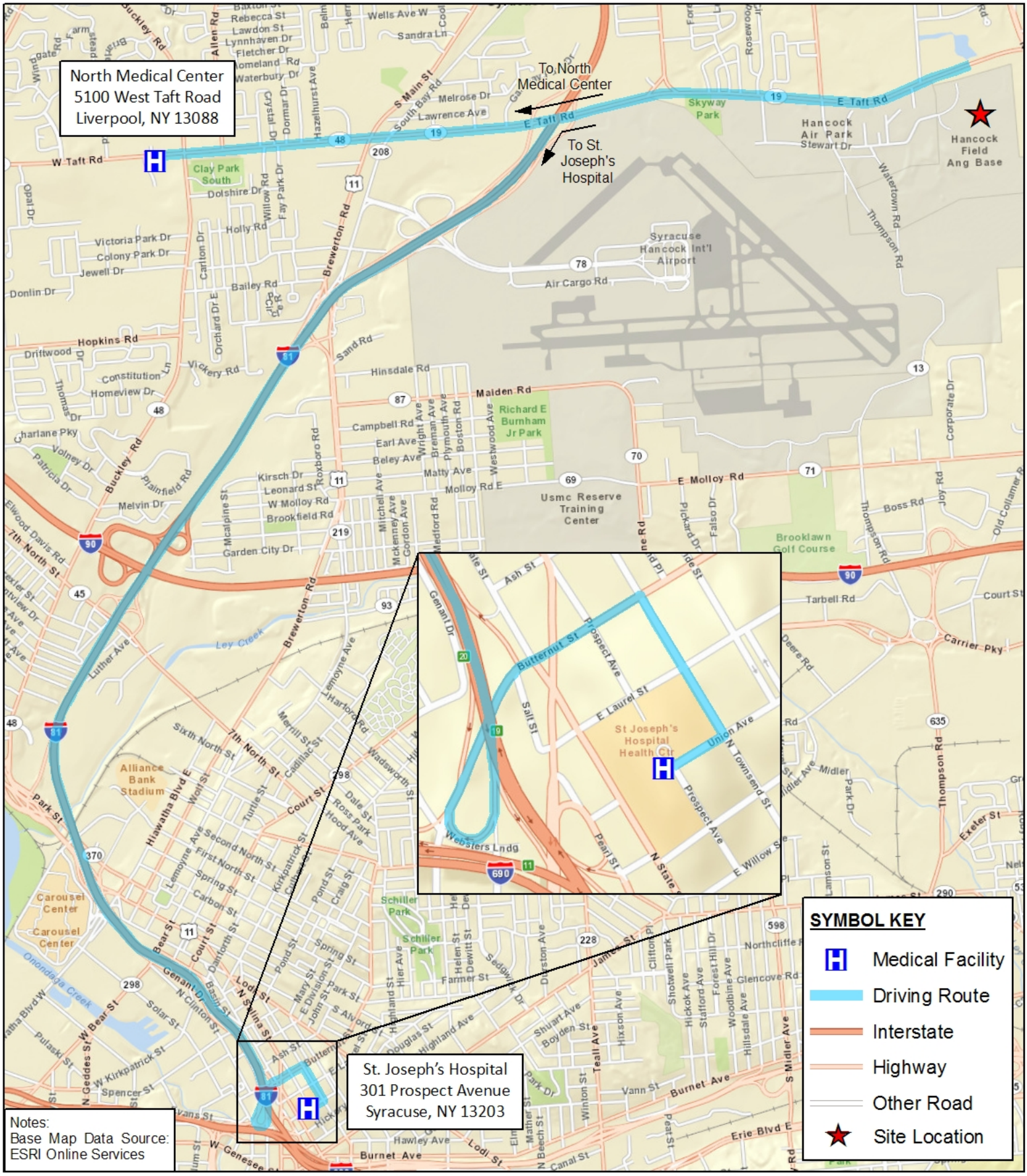
- Emergency telephone numbers will be posted at the field trailer and carried by at least two on-site personnel at each project site;
- A first aid kit shall be stored within each on-site vehicle during field activities. The first aid kit will be inspected weekly by the SSHO;
- The nearest hospital and occupational clinic to the project is identified in Table 10-1. A Map illustrating the route to the hospital and occupational health clinic is provided on Figure 10-1. Maps to the hospital and clinic will be posted at the project site; and,
- At a minimum, two on-site personnel will be certified in CPR and first aid during site activities.

Table 10-1. Injury and Emergency Facilities
Hancock Field Air National Guard Base, Syracuse, New York

Facility	Address	Phone
St. Joseph's Hospital	301 Prospect Avenue Syracuse, NY 13203	(315) 448-5111
North Medical Center	5100 West Taft Road Liverpool, NY 13088	(315) 452-2828

10.2 Off-Site Medical Support

In case of a medical emergency, on-site personnel shall determine the nearest facility. Contractor employees who require non-emergency treatment for work-related injuries should be treated at the occupational clinic. A list of emergency contacts is provided in Table 10-2.



New York Air National Guard
Syracuse, New York

N

FIGURE 10-1
Hospital and Occupational Clinic Locations
Accident Prevention Plan
174th Fighter Wing, Hancock Field Air National Guard Base - Syracuse, NY

0 0.5 1 2 3 Kilometers
0 0.5 1 1.5 2 Miles

06/25/2012	File: ANG_Hancock_Medical_Fac_Loc_APP.mxd	
PROJ: 912810001	Drawn: JBO	10-2

Table 10-2. Emergency Contact Information
Hancock Field Air National Guard Base, Syracuse, New York

Name	Title	Phone
Ambulance	--	(315) 437-0939
Fire	--	(315) 455-2511
Security	--	911
Poison Control Center	--	1-800-222-1222
AMEC Environment & Infrastructure, Inc.		
Darlene Abbott	Project Manager	(865) 218-1025
Donna Sharp	Project Geologist	(865) 218-1969
Jeremy Bennett	Field Manager	(865) 218-1961
Jeremy Bennett	Site Safety and Health Officer	(865) 218-1961
John Mazur	Regional HSE Manager	(910) 452-1185
Vladimir Ivensky	HSE Director	(610) 877-6144
Hancock Field		
2nd Lt Brent Lynch	Base Environmental Manager	(315) 233-2111
U.S. Army Corps of Engineers		
Adam Little	Project Manager	(402) 995-2730

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11.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

11.1 Site-Specific PPE

During field activities, controls will be implemented using the OSHA hierarchy of controls (e.g., engineering, administrative, and PPE, as the last resort). When engineering and administrative controls are not feasible or additional controls are needed, the use of PPE is implemented.

Prior to commencement of field activities, site personnel will be trained in the use of PPE. Standard minimum PPE for this project will consist of Level D protection, which includes the following:

- Hardhat;
- American National Standards Institute (ANSI) 87.1 approved safety glasses;
- Shirt with sleeves;
- Long Pants;
- Steel-toed boots (ANSI Z41-1991 approved);
- Hearing protection, as needed; and
- Class III High Visibility Work Vest.

A stock of common PPE required for the project will be provided for use by visitors where appropriate.

11.2 Hazard Assessment

Identifying and evaluating potential health and safety hazards prior to beginning and during field activities are an integral part of APP development. A formal site characterization must be completed by the SSHO per OSHA standard for hazardous waste sites in 29 CFR, Part 1910.120.

The SSHO will perform a preliminary survey at each site to collect as much information as possible concerning the types and degrees of hazards and risks that may be present. Based upon the information collected, the project team can assess additional hazards and identify additional safety requirements not initially addressed in this APP.

Following the initial site survey, the SSHO will identify the status and competence of emergency personnel available on or near the sites, the location of the nearest emergency facility, and modify the Emergency Response Plan discussed in Section 12.2 of this APP, if necessary. The initial site survey can help personnel determine, on a preliminary basis, hazardous or potentially hazardous conditions currently present at the sites. Conditions that will require immediate mitigations are those that can cause hazards due to inhalation or direct absorption through skin, become

immediately dangerous to life or health (IDLH), or can cause death or serious physical harm to workers.

11.3 Written Certifications for Personal Protective Equipment

Prior to starting any project activity, personnel will be instructed in the proper procedures for donning and doffing PPE. The SSHO shall brief personnel on the following items regarding PPE:

- Activities requiring PPE;
- What PPE is required;
- Limitations of PPE;
- Proper care, maintenance, useful life of PPE; and,
- Disposal procedures for PPE.

Reminders of PPE requirements shall be discussed during the daily tailgate safety meetings. Before wearing any level of PPE, it will be checked to ensure that it is in proper condition for its intended use. Workers with minor skin openings, such as cuts and scratches, will be given special attention before entering any contaminated area to guard against enhanced exposure effects. Workers with large cuts, rashes, or other such skin damage will not be allowed to don PPE.

12.0 PLANS, PROGRAMS, AND PROCEDURES REQUIRED BY THE SAFETY MANUAL

12.1 Layout Plan

The FM will establish a Layout Plan at the time of project mobilization.

12.2 Emergency Response Plan

An emergency is defined as a sudden, generally unexpected occurrence demanding immediate action. Emergencies at the project site include accidents, injuries requiring medical care, fires, explosions, spills, and extreme weather events. Upon mobilization, the FM/SSHO shall provide a means for effective emergency communications (e.g., landline telephone, cellular phone, or two-way radio) prior to commencing activities.

In the event that an emergency arises, the appropriate immediate response must be taken by the first person to recognize the situation. The field crew shall immediately notify the FM or SSHO of the incident, and the appropriate emergency service organization shall be contacted. A list of emergency contacts is provided in Table 10-2. A copy of the emergency telephone numbers and directions to the nearest selected urgent care facility shall be posted at the project site; however, emergency medical services (EMS) shall transport injured personnel to the nearest selected urgent care facility.

In case of injury or illness, a trained person will render the proper emergency first aid care. First aid equipment shall be available at fieldwork areas. Personnel will be notified of the locations of first aid equipment during the initial safety briefing.

Unless the emergency event is extreme and obvious, the decision to cease field activities and evacuate the site shall be made by the FM. Field personnel will report to the pre-designated area, if possible. Local authorities (e.g., police, fire department, and civil defense) will decide if the emergency requires evacuation of the surrounding community. Responsibility for community evacuations will be with the local authority in charge of the emergency.

12.2.1 List of Emergency Contacts and Notification

The local fire department shall be contacted prior to initiating and new activities. They shall be frequently advised and notified about upcoming site activities and potential emergencies.

The PM will be notified immediately in the event of an emergency. The SSHO will immediately evaluate the incident and, if necessary, notify emergency response personnel. Telephone numbers for emergency contact personnel are listed in Table 10-2. The list will be maintained with current contacts and telephone numbers, and shall be posted on-site.

The information provided to the emergency contact should include the nature of the incident and the exact location. Specifically, the information should include the following:

- Name and telephone number of individual reporting the incident;
- Location and type of incident;
- Nature of the incident (e.g., fire, explosion, spill);
- Number and nature of medical injuries;
- Potential for additional risks or dangers;
- Potential off-site risks or dangers;
- Movement or direction of spill/vapor/smoke;
- Response actions currently in progress;
- Estimate of quantity of any released materials;
- Status of incident; and,
- Other pertinent information.

12.2.2 Medical Emergency Response

Minor injuries will be treated on-site by qualified first aid/CPR providers. Injuries and illnesses that do not require immediate medical care can be treated at the clinic listed in Table 10-1.

For moderate to serious injuries that require immediate emergency care, the following procedures will be used as applicable:

- Administer first aid and contact the SSHO to arrange for dispatch of EMS;
- Notify the Program HSE Manager;
- Move the person to a support area if there is no risk of further injury;
- Assign an individual to meet the EMS at the project site entrance to minimize time in locating the injured worker(s);
- Wait for emergency care, document the event, and maintain communication with the SSHO; and,
- The SSHO shall accompany the injured worker to the hospital.

In the event of a chemical exposure, the following procedures shall be followed after notifying EMS:

- Skin contact:
  - Flush with water;
  - Remove clothing, flush skin; and,
  - Obtain prompt medical attention, as necessary.
- Inhalation

  - Remove the person from the area;
  - Administer first aid/CPR, as needed; and,
  - Obtain immediate medical attention.
- Ingestion:
  - Contact the Poison Center for immediate treatment, then obtain immediate medical attention; and,
  - Inducing vomiting may cause further injury to the victim; follow instructions from the MSDS and/or Poison Control Center.
- Eye Contact:
  - Flush eyes immediately with water for a minimum of 15 minutes; and,
  - Obtain immediate medical attention.

12.2.3 Fire Control

A 2-A:10-B:C fire extinguisher will be kept at each active work area and a 5-B:C fire extinguisher shall be mounted on all heavy equipment. In the event of a fire or explosion, the following actions will be implemented:

- Evacuate personnel to a safe location upwind or crosswind of the incident;
- Contact the SSHO or FM and local fire department, as necessary;
- If personnel who have fire extinguisher training are present, use available fire extinguishers to extinguish small fires if the fire can be safely extinguished;
- Alert the local hospital about the possibility of fire victims, as necessary; and,
- Document the incident in the field log and follow the procedures for incident reporting.

12.2.4 Spill Prevention and Control

Requirements for spill and discharge control (spill containment program) are presented to limit potential problems with material spillage and include:

- Drums and containers used for spill cleanup must be inspected before use and meet Department of Transportation, 49 CFR Parts 171-178, and U.S. Environmental Protection Agency requirements, 40 CFR Parts 264-265 and 300, for the wastes they are to contain. In addition, the contents of the drums and containers shall be noted on labels affixed to drums and containers.
- Drums must be inspected for their condition and integrity before they are moved. If they cannot be inspected before being moved due to storage conditions, they will be moved to an accessible location and inspected before further handling. Drum handling will be organized to minimize movement of drums or other containers. Drums or containers that cannot be

moved without potential failure will be overpacked or will have the materials contained inside transferred to another sound container.

- In areas where spills, leaks, or ruptures may occur; an adequate quantity of absorbent material and approved fire extinguishing equipment shall be available.

A spill kit will be available on-site with supplies for spill containment and control and includes:

- Sandbags,
- Absorbent pads (two bales),
- Solid absorbent (two bags), and
- Drums, 55-gallon size (two).

Subcontractors shall bring the necessary spill kit on-site to address spills, leaks, or ruptures occurring due to their specific activities. In addition, subcontractors will be responsible for assuring that any spills are contained and immediately containerized and the affected area is cleaned. Finally, the SSHO will be informed of any spills since an incident report is required to document the occurrence.

In the event of a spill or uncontrolled release, the SSHO will notify applicable emergency agencies based upon the location of the spill, spill amount, and status of site personnel. Hazardous substance spills will be contained as close to the source as possible. For small spills, absorbent materials such as sand, sawdust, or commercial sorbents will be placed directly on the spill to prevent further spreading and recovery. Sorbent material will be kept on-site. Berms of earthen material will be used to contain large spills and will be constructed downgradient of the leading edge of the spill. The SSHO will be responsible for implementing and supervising the cleanup of any spill. Other safety supplies should be readily available at the site (e.g., fire extinguisher, PPE, eyewash supplies, first-aid kit).

12.3 Hazard Communication Plan

On-site personnel will be trained on the physical and health hazards associated with hazardous materials planned for use during the project in compliance with OSHA standards 29 CFR 1910.1200 and 29 CFR 1926.59.

The HAZCOM Program formulates the basis for chemical safety found in the aforementioned OSHA standards. These standards provide the basis for workers to know the physical and health hazards involved with the chemicals used on-site. The implementation of an effective HAZCOM Program reduces the potential for workers to be exposed to hazardous chemicals. This program encompasses chemicals workers use in their daily activities. The elements of a HAZCOM Program include:

- Written workplace program;
- Chemical inventory (Appendix C);
- MSDSs (Appendix D);
- Training workers on the physical and health hazards, and methods and observations to detect the release or presence of hazardous chemicals; and,
- Labeling system.

The SSHO will maintain a "Site Chemical List" (Appendix C) and copies of MSDSs (Appendix D) for hazardous chemicals that are to be used on-site during project work. The SSHO will maintain a binder with contents of the OSHA standard (29 CFR 1910.1200 or 29 CFR 1926.59), written program, chemical inventory, and corresponding MSDSs in the AMEC site office. The SSHO will provide copies of applicable MSDSs to emergency service personnel as needed or requested.

Subcontractors shall provide a complete chemical inventory of chemicals intended for use on-site prior to mobilization. The AMEC Site Chemical List Form (Appendix C) can be used to document chemicals brought on-site. In addition, corresponding MSDSs for each chemical listed will be provided with the inventory for inclusion into the site HAZCOM binder. The SSHO will in turn inform subcontractors of the location of the project HAZCOM binder. The SSHO will provide copies of applicable MSDSs to subcontractor personnel as needed or requested.

Site personnel will be informed of the hazardous substances that they will be working with through HAZCOM training at the time of SSHO review and at safety meetings.

All primary containers (i.e. manufacturer's label) will include the product identity, hazard warnings, and manufacturer's name and address. If the label is defaced, an alternate label with the product identity and hazard warnings is required. Secondary containers package hazardous substances transferred from an original container to another container. These containers require labeling at the time that they are filled. The label shall include the identity of the product and any hazard warnings found on the original container (e.g. flammable, corrosive).

The precautions described under each AHA in Section 6.0 shall ensure that potential exposure to chemicals brought on-site is minimized.

Subcontractors are responsible for providing HAZCOM training for their personnel.

MSDSs for the site-related contaminants such as lead, gasoline, diesel fuel are included in this APP (Appendix D). These MSDSs are provided for informational purpose only. They are not part of the HAZCOM program. MSDSs provide information such as health effects that can result from exposure, flammability, and reactivity hazards associated with handling these materials. The SSHO will ensure the HAZCOM binder is appropriately supplemented with additional MSDSs as required

during performance of field activities, that the Chemical Inventory is maintained accurately on-site, that site personnel review appropriate MSDSs prior to using or handling these substances, and that MSDSs are maintained with this APP in an area accessible to all site personnel.

Personnel will observe all of the requirements and restrictions specified on the product MSDS (e.g., PPE, first aid, disposal, incompatibilities, etc.). The SSHO will determine respiratory protection requirements based on air monitoring results. Persons using a substance who are unfamiliar with the hazards conveyed by the substance or the necessary control measures must first review the MSDS, and have an opportunity to ask any questions to the SSHO. The SSHO is responsible for ensuring that persons using or handling the substances have been trained in HAZCOM (e.g., how to read and understand an MSDS, chemical labeling, etc.).

12.4 Respiratory Protection Plan

The Respiratory Protection Plan will be implemented during any ground disturbing activities, such as excavations. Limits for airborne particulate matter and volatile organic compounds (VOCs) are presented in Table 12-1.

A photoionization detector (PID) will be used as the direct instrument for real-time periodic monitoring of total VOCs. Respirable particulate matter will be monitored using a DustTrak Aerosol Flow Monitor (or equivalent equipment). A background reading will be collected at the beginning of the day (prior to commencing excavation) and at the end of the day (after excavation have been completed). Readings will be collected while test pits are being excavated and the maximum concentration will be recorded. All readings obtained with the monitor will be recorded in a log book maintained by the SSHO.

Historical metals concentrations from the area of known impacted soil indicated threshold. The SSHO will monitor that respirable particulate matter and VOCs do not exceed the action levels indicated in Table 12-1. If action levels are exceeded, the appropriate action will be performed to mitigate the risks associated with the associated hazard (See Table 12-1).

Table 12-1. Contaminant Action Levels
Hancock Field Air National Guard Base, Syracuse, New York

Potential Air Contaminant	Measurement Method	Action Level	Action Required
VOCs	PID	Continuous sustained readings of <5 ppm in the breathing zone	Continue Working in Level D protective clothing
		Continuous sustained readings of >5 ppm but <25 ppm above background in the breathing zone	Don respiratory protection, minimum half-face respirator with organic vapor cartridge, or a combination of an OV canister with HEPA filter.
Dust – metals (i.e., lead)	DustTrak	>0.5 mg/m^3	Wet the area and conduct personal air monitoring for lead to evaluate concentrations in airborne dust.
		> 5 mg/m^3	Don respiratory protection, minimum half-face respirator with HEPA filter.

* Measurements will be taken within the breathing zone of field personnel. Readings above action levels are to be constant or sustained for at least 2 minutes, PID readings must be corrected for the substance specific response factor. Decisions will be made under the discretion of the SSHO, if no apparent source of contamination is identified.
OV – organic vapor
HEPA – high efficiency particulate air
ppm – parts per million
mg/m^3 – milligram(s) per cubic meter
VOCs – volatile organic compounds

12.5 Health Hazard Control Plan

12.5.1 Chemical Hazards

This section describes the chemical hazards known or suspected to be present at work sites and gives an assessment of the potential for exposure. Available data from previous site investigations indicates that there may be a potential for contaminants at concentrations that could pose an occupational exposure threat to site workers.

In addition to the type and location of a task being performed, the potential for exposure to site contaminants will also be dependent upon the contaminant concentrations that are present and the work methods and safety control measures that are implemented. A listing of contaminants anticipated to be encountered at various work sites is provided below. From an occupational exposure threat standpoint, of greatest concern is the potential for exposure to particulate heavy metals that are contained within site soils. Other potential hazards include hydrochloric acid and nitric acid (sample preservatives), Luminox® (decontamination), and gasoline/diesel fuel. MSDS information for lead, Luminox®, hydrochloric acid, nitric acid, gasoline, and diesel fuel are included in Appendix D.

Table 12-2. Recommended Exposure Limits
Hancock Field Air National Guard Base, Syracuse, New York

Chemical/Compounds	Exposure Limits[a]	IDLH[b]
Hydrochloric acid (used for sample preservation)	5 ppm (Ceiling)	50 ppm
Nitric Acid (used for sample preservation)	2 ppm (8-hour TWA)	25 ppm
Isobutylene (used for equipment calibration)	ND	ND
Liquinox®	NA	ND
Luminox® (used for equipment decontamination)	100 ppm (8-hour TLV)	600 ppm
Methanol (used for sample preservation)	200 ppm (8-hour TWA)	6000 ppm
Lead	0.05 mg/m^3 (8-hour TWA)	100 mg/m^3

[a] Permissible exposure limit – *OSHA*
[b] *NIOSH Pocket Guide to Chemical Hazards*, National Institute for Occupational Safety and Health, 2005.
IDLH - immediately dangerous to life and health.
NA - not available.
ND - an IDLH value has not been established.
TWA - time weighted average.
Ceiling - concentration not to be exceeded at any time
mg/m^3 - milligrams per cubic meter of air
TLV - Threshold Limit Value.
ppm - parts per million.

12.5.1.1 Chemical Safety

Chemical safety revolves around the implementation of the HAZCOM Program in 29 CFR 1910.1200 or 29 CFR 1926.59. This standard provides the basis for workers to know the hazards involved with chemicals used on-site. The implementation of an effective HAZCOM Program reduces the potential for workers to be exposed to hazardous chemicals. This program encompasses chemicals workers use in their daily activities. Section 12.3 lists the elements of a HAZCOM Program.

12.5.1.2 Dust Control

Dust will be primarily controlled at work sites using water spray application. Direct reading monitoring instruments may be used at the perimeter to measure airborne dust during soil management activities. An airborne dust action level has been established (Section 12.4) which, if exceeded, will call for further air monitoring/sampling and the use of additional water spray application to reduce dust concentrations.

12.5.2 Physical Hazards

Physical hazards anticipated for this project include, but are not limited to:

- Slip, trip, and fall hazards;
- Crushing injuries from unstable equipment and site structures;
- Head injuries from falling tools or equipment;
- Diesel/gasoline engine exhaust emissions;
- Injuries from use of hand and power tools;

- Injuries associated with operation of heavy equipment, automobiles, or other vehicles at the site;
- Rigging equipment for material handling;
- Elevated noise levels;
- Exposure to the sun/sunburn;
- Fire or explosion;
- Injuries from scattered debris;
- Sharp objects such as nails, broken glass, sticks, etc.; and,
- Uneven terrain.

12.5.2.1 Slips, Trips, and Falls

Slips, trips, and falls are the primary physical hazard that site personnel may encounter. Therefore, personnel shall adhere to preventative measures. Supervisors will remind personnel and subcontractors to maintain sure footing on all surfaces. Sure footing includes safety boots with treaded soles to minimize slipping on surfaces. The supervisor and/or the SSHO will inspect all work areas prior to the start of work to look for hazards. The following preventive measures will reduce the potential for these hazards:

- Personnel will keep working areas clean. Tools, equipment, and materials will be used and stored in a fashion to minimize tripping hazards. Small, loose items such as tools, materials, and other small objects and debris will not be left lying around, particularly in areas where personnel walk.
- Walkways will be kept free of obstacles. Openings in walkways will be repaired, if possible. If not immediately repaired, the section must be roped off or closed until repairs can be made.
- Personnel will not walk or climb on piping, valves, fittings, or any other equipment not designed as walking surface. Walking and working surfaces will be properly maintained during inclement weather.
- Electrical extension cords and electrical wiring must be kept clear of walking and working areas and/or covered, buried, or otherwise secured.
- Personnel will maintain a three-point contact when mounting or dismounting heavy equipment.
- Running is prohibited on job sites unless under emergency conditions.
- Spills will be cleaned up immediately.
- Personnel will take extra precautions, such as establishing firm hand holds, footwear, and walking slowly when walking or working during wet, snowy, or icy weather.

The SSHO will enforce this "housekeeping" effort throughout the day. In addition, workers will not work near the edges of excavations. Excavation areas will be clearly delineated with stop logs, construction (mesh) fencing, and signage to alert workers of these locations.

12.5.2.2 Noise and Hearing Conservation

The project scope of work will involve the use of machinery that will generate some noise as a result of their operations. Hearing loss, resulting from occupational exposure to noise, can be prevented. The use of hearing protection devices reduces the potential for noise-induced hearing loss. Hearing protection should be worn if sound pressure measurements indicate levels above 85 decibels (dBA) TWA. The SSHO will conduct noise surveys and identify any areas requiring hearing protection. Proper selection of hearing protection requires sound level monitoring to determine optimal Noise Reduction Rating (NRR). The NRR is a manufacturer's single-number rating for noise attenuation in a laboratory setting. Ideally, the higher the NRR value, the better attenuation provided. However, the NRR value does not provide the same noise attenuation in field conditions. Therefore, OSHA recommends the effective NRR be reduced by 50 percent. A NRR value of 33 dBA is the minimal acceptable value for hearing protection. Protective devices will have an NRR appropriate to reduce the sound levels below 85 dBA while not affecting the worker's ability to communicate, hear alarms, or hear nearby moving equipment. Moreover, project staff will be trained on how to properly use hearing protection. Finally, the use of hearing protection devices will be monitored by the FM and SSHO. Personnel shall use protective devices per the following guidelines:

- The direction of the FM/SSHO; and,
- Based on the use and application of the following general rule of thumb:

If you must raise your voice to be heard by someone standing within arms length then you may be approaching excessive noise levels (>85 dBA) and hearing protection should be employed.

As part of the criteria for the medical surveillance program, audiometric testing will be conducted annually.

12.5.2.3 Material Handling

Material handling activities shall be done in accordance with Subpart H in 29 CFR 1926. Procedures for material handling, storage, and disposal include the following:

<u>Handling</u>

- Material handling devices should be used for handling heavy or bulky items whenever possible over manual material handling.
- When a difference in road or working levels exist; such as ramps, blocking, or grading

shall be used to ensure the safe movement of vehicles between two levels.

- Whenever handling heavy or bulky items, the material handling needs should be evaluated in terms of weight, size, distance, and path of movement.
- The following hierarchy for selection of material handling means should be used: elimination of material handling needs by engineering; movement of material by mechanical device (e.g., lift truck, overhead crane, conveyor); movement by manual means with handling aid (e.g., dolly, cart); and movement using safe lifting techniques.
- Proper safety precautions, such as glove safety, will be employed when handling materials.
- Hazardous materials shall be collected, stored, and disposed of in accordance with federal, state, and local requirements.

Storage

- Materials stored in tiers shall be stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling, or collapse.
- Storage areas shall be kept free from accumulation of materials that constitute hazards from tripping, fire, explosion, or pest harborage.

Hoisting

- Hoisting activities require rated slings, shackles, chains, and hooks. These items must have a visible and readable tag indicating specific load limits. Under no circumstance may personnel exceed listed limits of equipment. In addition, this equipment will be inspected prior to use. Personnel are prohibited to use fared, torn, or damaged hoisting equipment. If the equipment is not suitable for use, it will be tagged and removed from service.

Lifting

- Personnel must be trained in safe lifting procedures including:
  - Size up the load first (do a short "test lift," inspect paths of travel and areas where loads will be set down);
  - Get help if the load is bulky, heavy, or of unwieldy length;
  - Be sure of footing;
  - Bend at the knees, keeping the back straight;
  - Make sure that you have firm, reliable hand holds;
  - Keep the load as close to your body as possible;
  - Lift with your legs while keeping your back straight;
  - Keep your balance; and,
  - Do not twist under strain or jerk the load.

12.5.2.4 Use of Ladders and Scaffolds

Elevated work, where a fall potential exists, will be performed using appropriate ladders and/or fall protection (e.g., full body harness and lanyard, or guardrails). No employee may be exposed to a fall of over 6 feet (ft) without being adequately protected. Ladders and scaffolding (scaffold use is not expected) will only be used under the following conditions:

- Ladder use will comply with all applicable standards.
- Scaffold erection and use will comply with all applicable requirements and OSHA regulations. A trained competent person will supervise all scaffold erection and use. (As defined by 29 CFR 1926.650(b), a competent person means one who can identify existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.)
- Scaffolds will be inspected daily by a trained competent person.
- All personnel using scaffolds will be trained on the hazards and the safe use of the type of scaffold employed.

12.5.2.5 Excavation Safety

Excavation is considered the most hazardous operation in the field of construction. An excavation is any man-made cut, cavity, trench, or depression in the earth's surface formed by earth removal. Once opened, each excavation shall be protected to prevent personnel, vehicles, and equipment from falling into the excavation. Barricade fencing (e.g. construction fencing) placed at the perimeter of excavations will be at least 10 ft from any sloped opening. If this safe distance is not feasible, training of site personnel to indicate higher risk and signage are required. Site personnel will not be permitted to enter excavations unless appropriate engineering controls (i.e., shoring, shielding, and sloping) are in place in accordance with Subpart P, 29 CFR 1926.

Excavation areas will be delineated as exclusion zones (EZs) with contamination reduction zones established to reduce the potential for cross-contamination. EZs requirements in Section 12.20.11 must be adhered to during all phases of environmental services activities.

The PM, SSHO, and FM shall determine the steps necessary to ensure a safe excavation. A review of soil conditions will be a prime factor in determining whether to shore, slope, or shield the excavation. A soil analysis, along with a study of flood levels, will also be a factor in determining potential water hazards and the need for dewatering systems.

When persons will be in or around an excavation, a Competent Person (as defined in as outlined in 29 CFR 1926.652) shall inspect the excavation, the adjacent areas, and protective systems daily:

- Before each work shift;
- Throughout the work shifts as dictated by the work being done;
- After every rainstorm;
- After other events that could increase hazards (e.g., snowstorm, windstorm, thaw, earthquake, etc.);
- When fissures, tension cracks, sloughing, undercutting, water seepage, bulging at the bottom or other similar conditions occur;
- When there is a change in size, location or placement of the spoil pile; and,
- Where there is any indication or change in adjacent structures.

If conditions indicate soil type classification needs to be lowered, precautionary measures will be implemented to include moving barricade fencing further away from opening and restricting access.

The following provides general requirements governing activities in and around excavations and trenches, as well as the requirements for the selection and use of protective systems.

- Surfaces surrounding open excavations shall have all surface hazards removed.
- Utilities shall be located and cleared prior to initiating digging. Clearance and support methods shall be documented on the daily inspection checklist. Class I perimeter protection is the most protective and requires installation of fences and barricades, which would prevent members of the public (people other than workers) from entering or falling into the excavation. This class minimizes the potential for an incident to occur.
- When vehicles and machinery are operating adjacent to excavations, warning systems such as stop logs or barricades shall be used to prevent vehicles from entering the excavation or trench. In any case, vehicles, equipment, materials, and supplies will never be placed closer than 2 ft from the edge of any excavation. A professional engineer may have to calculate the distances of heavier equipment for placement away from the edge so as to prevent collapse of the excavation wall caused by the weight of the equipment.
- Excavated and loose materials should be kept at least 3 ft from the edge of excavations, but at a minimum of 2 ft from the edge of the excavation. In addition, spoils shall be placed in a way to divert water from entering excavation.
- Barriers shall be provided to prevent personnel from falling into an excavation. Workers within 2 ft of the edge of the excavation must be protected by fall protection (guardrails or personal protection).

12.5.3 Equipment Hazards

12.5.3.1 Use of Tools and Machinery

Tools and machinery use safety procedures include:

- Tools and machinery will be inspected and properly maintained in accordance with the manufacturer's instructions and recommendations. Hand tools and machinery should be inspected daily or before each use for defects. Tools that are burred, broomed, mushroomed, have split or loose handles, worn or sprung jaws, or are generally unsafe should be turned in to the FM or SSHO and immediately taken out of service.
- Defective or unsafe machinery must be tagged with "Do Not Use" or "Defective Do Not Use" tags until repaired or otherwise made acceptable. Defective or unsafe equipment must be removed to a secure place to prevent inadvertent use until repaired. Repaired items must be re-inspected by the SSHO before being placed back into service.
- Tools and machinery must be used only for the purpose for which it was designed (do not use a wrench for a hammer, screwdriver for a chisel, pliers for a wrench, pipe or stilson wrenches as a substitute for other wrenches, a pipe handle-extension or a "cheater" on a wrench). All modifications, extensions, replacement parts, or repairs of equipment must maintain at least the same factor of safety as the original equipment.
- Machinery containing liquid systems (e.g., fuel, hydraulic, lubrication) will be inspected daily to ensure that liquid-containing systems (e.g., hoses, tubing, hydraulic lines) are in good operating condition and that plugs, stoppers, valves, etc., are properly seated.
- Machinery must not be operated without proper training and special permission unless it is a regularly assigned duty.
- Loose or frayed clothing, dangling ties, rings, etc., must not be worn around moving machinery or other mechanical sources of entanglement.
- Air hoses should not be disconnected from compressors until the air within the hoses has been bled.
- Pressure reducers will be in place for air hoses used to blow off debris or clothing. Gauges will be used to ensure that air used to blow off debris or clothes will be no more than 30 pounds per square inch.
- Personnel shall not use air hoses to blow off potentially contaminated clothing.
- Electrical power tools, lighting equipment, etc. to be used must be properly grounded by using three- wire receptacles and extension cords rated for the amperage required. Ground fault circuit interrupters (GFCIs) should be used with temporary electrical

systems or other proper grounding system. Assured equipment grounding conductor program should be implemented if GFCIs are not exclusively used.

- Portable electric tools must not be lifted or lowered by means of a power cord. Electrical equipment cords should be kept coiled when not in use. When electrical equipment is in use, cords should be protected and positioned to avoid being run over by vehicles or equipment.
- Machinery must not be repaired or adjusted while in operation. Oiling of moving parts must not be attempted except on equipment that is designed or fitted with safeguards to protect the person performing the work.
- Personnel using hand and mechanical tools will position themselves properly and consider the events if a tool slips or suddenly moves.

12.5.3.2 Use of Heavy Equipment

The use of all heavy equipment is dangerous. Care will be exercised in its use and while working near equipment. Heavy equipment will be inspected and documented throughout environmental service activities using the Safety Inspection Form in Appendix C. Operators of equipment shall be qualified and licensed to operator the specific heavy equipment. Before equipment is placed into use, it will be inspected by the operator to ensure that it is in safe operating condition. Backhoes, front-end loaders, and other types of specialized heavy equipment may be used to accomplish the work at various work sites.

The following guidelines will be adhered to while operating heavy construction equipment:

- Hard hats, steel-toed boots, safety glasses or goggles, and high visibility vest shall be worn at all times when personnel are around heavy equipment. These PPE devices are the minimum requirements. The AHA shall specify any additional PPE requirements.
- Equipment will not be operated in a manner that will endanger persons or property nor will the safe operating speeds or loads be exceeded.
- Getting off or on any equipment while it is in motion is prohibited.
- Operators will maintain a “three-point” contact while mounting or dismounting equipment (i.e. two hands and one foot contact on stable equipment surface).
- Equipment will be operated in accordance with the manufacturer's instructions and recommendations.
- Determinations of road conditions and structures will be made in advance to assure that clearances and load capacities are safe for the passage of equipment.

- Machinery or equipment will be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. Equipment designed to running is exempt from this requirement.
- Buckets, blades, dump bodies, and similar equipment will be either fully lowered or blocked when being repaired or when not in use. All controls will be in a neutral position, with the engines stopped and brakes set, unless work being performed on the machine requires otherwise.
- No guard, safety appliance, or device will be removed from machinery or equipment, or made ineffective except for making immediate repairs, lubrications, or adjustments, and then only after the power has been shut off. All guards and devices will be replaced immediately after completion of repairs and adjustments and before power is turned on.
- Mechanized equipment will be shut down prior to and during fueling operations. Closed systems, with automatic shut off that prevent spillage if connections are broken, may be used to fuel diesel-powered equipment left running.
- Each piece of heavy equipment and other similar equipment shall be equipped with at least one dry chemical or carbon dioxide fire extinguisher with a minimum rating of 10 pounds B:C.
- Backup alarms will be used on equipment. Construction equipment with an obstructed rear view must have an audible alarm that sounds when the equipment is moving in reverse.
- Personnel will not work, pass under or ride in the buckets or booms of loaders or backhoes in operation.
- Only chains, hoists, straps, and other equipment that safely aids transport of heavy materials will be used. These items shall have a tag indicating the rated capacity for the item.
- Seat belt use is required while operating equipment.
- Personnel near moving equipment (drill rigs) will be alerted by the operator prior to the actuation of the equipment. Clothing and other potential snag hazards will be secured as to prevent entanglement. Loose-fitting clothing and loose, long hair will be prohibited around moving machinery.
- Heavy equipment used at a contaminated work site will be kept in the exclusion zone until the work has been completed. Such equipment will then be decontaminated within the designated decontamination area.
- Spotters for tight areas, overhead and underground utilities, excavation, etc. and sample collectors will be the only personnel allowed near heavy equipment. Spotters and sample

collection personnel will stay out of the boom radius. Personnel needing to approach heavy equipment while it is in operation will observe the following protocols:

- Never walk directly behind or to the side of heavy equipment without the operator's knowledge.
- Make eye contact with the operator (and spotter).
- Signal the operator to cease heavy equipment activity.
- Approach the equipment only after the operator has given a signal to do so.

12.5.3.3 Falling Objects

Falling objects are a potential hazard during all activities with heavy equipment. Personnel should be aware of overhead hazards, especially with the backhoe. Personnel will be required to wear hard hats during all activities involving heavy equipment and any other activities where falling objects are a hazard. Hard hats meeting ANSI 89.1-1996 standard will be provided.

12.5.3.4 Vehicle and Equipment Traffic Control

Vehicle owners shall have and maintain liability insurance, and have on their person a current valid state driver's license if they are driving. Vehicle and equipment traffic control procedures are required due to the presence of aircraft, concurrent vehicle, equipment, and/or pedestrian traffic and require the following:

- Workers will be cautioned to look carefully where they walk to avoid vehicles and moving equipment and to maintain eye contact with equipment operators.
- Traffic signs, barricades, flashers, delineators, traffic cones, caution tape, and/or flagmen (as needed) will be used around work areas with vehicle or equipment traffic.
- The FM and/or SSHO will establish vehicle and equipment traffic patterns to be used.
- Traffic haul routes around the site will be identified prior to implementation. Delivery personnel will not be permitted to exit their vehicles in the active construction area or where hazardous materials may be present.
- Contractor owned and/or operated vehicles, which of necessity must enter posted limited areas (Lines or Yards), will be permitted to do so if they are clearly and conspicuously marked with the name of the contractor operating the vehicle.

The PM and/or SSHO will establish vehicle and equipment traffic patterns to be used. Traffic haul routes around the site will be identified prior to implementation. Delivery personnel will not be permitted to exit their vehicles in the active construction area or where hazardous materials may be present.

Contractor owned and/or operated vehicles, which of necessity must enter posted limited areas (Lines or Yards), will be permitted to do so if they are clearly and conspicuously marked with the name of the contractor operating the vehicle.

12.5.4 Environmental Hazards

Construction activities conducted at the work site in either the winter or summer months may present a potential hazard to personnel for either heat or cold stress injuries.

12.5.4.1 Heat Stress

The potential for a heat stress injury rises considerably when workers are required to perform physical activities in PPE and outdoor temperatures are above 70 degrees Fahrenheit (°F). This type of exposure can result in health effects ranging from heat fatigue to serious illness or death. Level D or modified Level D will be used during this project. There may be specific tasks that require the use of Level C protection. However, these occurrences should be minimal in frequencies.

To minimize the potential for heat stress injuries, personal monitoring will be initiated in accordance with the AMEC Heat Stress Control Standard Operating Procedure (SOP) (Appendix E) if workers wear semi-permeable or impermeable PPE and temperatures exceed 70°F. If ambient conditions pose the potential for heat stress, workers will be advised during the daily safety tailgate meeting to be observant for symptoms of heat stress in themselves and their co-workers. Training will be a significant factor in the prevention of heat related disorders. Workers shall be continually briefed on these symptoms and the preventive measures to take during daily safety tailgate meetings as well as when physiological risk factors become evident.

Workers shall have drinking water readily available, and they will be instructed on adequate hydration levels. Under such conditions, the work/rest schedules may be adjusted to reduce the potential for a heat- related injury.

Eliminating the solar impact (e.g. direct sunlight) of heat stress on the body helps to reduce the physiological strain on the skin and body. Whenever possible, shading needs to be available to refract sunlight exposure.

12.5.4.2 Cold Stress

During the winter months, there is a potential for workers to be exposed to ambient outdoor temperatures that potentially could cause a cold stress injury. Cold-related work injuries and/or fatalities can result from failure to escape low environmental air temperatures or from immersion in low-temperature water. The reduction of the core body temperature can result in a reduction of

mental alertness, rational decision-making, or loss of consciousness, commonly known as hypothermia. Frostbite, the freezing of body tissues, is also a manifestation of cold stress. Other indications that cold stress should be addressed include heavy shivering, the feeling of excessive fatigue, drowsiness, irritability, or euphoria.

12.5.4.3 Severe Weather

Personnel will receive information regarding severe weather during Tailgate Safety Meetings. The following are examples of typical weather alerts:

- Lightning Watch – Lightning is possible within 5 miles of the site, which is approximately 30 minutes. Work may continue but personnel should be prepared to stop work operations.
- Lightning Warning – Lightning is imminent or occurring on within the immediate area. Personnel visually see lightning strikes. Operations must cease and personnel must seek cover (e.g., vehicle or field office) and wait 15 minutes after the final lightning strike.
- Tornado Watch – Issued by the National Weather Service (NWS) when conditions are favorable for the development of tornadoes in and close to the Tornado Watch area. Duration for watch is usually 4 to 8 hours.
- Tornado Warning – The NWS reports where the tornado was located and what towns will be in its path. Personnel are to take cover immediately if within or near the path. Seek low-lying areas if out in an open field. Cover head area with hands and arms, and lay still.

12.5.5 Biological Hazards

Personnel should be aware of the various biological hazards that may be encountered while working at the site, including various animals (e.g., rodents, deer, and coyotes), ticks, poisonous insects, and/or snakes. Appropriate preventive measures should be employed to minimize potential exposure to biological hazards, including personnel designating a field member to watch for biological hazards.

The SSHO will be responsible for instructing personnel in avoiding biological hazards. The keys to avoiding biological hazards are awareness of surroundings and general knowledge of the habits of various species that may present a threat. In general, the vertebrates will escape to avoid human contact when encountered. Reptiles will often seek out warm sunny locations in morning hours or during cold weather. A reconnaissance of the site work area should be conducted every morning to identify the presence of potential threat species.

12.5.5.1 Wildlife

During site activities and operations, animals such as dogs, rabbits, deer, coyotes, mice, and other rodents may be encountered. Workers shall use discretion and avoid all contact with these animals. Contact with these animals may result in acquiring Hantavirus, Rabies, or the Plague.

- Hantavirus – Hantavirus Pulmonary Syndrome (HPS) is a disease that may be contracted when a person comes into contact with Hantavirus-infected rodents, their nesting materials, droppings, urine, or saliva. HPS may develop when virus particles are inhaled, absorbed through broken skin or the eyes, or when an individual is bitten by an infected animal. The majority of HPS cases have been reported in the southwest; however, there is the potential for Hantavirus transmission in most regions with rodent populations. Hantaviruses do not cause apparent illness in their reservoir hosts (rodents and small mammals). Risk to workers at the site is considered to be low; however, the severity of disease is high. Therefore, field personnel should be aware of the potential for exposure and should avoid coming into contact with rodents of their burrows or dens. Precautionary procedures based on Center of Disease Control guidelines regarding Hantavirus prevention will be implemented for cleaning or working in rodent-infested areas.
- Rabies – Rabies is an acute, infectious, often fatal viral disease transmitted to humans by the bite of a warm-blooded infected animal. This disease affects the central nervous system of humans. A rabid animal may be recognized by signs of raging, uncontrollable movement, and possible foaming near the mouth. The best control method is avoidance of animals that could be rabid. If bitten by a potentially rabid animal, the individual shall seek medical attention immediately.
- Plague – Plague is a disease usually transmitted by rodent fleas. It may cause serious illness in humans. Symptoms usually occur within three to four days and include a rapid rise in body temperature, headaches, and inflammation of the lymph nodes. Control of plague transmission is accomplished by avoiding animals and rodents prone to carrying fleas, such as mice, rats, and dogs. If bitten and symptoms develop, seek medical attention immediately.

Snakes

The poisonous snakes found in New York are the Massasauga Rattlesnake, Timber Rattlesnake, and Copperhead. However, only the Massasauga Rattlesnake is found near Hancock Field. The Massasauga Rattlesnake, shown on Figure 12-1, is the smallest of the three venomous snakes found in New York State. The adult massasauga, also known as the "swamp rattler," is a stout-bodied snake with a broad head. It measures 18 to 40 inches in length. Average length is 27.5 inches. The body is

distinctively marked with a row of large black or dark brown hourglass-shaped markings along the back and three rows of smaller dark spots on each side. The background coloration is gray or brownish-gray. A dark bar with a lighter border extends from the eye to the rear of the jaw. Some adults, however, are all black. This rattlesnake can also be identified by the nine large scales on the crown of the head, similar to most non-venomous snakes.

Throughout most of its range, the distribution is decidedly disjunct, with many miles separating populations. Currently, there are only two known populations remaining in New York, both of which occur in boggy, forested wetlands with "open rooms" of low vegetation.

A bite from a massasauga is typically very painful and causes internal bleeding and severe illness, but rarely death. The degree of toxicity resulting from a snakebite depends on the potency of the venom, the amount of venom injected, and the general health, size, and age of the person bitten. Poisoning may also occur from absorption of venom through cuts or scratches. A snake may bite a person and not inject venom. Symptoms and signs of envenomation occur within minutes to include pain, weakness, faintness, nausea alterations in temperature, pulse, and blood pressure.

Figure 12-1. Massasauge Rattlesnake

Insects and Spiders

Nearly all work sites may contain ticks, venomous spiders, scorpions, and venomous insects. Venomous insects and spiders are generally reclusive and the greatest potential for exposure arises when personnel are opening containers, structures, buildings, well casings, or handling idle equipment and construction material stockpiles. Caution should be taken when opening the casing around monitoring wells. Personnel should be aware of ticks and inspect themselves at the end of each workday. Tick bites may result in the following conditions:

- Rocky Mountain Spotted Fever – Bites from wood ticks may result in the transmission of Rocky Mountain Spotted Fever, a serious and possibly fatal disease caused by the Rikettsia virus. Rocky Mountain Spotted Fever occurs mostly in the late spring and early summer, and is characterized by chills, fevers, severe pain in the leg muscles and joints and body rashes.
- Lyme Disease – Lyme disease is most often characterized by a "bulls-eye" rash, accompanied by nonspecific symptoms such as a fever, malaise, fatigue, headache, muscle aches, and joint aches. PPE offers some protection against insects, but personnel should also perform self-searches at the end of the day to check for ticks if they have been working in an area where ticks may be prevalent.

Northern Black Widow

Northern Black Widow Spider is found throughout the eastern U.S., from southern Canada south to Florida, and west to eastern Texas, Oklahoma, and Kansas. Outdoors, they are found in old stumps, hollow logs, under fallen fence posts, in abandoned animal burrows or piles of brush, and in the corners of sheds and crawlspaces. In the northern black widow, the distinctive "hour glass" marking on the underside of the abdomen is incomplete or split in the middle. Northern widows also have a series of red spots along the dorsal midline of the abdomen, and many have a series of lateral white stripes on the abdomen. The web of the black widow is an irregular mesh of strands in which the spider hangs in an inverted position.

As common as this spider is, black widow bites are infrequent because the spider is actually very timid and prefers fleeing when disturbed. That's a good thing because the venom of a widow spider is 15 times more toxic than that of rattlesnakes. However, due to the small amount of the venom injected into the bite, widow bites are far less serious. There is less than 1 percent mortality (mostly children) of persons bitten by black widows. The toxin affects the central nervous system and the severity of the bite depends on many factors including the age, size, and sensitivity of the victim, location and depth of the bite, and when the spider last used her venom. Pain is felt almost immediately after the bite, and increases for 1 to 3 hours but may last for 24 hours. In severe cases, large muscles become rigid with spasms, there is a rise in body temperature, blood pressure, profuse perspiration, and a tendency to be nauseous.

Figure 12-2. Northern Black Widow

Mosquitoes

Mosquitoes may carry diseases as well as be bothersome. They are attracted by heat, sweat, body odor, and carbon dioxide. Only the female mosquito bites. Site personnel should wear protective clothing and insect repellent containing dichlorodiphenyltrichloroethane, most commonly known as DDT. Insect repellent should be reapplied at least every 4 hours.

Venomous Insects

Venomous insects include wasps, bees, hornets, and ants. Nests should not be allowed to form near structures and areas where personnel will continue to have a need for access. If bitten, personnel should wash the bite area with soap and water, apply cool compress to the area, elevate area using a pillow, and make a paste of baking soda and water for itching.

12.5.6 Safety Considerations

12.5.6.1 Utilities

The minimum clearance is 10 ft from overhead power lines, up to 50 kilovolts (kVs). For voltages over 50kV, add 0.4 inches per kV to the minimum clearance distance to obtain safe distance between equipment and power lines. If voltage is unknown, remain at least 20 ft from overhead power lines.

If activities occur near adjacent overhead electrical lines, the following precautions will be taken to ensure worker's safety:

- Power to overhead lines will be shut off or confirm power lines are not operational.
- Equipment, or any part, may not come within the minimum clearance from energized overhead lines as specified in Table 12-3, Minimum Clearance from Energized Overhead Electrical Lines.

Table 12-3. Minimum Clearance from Energized Overhead Electrical Lines
Hancock Field Air National Guard Base, Syracuse, New York

Nominal System Voltage (kV)	Minimum Rated Clearance (ft)
0-50	9.8
51-200	14.7
201-300	19.7
301-500	24.6
501-750	34.4
751-1000	44.3

If for any reason the need to either shut-off or turn-on a utility (e.g., steam, water, or electrical), the FM will contact proper authorities prior to this action. In addition, only hand digging is permitted within 3 ft of underground high voltage, product or gas lines. Once the line is exposed, heavy equipment can be used but must remain at least 3 ft from the exposed line.

12.5.6.2 Illumination Hazards

No work shall be performed after dark.

12.6 Lead Abatement Plan

As indicated in the NTCRA Work Plan, lead-impacted soils at MRS SR001 and SR002 will be excavated, transported, and disposed at the proper off-site disposal facility. Procedures outlined in the work plan and within this APP shall be implemented and will comply with applicable requirements of federal, states, and local regulations and address:

- Sampling and laboratory analytical methods;
- Identification and classification of hazardous wastes;
- Scope of removal action, including estimated volumes;
- Spill prevention, containment, and cleanup contingency measures;
- Dust monitoring and mitigation; and,
- Proper PPE.

12.7 Asbestos Abatement Plan

Asbestos-containing materials are not anticipated to be encountered during the project scope of work.

12.8 Abrasive Blasting Plan

Not applicable to this project.

12.9 Confined Space

Not applicable to this project.

12.10 Hazardous Energy Control Plan

Prior to starting project activities, personnel shall locate the existence of any part of the utilities and electric power circuit (exposed or concealed) that could be touched by tools, equipment, or workers during the performance of specified work tasks.

- Electrical work installation and wire capacities, both temporary and permanent, shall be in accordance with the National Electrical Code.
- Electrical equipment whether portable or fixed shall be grounded; Portable tools that are double insulated need not be grounded.
- All extension cords and cords on plug-connected equipment shall be of three-wire type, equipped with three pronged plugs.
- Temporary lights shall be equipped with guards to prevent accidental contact with the bulb.
- Aisles, stairs, and walkways shall be kept clear of electric cords or cable so as not to present a tripping hazard. Unused cord and cables shall be picked up and stored away.
- Cords with worn, frayed, or broken insulation or with loose plugs shall not be used.
- Switches, circuit breakers, receptacles, and fuse boxes that may be exposed to water shall be protected so that water does not enter.
- Distribution panels, circuit breaker panels, and fuse boxes that may be exposed to water shall be protected so that water does not enter.
- Makeshift connections in welding leads are prohibited. All connections shall be insulated.
- The FM/SSHO shall enforce the use of GFCI Devices by AMEC and subcontractor workers on all electrical tools and extension cords.
- Electrical panel covers shall be re-installed at the end of each work shift or when workers will not be continuously present at the locations.
- Lockout/tagout procedures, included in Appendix E, will be implemented to assure the safety of personnel during servicing or maintenance of machines and equipment where the unexpected release of stored energy or the energizing of these machines or equipment could cause employee injury. These procedures shall comply with the requirements established in 29 CFR 1926.411.

12.11 Critical Lift Procedures

Not applicable to this project.

12.12 Contingency Plan for Severe Weather

The procedures provided below will be used on project sites to protect site personnel from lightning related injuries.

Training

A tailgate safety meeting will be conducted to increase awareness to the hazards and prevention of lightning related incidents.

Detection of Lightning

The SSHO will be proactive in monitoring conditions that may produce thunderstorms and lightning. A daily and weekly weather forecast will be tracked and communicated to site personnel. When signs of impending storms are observed (e.g., increased wind and darkening skies), local weather monitoring will be increased. Personnel will be notified when thunderstorms may impact site activities.

Suspension/Resumption of Activities

Outside activities will be suspended when lighting is imminent or occurring within the immediate area. Operations will cease and personnel must seek cover (e.g., vehicle or field office) and wait 15 minutes after the final lightning strike.

12.13 Access and Haul Road Plan

Access and haul roads that will be used during field activities are constructed of asphalt. These roads will be used to access the site on a daily bases and will be used multiple times per day by dump trucks that will haul impacted soil from the project sites to the offsite disposal facility. No road improvements are anticipated prior to the commencement of project work. However, if roads are damaged during project operations, gravel will be used to fill holes, large cracks, and other potential hazards. During hauling operations, signs will be placed on public roads to warn drivers that trucks will be entering the road.

12.14 Demolition Plan

During site activities, former targets at SR001 and portions of the Firing-In Buttress at SR002 will be demolished. Prior to demolition, a demolition plan will be prepared by a Registered Professional Engineer for the safe dismantling and removal of all building components and debris. Demolition activities will be performed in accordance with ANSI Standard A10.6, Safety Requirements for Demolition. All employees engaged in demolition activities shall be instructed in the demolition plan so that they may conduct their work activities in a safe manner.

12.14.1Wall Removal

During the demolition of the Firing-In Buttress, no wall section greater than 6 ft in height will be permitted to stand without lateral bracing. No wall section shall be left standing without lateral bracing any longer than necessary for removal of adjacent debris interfering with demolition of the

wall. The walls and ceiling of the buttress shall not be demolished until earthen berm that surrounds the structure has been removed. Personnel shall not be permitted to work on the top of a wall when weather constitutes a hazard.

12.14.2Mechanical Demolition

Mechanical demolition is not anticipated during NTCRA activities.

12.15 Emergency Rescue (Tunneling)

Not applicable to this project.

12.16 Underground Construction Fire Prevention and Protection Plan

Not applicable to this project.

12.17 Compressed Air Plan

Not applicable to this project.

12.18 Formwork, Shoring Erection, and Removal Plan

Not applicable to this project.

12.19 Jacking Plan

Not applicable to this project.

12.20 Hazardous Waste Cleanup Operations Site-Safety and Health Plan (SSHP)

12.20.1Background

12.20.1.1 Installation Location

Hancock Field, as shown in Figure 2-1, is located at the Syracuse Hancock International Airport, approximately 5 miles north of the City of Syracuse in Onondaga County, New York. It encompasses approximately 357 acres and consists of several buildings and operational facilities. The installation is divided into two tracts of land: Tract II and Tract III. Tract II encompasses approximately 87 acres and Tract III encompasses approximately 270 acres. The City of Syracuse owns all land bordering Tract II and Tract III.

12.20.1.2 MRS SR001, Small Arms Range and Shooting-In Buttress

Munitions Response Site (MRS) SR001 encompasses approximately 1.9 acres of land located within the Small Arms Range and Shooting-In Buttress (SR001) Munitions Response Area (MRA). MRS SR001 consists of approximately 0.63 acres located within the former small arms range and approximately 1.27 acres of land historically used as a practice grenade range (Figure 2-3). A description of the Small Arms Range and Shooting-In Buttress MRA is presented below.

The Small Arms Range and Shooting-In Buttress MRA encompasses approximately 3.7 acres in the south-central part of Tract II (Figure 2-1). Historically, the MRA consisted of the Shooting-In Buttress and small arms range. The access path to the small arms range was used for M-203 training with 40-mm practice grenades. Ordnance potentially used prior to 1986 at the range included 7.62- mm, .38-caliber, .45-caliber, and .50-caliber munitions. Small arms use after 1986 consisted of 5.56-mm and 9-mm ball munitions. The use of the small arms range was discontinued in 2002 (ITSI/Shaw, 2009).

12.20.1.3 MRS SR002, Firing-In Buttress

MRS SR002 encompasses approximately 0.03 acres of land located within the Firing-In Buttress (SR002) MRA. MRS SR002 consists of the Firing-In Buttress, which is a wood and concrete structure that is still standing, and the soil within the structure. A description of the SR002 MRA is presented below.

SR002 MRA comprises approximately 5.8 acres in the eastern part of Tract III (Figure 2-4). The MRA consists of the Firing-In Buttress, which is constructed of wooden railroad ties, concrete, and sod. According to the CSE Phase I, the top of the structure is comprised of eight rows of wooden railroad ties with a concrete slab over the wooden ties and sod covering the concrete. The side supports consists of 13 rows of wooden railroad ties. The opening of the structure is approximately 15 ft high and 80 ft wide. The inside of the wooden structure contains the soil impact berm.

The intended use of the site was as a backstop and safety berm for jammed rounds (ITSI/Shaw, 2009). It was also used by F-86 aircraft test firing and boresight alignment of up to .50-caliber ammunition (SKY, 2012).

Currently, SR002 MRA contains dense vegetation consisting of shrubs and trees. The wooden portion of the Firing-In Buttress structure is still present and largely intact. Currently the area is vacant and is not utilized.

12.20.2 Contamination Assessment

Based upon the results of the CSE Phase I/II, soil was the only environmental media impacted by historical activities at the two MRSs. MD has been observed on the surface of both MRSs. Results of x-ray fluorescence (XRF) sampling during the CSE Phase II indicate that lead was present at concentrations that exceeded the XRF modified screening level of 261 mg/kg at both MRSs.

XRF soil sampling results presented above indicate that lead-impacted soil extends to a maximum depth of 18 inches below ground surface (bgs). According to the CSE Phase I, groundwater is encountered at an average depth of 3 ft bgs. Although it does not appear that lead has migrated through soil and impacted groundwater, there is a potential pathway for lead to migrate into

groundwater. Therefore, groundwater will be characterized as part of this removal action to determine if historical activities have impacted groundwater.

12.20.3 Hazard/Risk Analysis

A Hazard/Risk Analysis for the activities to be conducted during this project can be found in Section 12.5 of this APP.

12.20.4 Staff Organization, Qualifications, and Responsibilities

A discussion of staff organization, qualifications, and responsibilities can be found in Section 4.0 of this APP.

12.20.5 Training Requirements

The training requirements for site workers associated with this project can be found in Section 6.0 of this APP.

12.20.6 Requirements for PPE

PPE requirements for field activities conducted during this project can be found in Section 11.0 of this APP.

12.20.7 Medical Surveillance Requirements

Personnel entering EZ areas on site will participate in a medical surveillance program consistent with the requirements of OSHA 29 CFR 1910.120(f). Each site worker's medical certification for fitness to perform the work they are assigned, and qualification to use respirators will be maintained by the SSHO, as applicable. AMEC medical examinations for field personnel are completed before job assignment and annually thereafter. The WorkCare is the organization that manages the company-wide AMEC medical surveillance program. The AMEC standard medical examination protocol consists of the following:

- A review of the history of the employee and a comprehensive medical exam (including the reading of blood pressure and review of the body systems;
- Vision test;
- Audiometric testing;
- Pulmonary function tests (FVC and FEV 1 .0);
- Complete blood count with differential;
- Urinalysis;
- Blood chemistry panel;
- Chest X-ray (every 3 years for persons 40 years old and younger; yearly for persons over 40 years old); and,

- Electrocardiogram (every 3 years for persons 40 years old and younger; yearly for persons over 40 years old).

12.20.7.1 Medical Examination Reports

Medical examination reports for AMEC personnel are presented in the form of medical clearance report titled "Work Status Report." These reports indicate any detected medical conditions that would increase an individual's risk of health impairment from occupational exposure or if the individual has limitations in the use of PPE such as protective clothing or respirator use. Copies of medical clearance reports for site personnel will be maintained by the SSHO and will be provided as required. If the SSHO does not have a report for AMEC personnel, the SSHO can request the report from WorkCare. Subcontractors requiring access into EZ areas shall provide a medical clearance report meeting the requirements of 29 CFR 1910.120(f)(7) to the SSHO. If the report does not meet the minimum requirements in 29 CFR 1910.120(f)(7), the employee shall not be permitted into the EZ.

12.20.7.2 Exposure Incident Medical Examinations

A chemical exposure incident medical examination will be completed if a worker is exposed to chemicals (or if suspicious symptoms exist). An incident report is required when this type of exam is administered (See Section 9.0 for Accident Reporting). The chemical exposure incident medical examination is mandatory and should be completed as soon as possible, but in no case later than 48 hours after the incident. The SSHO and/or designated physician will provide the treating physician with a list of all suspected chemicals that the worker may have contacted, and any additional information that may aid the physician. The worker will not be allowed back to work until a return to work notice has been issued by the treating physician and presented to the SSHO.

12.20.7.3 Lost Time of Illness Examinations

A medical examination may be necessary if a worker develops a lost time injury or illness during the period of the project contract. The worker will not be allowed back to work until a return to work notice has been issued by the treating physician and presented to the SSHO. The SSHO may request assistance from WorkCare to evaluate the return to work notice if any restrictions are noted.

12.20.7.4 Information Provided to Occupational Physician

Information that may be provided to the Occupational Physician includes the following:

- Site description and contamination characterization information;
- Anticipated or measured exposures of site personnel to site contaminants;
- Description of PPE used or to be used;

- Description of site personnel duties as they relate to employee exposures;
- Copy of 29 CFR 1910.120 or 29 CFR 1926.65 b;
- Copy of Section 5.0 of National Institute for Occupational Safety and Health (NIOSH) Publication No. 85-115; and,
- Information required by 29 CFR 1910.134.

12.20.8 Exposure Monitoring

The SSHO will be responsible for completing exposure monitoring during field operations to make initial exposure determinations and to evaluate where there is potential exposure to airborne dust and specific airborne contaminants above OSHA Permissible Exposure Limits (PELs), American Conference of Governmental Industrial Hygienists (ACGIH), or other published exposure guidelines. The components of the exposure monitoring program and the frequency of such personal and environmental monitoring will be based upon the work tasks to be completed, work methods used, and site contaminants and anticipated concentrations that are present.

12.20.8.1 Air Monitoring Objectives

The primary objectives of air monitoring to be implemented at project sites are to identify and quantify airborne contaminant concentrations during site work. The data obtained will be used to establish criteria for use of engineering controls and safe work practices, upgrade or downgrade of personal protection equipment (PPE), work stoppage and/or emergency evacuation, and prevention and/or minimization of public exposure.

12.20.8.2 Exposure Monitoring Plan

Monitoring will be required to determine personnel exposures to chemical contaminants during various site activities. Monitoring during project operations will be completed by the SSHO or designated representative.

Monitoring will be conducted for on-site personnel who are likely to have the highest exposures to hazardous substances and health hazards likely to be present above 50 percent of the PEL or Threshold Limit Value (TLV) (the lowest value).

The Exposure Monitoring Plan below provides information regarding the anticipated exposure monitoring to be completed on-site during project work. Should action level concentrations indicated in the exposure monitoring action plan be exceeded, response actions will be initiated to implement engineering controls, safe work practices, upgrade/downgrade in PPE, work stoppage and/or emergency evacuation, and notification/evaluation by the SSHO. Monitoring program data will be recorded and maintained by the SSHO. Recordkeeping of air monitoring instrument

measurements shall be documented on a Workplace Exposure Sampling Record (Appendix C). Completed forms shall remain on-site in hard copy records.

The SSHO will provide the results of exposure monitoring for specific contaminants monitored to individuals monitored within 5 days of receipt of results. The SSHO will maintain copies of such exposure monitoring records at the site for the duration of the project. Upon completion of the project, the exposure monitoring records will be maintained similarly to medical records and placed in each applicable employee's exposure monitoring record files for the duration of employment plus 30 years.

Air Monitoring Implementation

Monitoring for airborne hazards at a work site will fall into five categories: screening monitoring, periodic monitoring, personal exposure monitoring, site perimeter monitoring, and community monitoring. Before commencement of site work, background air monitoring should be conducted by the SSHO at locations representative of and consistent with work zones proposed in the APP. The pre- startup or background sampling locations will be determined by the SSHO, who will consider such factors as wind direction, terrain, and building locations. The following categories of monitoring will be performed during excavation of contaminated soils, in-situ and ex-situ activities, and site characterization.

Screening Monitoring

Site characterization is used to identify primary health and safety concerns associated with a work site. Pre-startup or background screening monitoring is conducted prior to the beginning of site work to determine background airborne concentrations) for site contaminants (vapor and/or dust and to evaluate the potential threats associated with air contaminant sources identified in site characterization sampling (e.g., soil sample results). Screening should be performed with the instrument and detector appropriate for the contaminant to evaluate the actual sources and concentrations of contaminants released in the immediate area of site personnel. Information from the screening will determine the need for periodic monitoring of site conditions or personal exposure monitoring.

Periodic Monitoring

Periodic monitoring of ambient air in the work area is necessary when screening monitoring has demonstrated an air contaminant source that may persist as a hazard to personnel (i.e., >50 percent of PEL for a respective contaminant). Periodic monitoring is also necessary when a new task or activity has begun or a change in the work process has occurred. Periodic monitoring should be conducted using direct reading real-time instrumentation to provide a quick assessment of work

area concentrations. If direct reading instrumentation is not available, utilize the appropriate monitoring collection devices to assess airborne hazards.

Periodic monitoring within the EZ shall be conducted at various locations downwind and during active field activities. The SSHO shall roam to fully assess EZ airborne conditions utilizing direct reading instruments to monitor for dust and VOCs. These readings shall last 2 to 4 minutes at each location. The SSHO shall document instrument readings on the Workplace Exposure Sampling Record (Appendix C) annotating specific location, date, time, and chemical contaminants.

A PID will be used as the direct reading instrument for real-time periodic monitoring of total VOCs. Dust will be monitored using a real-time aerosol dust monitor including an in-line filter and constant flow air sampling pump. Periodic monitoring areas include support activity areas [e.g., loading areas, storage areas, and contamination reduction zones (CRZs), site perimeter, and inside the EZ]. The SSHO will conduct periodic monitoring within these locations to ascertain if protective measures are adequate.

Perimeter Monitoring

Periodic monitoring results within the EZ provide a basis for site perimeter monitoring. Site perimeter monitoring will be conducted during active phases of field activities where and when periodic monitoring within the EZ indicated air contaminant or dust levels exceeded action levels in Table 12-1. The SSHO shall monitor air contaminants and dust downwind of periodic monitoring locations that exceeded action levels. During site perimeter monitoring, site perimeter action levels in Table 12-1 shall be utilized to determine when concentrations of contaminants exceed action levels. Implementation of corrective measures triggered by a contaminant exceeding action levels shall activate site personnel to mobilize the Emergency Response Plan (Section 12.2). This monitoring will continue until sufficient documentation has established that either no hazard exists or that a constant known hazard level, that is unlikely to change, has been identified. Site perimeter monitoring may involve integrated, real-time (direct reading), or other specialized monitoring techniques as necessary, based on the SSHO's determination.

Personal Exposure Monitoring

Personal exposure monitoring, especially personnel within the EZ, may be performed to determine adequacy of protective levels. If real-time screening or periodic monitoring show exceedance of action levels in Table 12-1, then personal exposure monitoring shall be implemented to determine the adequacy of PPE being utilized during specific activities. Personal worker exposure monitoring related to hazardous work activities will also be conducted whenever

personnel voice concerns regarding hazardous substance exposure based on qualified symptoms confirmed by the SSHO or documented by a physician.

Personal exposure monitoring may include both worker breathing zone and ambient work zone air. The monitoring should be conducted when there is a possibility of exceeding action levels during each hazardous, task-specific activity. Samples can be collected to determine the 8-hour TWA or short-term exposures represented by the specific task. Initial samples will be collected for workers with the highest likelihood of exposure. The number of initial samples will be determined by the SSHO based on the extent and conditions of the new task-specific activity.

Specific hazard exposure will be monitored on or around personnel engaged in unique work activities (such as environmental sampling personnel, crane operator, and excavator operators) and where there exists a concern for exposure over an OSHA PEL. These workers due to their proximity to high-risk activities may potentially be exposed to elevated concentrations of contaminants.

Air Monitoring Calibration

The SSHO or a designee under the SSHO's direction will calibrate monitoring equipment in accordance with manufacturers' instructions. Frequency of calibration varies with the instrument. Direct-reading instruments require calibration before use and after each use. A span gas check (bump test) using a tedlar bag is the preferred method to determine if the instrument is within the manufacturer's calibration parameters. Other instruments are less prone to response drift and may require less frequent checks of instrument response. The user should verify the calibration frequency before use. Factory servicing of the monitoring instruments will be conducted periodically as recommended by the manufacturer. The SSHO will make provisions for replacement equipment when factory service of an instrument is needed.

Documentation of instrument calibration is required. The Instrument Calibration Log (Appendix C) will be used to document instrument calibration for direct-reading instruments. Each calibration event should be noted in the respective log sheet.

For personal air sampling pumps, pump flow calibration results will be documented using Instrument Calibration Log (Appendix C) for integrated sampling instruments. A copy of the current calibration curve for the rotameter used for calibration will be filed with the pump calibration data. Documentation of any field servicing or repair of an instrument will be documented in the calibration log sheet.

All user comments regarding instrument operation, problems, questionable readings, misuse, or other issues will be fully documented in the field logbook. Certifications of analysis for calibration

gas standards and span gases will be maintained on file by the SSHO. Factory or manufacturer communications regarding the instruments will be documented in the field logbook. Primary calibration documents for flow meters calibrated by the manufacturer or equipment technician will be maintained with the calibration documentation (especially the calibration curves).

Air Sampling Action Levels

For those sites where intrusive work is being performed, periodic air monitoring for VOCs will be conducted within the work zone at the worker's breathing zone. The results will be recorded on a Workplace Exposure Monitoring Record (Appendix C) during each sampling event. This information will be recorded and a report will be generated by the SSHO to personnel working on-site.

Personal air monitoring will be conducted during intrusive activities at the site if the real-time monitors indicate high levels (greater than PEL) of contaminant. The sampling will be conducted at the discretion of the SSHO. Sampling efforts will be coordinated between the SSHO, FM, and the PM. Analytical results of any personal sampling efforts will be reviewed and posted at the site within 5 days of receipt. See Section 12.5 for more detail on airborne chemical exposure. All monitoring instruments used will be calibrated, operated, maintained, and stored in accordance with manufacturer's specifications and recommendations. To satisfy these requirements, a copy of the manufacturer's operating and maintenance manual must be collected and maintained at the work site. Only individuals who through training and/or experience are competent to operate air monitoring instruments and properly interpret their results will be permitted to operate these devices.

12.20.9 Physical Monitoring

The following sections detail the potential physical hazards of field activities and monitoring that should be conducted when these hazards are present.

12.20.9.1 Heat Stress

Heat stress monitoring per the AMEC Heat Stress Control SOP (Appendix E) will be conducted at times when elevated ambient temperatures, moderate to heavy workloads, and impermeable protective clothing are being used. Heat stress monitoring will be implemented when impermeable protective clothing is in use and ambient temperatures exceed 70°F. The frequency of monitoring will increase as the ambient temperature increases or if slow recovery rates are indicated. When ambient temperatures exceed 80°F, monitoring will be accomplished after each work period.

Heat stress monitoring and establishment of work-rest regimens for heat stress prevention

will be completed through physiological monitoring of workers. Physiological monitoring is performed by measuring body temperature in °F with an ear thermometer set or an adult oral temperature thermometer. The heart rate is measured at the worker's radial (wrist) pulse rate. Monitoring will be accomplished at the beginning of work and following each work period. Action levels for elevated body temperatures to be used are 99.6°F (for the SSHO to observe/evaluate the condition of the individual) and 100.4°F (for the SSHO to observe/evaluate the condition of the individual) and 100.4°F (for removal of the individual from work involving heat exposure for the rest of the workday). The physiological monitoring procedures are described below.

Body Temperature Monitoring

Perform baseline measurement at the start of work shift before entering the EZ. Measure the body temperature using an ear thermometer or an oral thermometer. If using an oral thermometer, ensure the thermometer remains under the tongue for at least 3 minutes before taking a reading of the thermometer. In addition, wait at least 5 minutes if the worker was drinking a cool drink before placing the oral thermometer into the mouth of a worker.

Following the first work period, measure the body temperature as soon as possible in the next rest period before drinking. If the body temperature exceeds 99.6°F (or baseline by 1°F), reduce the next work cycle by one-third without changing the duration of the rest period.

Following the next work period, if the body temperature still exceeds 99.6°F (or baseline by 1°F), then again shorten the following work cycle by one-third while keeping the length of the rest period the same.

Watch for signs and symptoms of heat stress throughout the work process. Pay strict attention to anyone whose body temperature exceeds 99.6°F (or 1 to 2°F above baseline) and contact the SSHO for an evaluation of the individual. Do not permit a worker to wear semi-impermeable or impermeable garments when the body temperature exceeds 100.4°F. If the body temperature exceeds 100.4°F, immediately contact the SSHO, remove the worker from the work area, remove protective clothing from the worker, and treat for heat exhaustion/heat stroke if symptoms are evident. If the body temperature exceeds 100.6°F, the worker must not be allowed to do work involving heat exposure for the rest of the workday.

Heart Rate Monitoring

Accomplish baseline measurements at the start of work shift before entering the EZ. Measure the heart rate by counting the radial pulse for a 30-second period and multiply the value by two to determine the number of beats per minute (bpm).

Following the first work period, measure the heart rate as early as possible in the resting period. If the heart rate exceeds 110 bpm, then reduce the next work period by one-third while keeping the length of the rest period the same.

Following the next work period, if the heart rate still exceeds 110 bpm, then again shorten the following work cycle one-third while keeping the length of the rest period the same. Watch for signs and symptoms of heat stress throughout the work process. Contact the SSHO for an evaluation when a worker's heart rate exceeds 110 bpm. Record physiological measurements using the Heat Stress Monitoring Form in Appendix C.

The heat stress monitoring program will be managed on-site by the SSHO. Table 12-4 provides a summary of the types of heat-related illnesses that are possible when working in hot temperature extremes. Monitoring will increase with temperature extremes.

Of particular importance is heat stress resulting when protective clothing decreases natural body ventilation. One or more of the following steps will help reduce heat stress:

- Drinking water and/or electrolyte solution will be made available to the workers in such a way that they are stimulated to frequently drink small amounts (i.e., two or more cups at every break period). The fluid will be kept reasonably cool (55 to 60ºF) and shall be placed close to the workplace so that the worker can reach it without abandoning the work area. However, where contaminants that pose an ingestion toxicity hazard are known/suspected to exist, workers will not be permitted to consume any fluids without first performing decontamination procedures and going to an uncontaminated area. Table 12-5 represents guidelines for prevention of heat stress through fluid intake.
- Lightweight clothing acts as a wick to help absorb moisture and to protect the skin from direct contact with heat-absorbing protective clothing.
- When and as determined to be necessary/applicable, the installation of mobile showers and/or hose-down facilities to reduce body temperature and cool protective clothing.
- In extremely hot weather, conduct non-emergency response operations in the evening.
- In hot weather, rotate shifts or workers wearing impervious clothing.

Table 12-4. Summary of Heat-Related Illnesses
Hancock Field Air National Guard Base, Syracuse, New York

Heat Related Illness	Signs and symptoms	Emergency Care
Heat Rash	Red skin rash and reduced sweating	Keep the skin clean, change all clothing daily, cover affected areas with powder containing corn starch or regular corn starch
Heat Cramps	Severe muscle cramps, exhaustion, sometimes with dizziness or periods of faintness	Move the patient to a nearby cool lace; give the patient half-strength electrolyte fluids; if cramps persist, or if more serious signs develop, seek medical attention
Heat Exhaustion	Rapid breathing, weak pulse, cold and clammy skin, heavy perspiration, total body weakness, dizziness that sometimes leads to unconsciousness	Move the patient to a nearby cool lace; keep the patient at rest, give the patient half-strength electrolyte fluids, treat for shock, seek medical attention. **DO NOT TRY TO ADMINISTER FLUIDS TO AN UNCONSCIOUS PATIENT**
Heat Stroke	Deep breaths, then shallow breathing; rapid, strong pulse, then rapid, weak pulse; dry, hot skin; dilated pupils, loss of consciousness (possible coma); seizures or muscular twitching may be seen	Cool the patient rapidly; treat for shock; if cold packs or ice bags are available, wrap them and place one bag or pack under each armpit, behind each knee, one in the groin, one on each wrist and ankle, and one on each side of the neck; seek medical attention as rapidly as possible; monitor the patient's vital signs constantly. **DO NOT ADMINISTER FLUIDS OF ANY KIND**

- Good hygienic standards must be maintained by frequent changes of clothing and daily showering.
- Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult the SSHO.
- Acclimatization to heat involves a series of physiological and psychological adjustments that occur in an individual during his first week of exposure to hot environmental conditions. The work-rest regimen in this procedure is valid for acclimated workers who are physically fit. Extra caution must be employed when unacclimated or physically unfit workers must be exposed to heat stress conditions.
- A shaded rest area will be available to dramatically reduce the heat strain effects.

The following physiological factors are potentially life threatening and require immediate medical attention:

- Oral temperature of 101.3°F or higher,
- Recovery heart rate at 1 minute after a peak work effort greater than 120 bpm, or
- Symptoms of sudden and severe fatigue, nausea, dizziness or lightheadedness, or other heat stoke symptoms.

Table 12-5. Guidelines for Prevention of Heat Stress through Fluid Intake
Hancock Field Air National Guard Base, Syracuse, New York

1. The sense of thirst is not an adequate regulator of water replacement needs during heat exposure. Therefore, fluids must be replaced at prescribed intervals. Water or other flavored drinks will be provided: • Before work begins, drink two 8-ounce glasses of fluid • During each rest period, drink at least two 8-ounce glasses of fluid
2. An adequate supply of potable water or electrolyte solution and drinking cups will be readily available, such as in the support zones, to provide water during the rest periods. Recommended drinks are: • Plain water served cool • Juice diluted 3:1 with water being the main constituent • Electrolyte solutions, such as Gatorade, diluted with water, with water being the main constituent
3. Adding salt to water is not recommended. Do not use salt tablets! Also avoid the following: • Alcoholic beverages • Concentrated juices • Water with salt added

12.20.9.2 Cold Stress

Cold stress monitoring per the AMEC Cold Stress Monitoring SOP (Appendix E) will be conducted at times when decreased ambient temperatures are below 45°F. Cold stress monitoring is completed by measuring the air temperature in the work environment (dry bulb temperature) and measuring the body temperature of the worker. Requirements for use of warm clothing for prevention of cold injury to body extremities are necessary.

Guidelines for cold stress prevention are contained in ACGIH "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices." Use of warm clothing at temperatures below 40°F for prevention of cold injury to body extremities is recommended. Worker body temperatures should not fall below 96.8°F as a general rule and for a single, occasional exposure to a cold environment, a drop in body temperature to no lower than 95°F is permitted.

A cold stress monitoring program will be implemented should decreased ambient temperatures (less than 45°F) occur. When air temperatures are below 45°F, air temperature monitoring will be initiated and if the temperature drops below 30°F, the air temperature will be measured every 4 hours. At temperatures lower than 45°F, personnel will wear warm clothing including, as needed, boots; heavy socks (i.e., wool or polypropylene); mittens, insulated gloves, insulated head covers; thermal underwear; and insulated coveralls. At temperatures lower than 25°F, personnel will avoid continuous cold exposure to their skin.

Table 12-6 presents a wind chill index indicating the equivalent ambient temperature when ambient temperature and wind conditions are combined. This table lists categories of risk due to this combined effect on exposed flesh.

Table 12-6. Chill Temperature Chart
Cooling Power of Wind on Exposed Skin Expressed as an Equivalent Temperature
Hancock Field Air National Guard Base, Syracuse, New York

Estimated Wind Speed (in mph)	Actual Temperature Reading (˚F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (˚F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect)	LITTLE DANGER In < hr with dry skin. Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within 1 minute.				GREAT DANGER Flesh may freeze within 30 seconds.			
Trenchfoot and immersion foot may occur at any point on this chart.												

From American Conference of Governmental Industrial Hygienists, Inc., *2001 Threshold Limit Values (TLVs®) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs®)*. Reprinted with permission.

12.20.10 Standard Operating Safety Procedures, Engineering Controls, and Work Practices

The following are general site rules that must be followed.

- Workers must obey directives from the SSHO; personnel who do not comply with safety requirements may be immediately dismissed from the site as required by the PM, and/or SSHO. Personnel at the site will work in teams of at least two persons (buddy system) and visual contact between team members must be maintained.
- Possession or use of drugs, alcohol, and firearms are not allowed at the site.
- Site personnel are encouraged to immediately report unsafe work conditions, unsafe work practices, equipment problems, and violations of APP requirements observed to their supervisor and/or SSHO without fear of reprisal.
- Avoid contact with potentially contaminated substances within EZ and CRZ by walking around puddles, pools, mud, or other such areas. Avoid, whenever possible, kneeling on the ground or leaning or sitting on equipment. Do not place monitoring equipment on potentially contaminated surfaces.

- Be familiar with and adhere to instructions provided within this APP.
- Must have a means of communicating with site personnel via cellular phone with key personnel numbers pre-programmed or two-way radios if cellular phone service is inadequate.
- Be aware of emergency telephone numbers.
- Attend briefings on anticipated hazards, equipment requirements, Safe Work Permits, emergency procedures, and communication methods before going on-site.
- Plan and mark entrance, exit, and emergency escape routes.
- Rehearse unfamiliar operations prior to implementation.
- Maintain visual contact with each other and with other on-site team members by remaining in close proximity in order to assist each other in case of emergency.
- Establish appropriate Safety Zones including Support, CRZs, and EZs.
- Minimize the number of personnel and equipment in contaminated areas (such as the EZ). Non-essential vehicles and equipment should remain within the Support Zone.
- Establish appropriate decontamination procedures for leaving the site.
- Observe coworkers for signs of toxic exposure and heat or cold stress.
- Inform co-workers of potential symptoms of illness, such as headaches, dizziness, nausea, or blurred vision.

12.20.11 Site-Control Measures

Due to the nature of work activities at the site, the establishment of formalized work zones (i.e., EZ, CRZ, and Support Zone) will be required. Site work zone requirements are established to limit access to work areas by unauthorized personnel, prevent the spread of contamination from the work area, establish site communication, and ensure site security measures. Site work zones will be established based on the type of work operations, potential for contaminant exposure, and potential for contact with other safety hazards.

Establishment of controlled site work zones will be required at locations where intrusive work in contaminated areas will be performed and/or where contact with contaminated soil is possible. Work zone demarcation will be established through use of caution tape or other means (e.g., barricades, fencing, signs) as approved by the SSHO.

12.20.11.1 Work Zones

Work areas shall be established to provide for protection of personnel during sampling, excavation, treatment, and demolition activities associated with site activities. These work areas will be dynamic and will change as the work proceeds from one area of the site to another. The work area is defined as the overall boundary where field activities will be performed. Activities that will

occur in the work area include equipment and material staging, clearing and grubbing, excavation, sampling, backfill, surveys, and final site restoration. Site personnel, including visitors such as client or regulatory agency personnel, will be properly briefed on the APP prior to entering any designated work area. Work areas will be clearly identified using barricade fencing, hazard tape, or adequate signage.

The EZ will be delineated from the CRZ and support zones using signage, caution tape, and/or barrier fence. After backfilling and compaction, excavated area will be roped off until the grounds become stable. The SSHO may limit access to other site areas depending on the hazard presented in the area.

Exclusion or Hot Zone

The EZ is the work zone that represents the area of highest contamination at the site. The EZ will be identified by the SSHO for each work area. The levels of protection used within the EZ may vary dependent upon the various work tasks to be conducted and is determined by the SSHO. The outer border of the EZ will be identified with caution tape.

Contamination Reduction Zone

The CRZ is the work zone that represents the transition area between the EZ and the Support Zone at the site. Entry to/exit from the EZ will be through a designated location in the CRZ. Upon exit from the EZ, workers will be required to pass through the CRZ before entering the Support Zone. Personnel decontamination will occur within the decontamination station in the CRZ.

Support Zone

Sign-In/Sign-Out Forms (Appendix C) will be utilized to document personnel visiting, entering, or working at the site. A new form will be used daily. This form includes entries for the date, name, organization, and time entering and exiting the site. This form will be maintained by the SSHO in the AMEC site office. All personnel are required to report and sign in at the AMEC site office upon arrival at the site.

Personnel who wish to enter a CRZ or EZ at the site must provide to the SSHO copies of required training, medical fitness for duty, and respirator fit testing documentation, as applicable, and receive site-specific training as documented using the APP Compliance Agreement Form (Appendix C) prior to authorization for site entry.

12.20.11.2 Site Security

Site security measures are required to prevent unauthorized access to controlled areas of the site. Site security measures are presented in the following sections.

General Requirements

No unauthorized persons will be allowed in controlled areas of the site. In addition, personnel are required to check-in with AMEC before entering controlled areas of the site.

The use of temporary fencing, barricades, signs, and/or color-coded tape for delineation of controlled areas shall be instituted. Color coded tape (e.g., yellow "CAUTION" tape and red "DANGER" tape) will delineate work zones to limit access within EZs to only essential personnel.

Use protection around open trenches during off hours or when departing the work zone area for extensive period of time (e.g., temporary fencing, barricades with flashing lights and signs/color coded tape).

Prohibited Articles

The following listed articles are prohibited within the perimeter:

- Firearms and ammunition;
- Strike-anywhere materials;
- Explosives;
- Intoxicants;
- Narcotics; and,
- Drugs.

Smoking in restricted areas will be allowed in approved, posted smoking locations only.

12.20.12 Personal Hygiene and Decontamination Requirements

12.20.12.1 Personal Hygiene

Worker exposure concerns to site contaminants through inhalation are highly unlikely. However, several of the substances that have been previously detected at the intended site work areas possess some exposure concerns if sufficient quantities either come into direct contact with exposed skin or if they are ingested. These potential exposure pathways (i.e., skin contact and ingestion) will be protected through following good safe work practices, hazard controls, and the use of PPE. A key element to prevent these types of exposures is through site personnel practicing good personal hygiene practices. This involves washing the hands and face with soap and potable water. This should be performed every time a site worker leaves an active site work area, after he/she has completed appropriate personal decontamination and before performing any hand-to-mouth activities. Hygienic wipes will be used as a temporary mainstay at remote areas until access to a suitable location may be obtained.

12.20.12.2 Decontamination Procedures

Level D and Modified Level D Protection

The use of disposal PPE will be emphasized when utilizing Modified Level D protection. This will reduce the impact of decontamination procedures. Proper doffing procedures will still be emphasized by the SSHO while the amount of soap and water will significantly be reduced. Spent disposal PPE shall be placed within containerized trash bin with a plastic lined bag. Prior to disposal into waste receptacles (e.g. trash dumpsters), the plastic bag shall be placed within a second plastic bag for double bagging.

When reusable chemical protective clothing (e.g. chemical suits, boots, and gloves) is used then decontamination will involve scrubbing with a soap and water solution followed by rinsing with potable water. Hands should be washed immediately after removing gloves with soap and water. Good hygiene practices will be observed, scrubbing with soap for at least 30 seconds followed by a potable water rinse. **(NOTE: LEVEL D PPE IS A WORK UNIFORM AFFORDING MINIMAL PROTECTION AND USED FOR NUISANCE CONTAMINATION ONLY)**

Recognizing that the planned tasks will involve minimal expected contact with site contaminants, and recognizing that minimal chemical-protective PPE will be required for the planned tasks, personal decontamination procedures will not be extensive. For all intrusive tasks performed at any of the areas, the general decontamination process to be performed in the CRZ will be as follows:

- Equipment drop (hand tools, instruments, hardhats, safety glasses, etc.);
- Segregated removal of disposable PPE worn (gloves, duct tape, coveralls, etc.), from head down and from outer layers inward;
- Place disposal PPE into containerized trash bin and properly dispose with double-bag layers; and,
- Exit CRZ, wash hands and face with soap and potable water prior to any hand-to-mouth activities.

Level C Protection

If Level C is used, a personnel decontamination facility will be provided at specific work sites. It will consist of stations for contaminated protective clothing removal and placement into containers, and a field wash station. Disposal PPE potentially exposed to contaminated soils will be double-bagged, characterized and disposed of appropriately as waste. Use of laundry services for laundering of work coveralls is not expected for site work. The following personnel decontamination procedures for Level C protection (wet/muddy and/or heavy contamination) are indicated below:

Station 1 - Equipment Drop: Deposit used equipment on sheet plastic liner.

Station 2 - Boots and Outer Garments Wash/Rinse: Scrub outer boots, outer gloves, and suit with detergent/water solution. Rinse off with water. If disposable protective clothing is used, use this station for gross contamination removal.

Station 3 - Outer Boot Covers and Outer Gloves Removal: Remove outer boot covers and outer gloves. Deposit in container with plastic liner.

Station 4 - Cartridge/Canister or Mask Change-Out: Change-out air purifying respirator cartridges/ canister or face piece as needed, don new outer gloves and boot covers, tape at joints, and return to EZ (Note: Last step in decontamination sequence for canister or mask change-out; continue decontamination sequence if entering Support Zone).

Station 5 - Boots and Outer Garment Removal: Remove boots and suit and deposit in containers with plastic liners.

Station 6 - Respirator Face piece and Inner Gloves Removal: Remove respirator face piece (avoid touching face with fingers) and deposit on sheet plastic or in plastic bag. Remove inner gloves.

Station 7- Field Wash: Wash hands and face thoroughly.

12.20.13 Equipment Decontamination

Procedures for equipment and personnel decontamination will be implemented to minimize the spread of contamination to clean zones, to reduce exposure to personnel, and to reduce cross-contamination. Field equipment should be washed with hot water (steam clean) and detergent. Alconox is recommended.

Equipment must be scrubbed until all visible dirt, grime, grease, oil, etc. have been removed. After cleaning and detergent rinse, equipment must be rinsed with potable (tap) water and inspected by a designated individual prior to leaving the site. All wash and rinse water shall be controlled from running off the decontamination location and collected for proper disposal. This action can be performed by establishing a berm around the area and sloping the area to facilitate collection of potentially decontamination contaminated water.

12.20.14 Emergency Decontamination and Treatment

In an emergency, the primary concern is to administer first aid to the injured team member(s), and to prevent further injury to other team members. However, decontamination of personnel injured, to the maximum extent possible, must still occur before the injured team member(s) can enter the Support Zone.

Chemical hazards or emergencies associated with exposure to chemical hazards are not anticipated. During any site evacuation, decontamination procedures will be performed only if doing so does not further jeopardize the welfare of site workers. Decontamination will not be performed if the incident warrants immediate evacuation.

12.20.14.1 Non-Life Threatening Medical Incident

At least one person will be trained and on-site to provide First Aid and Cardiopulmonary Resuscitation (CPR) level support. All general first aid measures for non-life threatening medical incidents (bruises, cuts, scrapes, etc.) will be performed by a First Aid/CPR trained individual.

12.20.14.2 Life Threatening Medical Incident

First aid procedures for life threatening injuries shall be performed by the First Aid/CPR trained individual. The first aid procedures are as follows:

- Engage Emergency Notification Sequence, notify, or instruct a specific team member to notify, off- site response agencies.
- If it will not endanger the injured individual (e.g., spinal cord injury, etc.) remove any outer PPE. Removal may require the use of bandage scissors to remove the outer garments. If this type of injury is suspected do not move injured person, notify emergencies services.
- Begin life saving techniques as appropriate, such as first aid, CPR, cooling or warming regimens, etc.
- Wrap the injured in a blanket for transport to the hospital.

Note: One person from the field team will accompany the injured to the hospital with his/her medical data sheet, appropriate MSDSs (if applicable), a copy of this APP, and the incident forms. This person will collect as much information as possible and transfer that information to the HSE Manager, SSHO, and WorkCare as per the Emergency Response Plan provided in Section 12.2 of this APP. All other personnel will engage in site control/site security measures.

Emergency Medical Treatment Protective Measures

Personnel are only permitted to provide treatment to the level of their First Aid Training. It should also be noted that all first aid shall be administered voluntarily. All First Aid and emergency medical treatment will be initiated under the following guarded restrictions:

- Take the necessary precautions to prevent direct contact with the injured person's body fluids. This may be accomplished through the employment of the following measures:
  - Use surgeon's gloves when handling cuts, abrasions, bites, punctures, etc. or any part of the injured person. The use of safety glasses/face shield and surgeon's masks maybe

necessary if there is the potential for uncontrolled spread of body fluids. The Corporate HSE Manager will be immediately notified in the event that personnel providing emergency first-aid have been exposed to body fluids or other potentially infectious tissues.

- Should CPR be required, use a CPR Micro-Shield mouthpiece or a resuscitation bag when administering CPR to prevent contact with the injured person's body fluids.
- In order to engage these protective measures the FM and/or SSHO shall ensure that these items are part of their first-aid kit.

12.20.15 Emergency Response and Contingency Procedures

Emergency Response Plans are presented in Section 12.2 of this APP.

12.21 Blasting Plan

Not applicable to this project.

12.22 Diving Plan

Not applicable to this project.

12.23 Fall Protection Plan

Not applicable to this project.

12.24 Steel Erection Plan

Not applicable to this project.

12.25 Night Operations Lighting Plan

Not applicable to this project.

12.26 Site Sanitation Plan

The following provisions shall be made to address sanitation:

- Portable toilets shall be provided, as necessary, at convenient locations at the project sites. Arrangements will be made for the routine servicing and cleaning of these units.
- Safe drinking water shall be provided at each project site. One-serving size individual bottles of water or disposable sanitary cups shall be provided with receptacles for their disposal. All outlets dispensing non-potable water shall be posted with appropriate warning signs.

- Portable washing facilities shall be provided as necessary at project sites. Portable washing facilities shall consist of, at a minimum, soap, water, and paper towels. When it is not feasible to use soap and water (i.e., during freezing weather), handi-wipes or equivalent shall be made available.

12.27 Fire Prevention and Protection Plan

12.27.1 Workplace Fire Hazards

The primary fire hazards at the project consist of fueling operations, storage of fuels, and other flammable liquids at the project site.

12.27.2 Potential Ignition Sources

The significant ignition sources at the project include smoking materials, vehicle/equipment exhaust, catalytic converters, and engine block surfaces. Personnel shall also be alert for other ignition sources such as static electricity, lightning, and electrical equipment.

12.27.3 Fire-Control Systems, Equipment, and Procedures

Depending on the nature and extent of any fire, the following fire-control systems and equipment shall be evaluated or provided for at the project site:

- The fire department shall be contacted prior to beginning new operations at the site and at the conclusion of operations.
- Project vehicles and heavy equipment shall be equipped with fire extinguishers.
- Flammable and oxidizing materials shall be stored in marked (No Smoking, Matches, or Open Flame) flammable materials storage areas with fire extinguishers available.
- Smoking shall only be permitted in designated areas. Personnel shall never discard cigarette butts into the environment while working at the project site.
- Project personnel are only permitted to extinguish small fires in their incipient stages.
- Fighting fires shall only be performed by the local fire department.

12.27.4 Fire-Control Equipment Maintenance Responsibilities

The SSHO is responsible for monthly inspections and service of fire extinguishers provided at the field trailer and work areas. Vehicle and heavy equipment operators are responsible for the inspection and service of fire extinguishers in vehicles and heavy equipment.

13.0 SITE-SPECIFIC HAZARDS AND CONTROLS

The AHAs identify potential safety, health, and environmental hazards associated with specific tasks and provide protective measure for personnel, the community, and the environment.

The AHAs were developed for all major tasks that will be performed for the project and are included in this APP. The AHAs will be reviewed and modified by the SSHO and FM (with input from the field employees and subcontractors). An AHA will also be prepared when new tasks are added, a task is modified, or when it becomes necessary to alter safety requirements. Work will not proceed on a particular task until the AHA has been reviewed with the work crews. Additions or changes to the AHAs must have written approval from the PM.

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14.0 REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH), 2005. *Threshold Limit Values for Chemical Substances and Physical Agents Biological Exposure Indices*.

Code of Federal Regulations (CFR), Title 29: *Labor*; Subtitle B - *Regulations Relating to Labor*, Chapter XVII - *Occupational Safety and Health Administration, Labor Department*; Part 1910: *Occupational Safety and Health Standards*.

CFR, Title 29: *Labor*; Subtitle B - *Regulations Relating to Labor*, Chapter XVII - *Occupational Safety and Health Administration, Labor Department*; Part 1926: *Safety and Health Regulations for Construction*.

CFR, Title 40: *Protection of Environment*, Chapter I: *Environmental Protection Agency*, Subchapter I: *Solid Wastes*.

CFR, Title 40: *Protection of Environment*; Chapter I: *Environmental Protection Agency*; Subchapter J: *Superfund, Emergency Planning, and Community Right-To-Know Programs*; Part 300: *National Oil and Hazardous Substances Pollution Contingency Plan*.

CFR, Title 49: *Transportation*, Subtitle B: *Other Regulations Relating to Transportation*, Chapter I: *Pipeline and Hazardous Materials Safety Administration, Department of Transportation*, Subchapter C: *Hazardous Materials Regulations*.

Innovative Technical Solutions, Inc. and Shaw Environmental, Inc. (ITSI/Shaw), 2009. *Hancock Field ANGB, CSE Phase I Report*. September.

National Institute for Occupational Safety and Health (NIOSH), 2005. *Pocket Guide to Chemical Hazards*. September.

Sky Research, Inc. (Sky), 2012. *Hancock Field ANGB CSE Phase II Report (Final)*, U.S. Army Corps of Engineers, Omaha District. December.

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APPENDICES

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APPENDIX A

ACTIVITY HAZARD ANALYSIS

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ACTIVITY HAZARD ANALYSIS (AHA)
FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES
FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

Title: **MOBILIZATION AND DEMOBILIZATION FOR ALL SITES**
Number: **AHA-01** **Revision No: 0** **Prepared by/date:**

GENERAL INFORMATION	
KEY PERSONNEL: **Project Manager:** Paula Bond **Field Manager:** Jeremy Bennett **SSHO:** Jeremy Bennett	**Training Requirements:** HAZWOPER General Worker, Site Safety and Health Plan, Respiratory Protection, AHA briefing **Medical Monitoring and Surveillance Requirements:** Hazardous Waste Operations and Emergency Response (HAZWOPER) (29 CFR 1926.65 (f))
Emergency Communication	911
Emergency Hospital/Telephone Number	St. Joseph's Hospital 301 Prospect Avenue Syracuse, NY 13203 Telephone # **(315) 448-5111**
Facilities Covered	Hancock Field, MRSs SR001, Small Arms Range and Shooting-In Buttress, and SR002, Firing-In Buttress
Emergency Assembly Points	TBD based on facility location
Permits/Specialized Training Required	PPE
Special Instructions	The SSHO shall brief forecasted weather warnings during daily tailgate meeting.

AHA Preface:

**** ALL EMPLOYEES HAVE SUSPEND/STOP WORK AUTHORITY –** All employees, are reminded that they have both the authority and responsibility to stop work when they perceive that an unsafe condition exists that threatens themselves, their coworkers, or the environment. Every employee has the right to a safe workplace, safe working conditions, and to understand the hazards of the workplace.

ALL INJURIES, ILLNESSES, AND INCIDENTS MUST BE REPORTED TO THE SITE SAFETY AND HEALTH OFFICER IMMEDIATELY. See the Section 9.0 on protocol to follow found in the APP.

ALL PERSONNEL ARE ENCOURAGED TO ASK QUESTIONS AND OFFER SUGGESTIONS. Feedback on work methods, procedures, hazard controls, and preventative measures during all phases of work is essential to continuous improvement of work processes and is a part of the Integrated Safety Management System. Help us make your job easier and safer!

Signature of Site Safety and Health Officer: **Date:**

ACTIVITY HAZARD ANALYSIS (AHA)
FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES
FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

Risk Assessment Code (RAC) Table							
		Probability					
Severity		Frequent	Likely	Occasional	Seldom	Unlikely	
	Catastrophic	E	E	H	H	M	E = Extremely High Risk; H = High Risk; M = Moderate Risk; L = Low Risk
	Critical	E	H	H	M	L	Noted in "Potential Hazard" Column
	Marginal	H	M	M	L	L	
	Negligible	M	L	L	L	L	

PREREQUISITES		
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
Standard PPE: ANSI Z89.1 approved hard hat (Class C), steel-toe boots (ANSI Z41), ANSI Z87.1 approved safety glasses, and reflective safety vest. Eye wash station capable of providing 15 minutes of continuous service when corrosive materials are used on site.	Inspect PPE equipment prior to donning and doffing equipment. Inspect eye wash station at least weekly. Completion of Equipment Inspection Form before subsequent daily use. Prior to equipment demobilization, equipment used in exclusion zone areas shall be wash down in decontamination wash down station area.	Only trained and qualified personnel will be allowed to work within exclusion zone. Only trained and qualified personnel will be allowed to operate equipment. All personnel trained on the physical and health hazards associate with chemicals used on site. Source documents will be MSDSs from supplier of items.

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Collect and confirm required worker training and medical compliance documentation.	Acceptable worker knowledge and fit-for-duty status (RAC: M)	• All personnel participating in field activities shall be current on HAZWOPER training requirements listed in 29 CFR 1910.120 (e) as well as medical surveillance requirements in 29 CFR 1910.120 (f). • Visitors not meeting the above requirements shall be escorted throughout their visit by an AMEC representative.
Perform site survey and initial inspections of intended work areas	Slips, trips, and falls (RAC: M)	• Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow). • Personnel shall wear protective foot wear. Foot wear shall have adequate sole and tread to reduce the potential for slipping or falling on slick surfaces. • Maintain work area clear and in good order.

	ACTIVITY HAZARD ANALYSIS (AHA) FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Perform site survey and initial inspections of intended work areas (cont.)	Traffic safety (RAC: M)	• Stay clear of the designated contractor's route, use signals, horns, etc. when entering site where workers are present. • Post "Men at Work" signage to notify vehicular traffic of activity being performed adjacent to roadway. • Use traffic cones to demarcate work zone entrance near roadway. • Designated traffic pattern shall be used to ensure safe movement of trucks in and out of loading zone. • Use escort vehicles with flashing lights to warn and control local traffic when moving large equipment to support area. • A spotter shall guide drivers when backing up into congested and narrow path areas.
	Struck by hazard (RAC: L)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between trucks and equipment or structures. • Site workers on the ground will remain in the line of sight of personnel operating trucks and use high visibility reflective vest or highly-visible colored apparel.
Perform inspections of vehicles and equipment arriving/preparing to depart the site	Operating vehicles and heavy equipment unsafely (RAC: M)	• Prior to operating a vehicle, the driver shall perform daily inspections using the Safety Inspection Form. • Prior to operating equipment, operator shall perform daily inspection using Safety Inspection Form. • Personnel working near heavy equipment shall wear high visibility vests. • The equipment operators and on-site supervisors are responsible for ensuring that the Safety Inspection Forms have been reviewed and completed, and that all moving parts are guarded if such parts are exposed. • Equipment operators shall operate equipment in a safe manner at all times and wear seatbelts while operating heavy equipment. • Check/test all emergency stop controls. Personnel shall only operate equipment that is in good condition and safe to operate. • Equipment found to be in need of repair, defective, or unsafe in any way, shall be tagged and taken out of service. Equipment shall not be operated with damaged windshield or glass. Equipment shall not be placed back into service until repaired and inspected and authorized to do so by SSHO. • Loads shall be lowered and power shut off when equipment is left unattended. Heavy equipment shall be equipped with backup alarms. • Equipment shall have properly functioning: brake system, brake lights, audible horn, and all other safety systems specified in the operator's manual. • Fire extinguishers shall be mounted on diesel and propane powered mobile equipment. • Equipment shall be shut-off prior to refueling. • No smoking or spark sources shall be allowed near refueling or battery maintenance areas.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Limited Site Clearing including brush removal using heavy equipment, chain saws, and other similar equipment	Rotating/cutting machinery and light equipment operation (RAC: M)	• Equipment shall be inspected in accordance with Federal safety and transportation guidelines, OSHA (1926.600,.601,.602), and manufacturers design. • Only manufacturer-approved parts may be used in repair of site equipment. • An equipment inspection checklist will be completed prior to the use of project vehicles, machinery and equipment. • Equipment shall be operated by knowledgeable ground crew. • Establish safe zones and routes of approach to the operation (personnel should remain cognizant that this is a multi-task operation with many activities engaged in simultaneously). • Restrictions at the operation (All personnel not directly supporting this clearance activity will remain at least 50-100 feet from the point of this operation). • Hand signals with the light equipment operator will be established prior to the commencement of activities. • Work areas will be kept clear of clutter. • Secure all loose articles to avoid possible entanglement. • Self-propelled equipment shall be equipped with movement warning systems. • Personnel will be instructed in the location and operations of the emergency shut-off device(s). This device will be tested initially (and then periodically) to insure its operational status. • Damaged or questionable equipment shall not be used and labeled with “Do Not Use”.
	Noise hazard (RAC: M)	• Equipment producing sound level measurements in excess of 85 dB A-weighted may require the use of hearing protection depending on duration of exposure to the equipment. Rule of thumb, if personnel must shout to be heard at arms distance, hearing protection is required. • Due to expected high elevated noise levels from machinery and equipment, excessive noise control will be facilitated through the use of hearing protection. Hearing protection with noise reduction statistic range between 21-32 (noise reduction rating 30) is adequate for protecting workers.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Limited Site Clearing including brush removal using heavy equipment, chain saws, and other similar equipment (cont.)	Flying projectiles/falling tree limbs (RAC: M)	• Inspect the chainsaw prior to each use. Insure the blade is adjusted and sharp, and all parts are lubricated per the manufacturer's instruction. Test all safety devices initially and then periodically to insure operational status. • When starting, place the chainsaw on the ground or some other firm surface. Place your foot in the hand guard at the rear of the saw, grip the top handle of the saw with one hand, pull the start cord with the free hand. Never attempt to start the saw free hand or by placing on your knee. • Never cut with tip of the chain saw blade. • Plan the cut. Know where the tree will fall. Have a clear escape plan when dropping trees greater than 2 inches in diameter. • Preview the tree to be dropped. Often, red wasps will nest in hollowed out trunks and in tree tops. Do not stand between falling trees and branches and fixed items or other trees. • Do not cut over your head. • Do not cut materials other than wood with the chain saw. • Wear prescribed safety equipment (hard hat with mesh face shield, chainsaw chaps, etc.). • Monitor, the condition of the saw during use, make adjustments as necessary. • When limbing a tree, to the extent possible cut from the other side of the trunk, which will serve as a shield. • Be attentive as to which way the trunk may move when removing limbs, place yourself out of the anticipated pathway when cutting. • Be attentive to movement of the trunk as an indication of the stability of the tree and brush pile. • Keep the work area free from clutter to avoid potential slip, trip, and fall hazards.
Set up material and equipment lay-down areas	Injuries from hand and power tools (RAC: L)	• All hand and power tools shall be used in accordance with the APP. • Keep any machine guarding in place. • Avoid any moving parts and secure loose clothing, jewelry or long hair that could become entangled. Inspect tools prior to use. Damaged tools shall be removed immediately. Tools shall be used for its designed purpose.
	Crushing injuries from unstable loads (RAC: M)	• Inspect staging areas prior to placing materials. • Utilize traffic cones to demarcate loading/unloading zone for delivery of support materials • Prior to the initiation of work, personnel will be informed of potential hazards and required precautions. Equipment shall be properly leveled/stabilized and checked to insure that it will not move once in place. All rigging equipment shall be inspected prior to use. Only rigging equipment with the load capacity stamped or labeled on the equipment shall be used. • Rigging equipment rating to load ratio shall be 4 to 1 as a minimum. Ensures stability of load during transport. • No load shall be transported above any individual. Maintain load as close to the ground when transporting from one location to the other. • Personnel shall not stand underneath loads handled by lifting or digging equipment. • Damaged, unrated, or questionable rigging equipment shall not be used and labeled with "Do Not Use".
	Noise hazard (RAC: L)	• Equipment producing sound level measurements in excess of 85 dB A-weighted may require the use of hearing protection depending on duration of exposure to the equipment. Utilize hearing protection with Noise Reduction Rating of at least 33 dB. Rule of thumb, if personnel must shout to be heard at arms distance, hearing protection is required.

	ACTIVITY HAZARD ANALYSIS (AHA) FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up material and equipment lay-down areas (cont.)	Pinch point hazards (RAC: L)	• Wear leather work gloves when handling support materials. • Never place hands into bind spots of equipment.
	Heavy Lifting, Strains, Sprains (RAC: L)	• No individual employee is permitted to lift any object that weighs over 50 lbs. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50 lb. limit. (EM385-1-1 14.A) Use proper lifting techniques: - Lift with your legs, not your back, bend your knees, move as close to the load as possible, and ensure good handholds are available. - Minimize the horizontal distance to the center of the lift to your center of gravity. - Minimize turning and twisting when lifting as the lower back is especially vulnerable at this time. - Break lifts into steps if the vertical distance (from the start point to the placement of the lift) is excessive. • Other considerations defining lifting hazards - Area available to maneuver the lift. - Area of the lift – workplace clutter, slippery surfaces. - Overall physical condition.
	Chemical hazards from chemicals utilized on site (RAC: L)	• The on-site Hazard Communication Program will be followed. All chemicals brought onto the site by AMEC and subcontractor personnel will be inventoried and have an MSDS on-site, on file. This effort shall include: - Maintain an accurate chemical inventory list (entries will match chemicals brought on-site, as the names appear on the MSDS) - MSDSs will be maintained in a central location, accessible to all personnel. • All containers will have labels specifying the following information: - Chemical Identity (As it appears on the label, MSDS, and Chemical Inventory List) - Appropriate Warning (i.e., eye and skin irritation, flammable, etc.) - Manufacturer's Name, Address, and Phone Number • It will be the SM and/or the SSO's responsibility to insure this is completed.
Establish excavation locations and arrange for utility clearances prior to intrusive activities. Secure permits from appropriate authorities	Potential to strike existing utility lines (RAC: H)	• Pre-inspect vehicle moving lanes noting overhead utilities. • Do not approach within 10' of any overhead electric line of 50 kV or less. Additional clearance distance is required for lines of > 50kV. Reference Section 5.8.2. • Pre-survey the height of equipment and height of utility lines to determine which lines must be removed or raised. • Pre-plan the move with the local utility companies if utility lines must be moved.
	Electrocution or penetration of buried utilities from equipment coming into contact with power, gas, water or sewer lines (RAC: H)	• Contact Holloman AFB Civil Engineering Services to demarcate locations of utilities prior to intrusive activities. • All underground and above utilities will be located prior to the initiation of work. Only qualified personnel shall install temporary utilities. • The locations of all underground utilities will be identified and marked in the field prior to subsurface investigation.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
General safety during this activity	Severe Weather (RAC: L)	• Prior to work, check the weather forecast for the day. Take cover in a building/vehicle if lightning is spotted. (EM385-1-1 06.J) • Wear appropriate clothing for weather conditions.
	Sunburn (RAC: L)	• Sunscreen will be available for use during the summer months. Use appropriate sunscreen with a SPF of no less than 30. Protect exposed areas of the skin. • Shade should be utilized when available and/or shade provided when feasible. If feasible, avoid sunlight during the hours of 10 am and 2 pm when the sunlight is most intense. (EM385-1-1 06.I) • Wear hats and other protective garments to provide shade.
	Heat/Cold Stress (RAC: L)	• Drink plenty of fluids to keep your body hydrated. • Heat stress and cold related injuries will be monitored and controls will be implemented as necessary. (EM385-1-1 06.I) • An adequate supply of drinking water shall be provided in all places of employment. Frequent rest break shall be taken as needed to insure proper hydration during weather extremes. (EM 385-1-1 02.C.01)

ACTIVITY HAZARD ANALYSIS (AHA)
FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES
FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

Title: **GROUNDWATER SAMPLING**
Number: **AHA-02** **Revision No: 0** **Prepared by/date:**

GENERAL INFORMATION	
KEY PERSONNEL: **Project Manager:** Paula Bond **Field Manager:** Jeremy Bennett **SSHO:** Jeremy Bennett	**Training Requirements:** HAZWOPER General Worker, Site Safety and Health Plan, Respiratory Protection, AHA briefing **Medical Monitoring and Surveillance Requirements:** Hazardous Waste Operations and Emergency Response (HAZWOPER) (29 CFR 1926.65 (f))
Emergency Communication	911
Emergency Hospital/Telephone Number	St. Joseph's Hospital Telephone # **(315) 448-5111** 301 Prospect Avenue Syracuse, NY 13203
Facilities Covered	Hancock Field, MRSs SR001, Small Arms Range and Shooting-In Buttress, and SR002, Firing-In Buttress
Emergency Assembly Points	TBD based on facility location
Permits/Specialized Training Required	PPE
Special Instructions	The SSHO shall brief forecasted weather warnings during daily tailgate meeting.

AHA Preface:

**** ALL EMPLOYEES HAVE SUSPEND/STOP WORK AUTHORITY –** All employees, are reminded that they have both the authority and responsibility to stop work when they perceive that an unsafe condition exists that threatens themselves, their coworkers, or the environment. Every employee has the right to a safe workplace, safe working conditions, and to understand the hazards of the workplace.

ALL INJURIES, ILLNESSES, AND INCIDENTS MUST BE REPORTED TO THE SITE SAFETY AND HEALTH OFFICER IMMEDIATELY. See the Section 9.0 on protocol to follow found in the APP.

ALL PERSONNEL ARE ENCOURAGED TO ASK QUESTIONS AND OFFER SUGGESTIONS. Feedback on work methods, procedures, hazard controls, and preventative measures during all phases of work is essential to continuous improvement of work processes and is a part of the Integrated Safety Management System. Help us make your job easier and safer!

Signature of Site Safety and Health Officer: **Date:**

ACTIVITY HAZARD ANALYSIS (AHA)
FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES
FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

Risk Assessment Code (RAC) Table							
		Probability					
Severity		Frequent	Likely	Occasional	Seldom	Unlikely	
	Catastrophic	E	E	H	H	M	E = Extremely High Risk; H = High Risk; M = Moderate Risk; L = Low Risk
	Critical	E	H	H	M	L	Noted in "Potential Hazard" Column
	Marginal	H	M	M	L	L	
	Negligible	M	L	L	L	L	

PREREQUISITES		
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
Standard PPE: ANSI Z89.1 approved hard hat (Class C), steel-toe boots (ANSI Z41), ANSI Z87.1 approved safety glasses, and reflective safety vest. Contact with groundwater: Standard PPE plus two layers of nitrile rubber gloves with at least 4 mm thickness. Eye wash station capable of providing 15 minutes of continuous service.	Inspect PPE equipment prior to donning and doffing equipment. Inspect eye wash station at least weekly. Prior to equipment demobilization, equipment used in exclusion zone areas shall be wash down in decontamination wash down station area.	Only trained and qualified personnel will be allowed to work within exclusion zone. Only trained and qualified personnel will be allowed to operate equipment. All personnel trained on the physical and health hazards associate with chemicals used on site. Source documents will be MSDSs from supplier of items.

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up decontamination area and groundwater sample collection equipment	Slips, trips, and falls (RAC: M)	• Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow). • Personnel shall wear protective foot wear. Foot wear shall have adequate sole and tread to reduce the potential for slipping or falling on slick surfaces. • Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Maintain work area clear and in good order. • ALWAYS PLACE TRASH INTO PLASTIC BAGS and dispose of bags in proper waste receptacles.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up decontamination area and groundwater sample collection equipment (cont.)	Heavy lifting, muscle strains and sprains involved with handling pumps, polyethylene lining rolls, and generator equipment.(RAC: L)	• No individual employee is permitted to lift any object that weighs over 50 lbs. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50 lb. limit. (EM385-1-1 14.A) • Use proper lifting techniques: - Lift with your legs, not your back, bend your knees, move as close to the load as possible, and ensure good handholds are available. - Minimize the horizontal distance to the center of the lift to your center of gravity. - Minimize turning and twisting when lifting as the lower back is especially vulnerable at this time. - Break lifts into steps if the vertical distance (from the start point to the placement of the lift) is excessive. • Other considerations defining lifting hazards - Area available to maneuver the lift. - Area of the lift – workplace clutter, slippery surfaces. - Overall physical condition.
	Use of sharp edge hand tools to cut tubing (RAC: M)	• Insure handles are in good construction (no cracks, splinters, loose heads/cutting apparatus). • Insure all cutting tools are maintained properly. Blades shall be sharp without knicks and gouges in the blade. • All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with a sheath to protect individuals, when not in use. • ALWAYS USE A CUTTING MOTION MOVING AWAY FROM YOU. Never cut towards your body. • All personnel will maintain a 10-foot perimeter around persons clearing brush.
	Struck by hazard (RAC: L)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between trucks, and equipment or structures. • Site workers on the ground will remain in the line of sight of personnel operating trucks and use high visibility reflective vest or highly-visible colored apparel.
Collecting purge water from wells using submersible pump connected to 110 W generator	Portable energized sources (RAC: M)	• Perform all service and maintenance work with the generator engine off and the positive battery cable disconnected. Moving parts can cause severe personal injury or death, and live wires could cause fatal electrocution. • Keep the exhaust and air intake free from obstructions such as clothing, furniture or other material. • Always operate the generator in an area where the wind will carry away the exhaust fumes. • Do not overload the generator. • Use the right power cords with your portable power generators such as heavy duty, outdoor rated cords with a wire gauge adequate for the equipment load. Overloaded cords can cause fires or equipment damage. You must also not use extension cords with exposed wires or worn shielding. • Fuels and other flammable liquids should be stored away from exhaust. In addition, the container of flammable or combustible liquids shall an approved safety can.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Collecting purge water from wells using submersible pump connected to 110 W generator (cont.)	Noise hazard (RAC: M)	• Equipment producing sound level measurements in excess of 85 dB A-weighted may require the use of hearing protection depending on duration of exposure to the equipment. Rule of thumb, if personnel must shout to be heard at arms distance, hearing protection is required. • Personnel within 15 feet of operating generator shall wear hearing protection. Hearing protection with noise reduction statistic range between 21-32 (noise reduction rating 30) is adequate for protecting workers. • Position generator at least 20 feet way from sample collection area.
Collecting purge water from wells using submersible pump connected to 110 W generator (cont.)	Potential inhalation hazard from contaminants of concern in groundwater (RAC: L) The primary contaminants of concern (COC) include Benzene, Carbon Tetrachloride, Chloroform, Ethylene Ddichloride, Ethyl Benzene, Methylene chloride, Trichloroethylene (TCE), Toluene, and Xylenes (see Table 5-1 in the HASP).	• It is not anticipated that potential contaminant concentrations at outdoor sample locations will present an inhalation hazard. • A Photoionization Detector (PID) will be used to screen samples and detect the presence of any potential organics. The PID must have a 10.6 eV lamp or higher. A Flame Ionization Detector (FID) may be substituted for the PID. To the extent that contents are known, use correction factors supplied with the monitoring instrument. Source monitoring of the work area will be conducted at regular intervals as determined by the SSHO. Positive sustained results at a source of downwind location(s) which may impact operations crew will require the following actions: - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above the values listed in the APP or twice the background levels in the breathing zone areas of the a-risk employees requires site activities to be suspended and site personnel to retreat to an unaffected area. - Work may only resume if airborne readings in worker's breathing zone areas return to background levels. If elevated readings in worker's breathing zone persist, the PM and SSHO will be contacted to determine necessary actions and levels of protection. - Record all readings especially when values exceed Table 7-1 concentrations. Note duration of elevated readings. • Personnel shall receive training on the elements of each of the identified COCs.
	Potential contact and ingestion hazards from COCs in groundwater (RAC: M)	• Personnel shall wear two layers of nitrile rubber gloves during contact with groundwater. • Personnel shall not perform any hand to mouth contact until gloves are removed and hands thoroughly washed.

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Collecting purge water from wells using submersible pump connected to 110 W generator (cont.)	Transfer of contamination into clean areas (RAC: M)	• Decontaminate all equipment and supplies if they become contaminated, between locations and prior to leaving the site. Items like submersible pumps will be decontaminated at the decontamination station near the AMEC field office. • Dispose of all supplies in direct contact with groundwater into heavy duty plastic liners with 6 mm thickness. (e.g. tubing, disposable PPE). • Minor decontamination of equipment requires the use of liquid detergent solution, DI water, and isopropyl alcohol. These items are placed in secondary container spray bottles (normally 32 fl oz). • Personnel shall ensure spray bottles are properly label in accordance with Hazard Communication requirements. • Ensure all transport containers (e.g. polyethylene tanks) are not filled to the top. Secure transport container lids when in transit. • All transport containers shall be label with "Non Potable Water" stickers or hand written. • Transport containers shall have camlock fittings and ball valve to control flow of water.
Collecting samples for groundwater analysis	Potential inhalation hazard from contaminants of concern in groundwater (RAC: L) The primary contaminants of concern (COC) include Benzene, Carbon Tetrachloride, Chloroform, Ethylene Ddichloride, Ethyl Benzene, Methylene chloride, Trichloroethylene (TCE), Toluene, and Xylenes (see Table 5-1 in the HASP).	• It is not anticipated that potential contaminant concentrations at outdoor sample locations will present an inhalation hazard. • A Photoionization Detector (PID) will be used to screen samples and detect the presence of any potential organics. The PID must have a 10.6 eV lamp or higher. A Flame Ionization Detector (FID) may be substituted for the PID. To the extent that contents are known, use correction factors supplied with the monitoring instrument. Source monitoring of the work area will be conducted at regular intervals as determined by the SSHO. Positive sustained results at a source of downwind location(s) which may impact operations crew will require the following actions: - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above the values listed in the APP or twice the background levels in the breathing zone areas of the a-risk employees requires site activities to be suspended and site personnel to retreat to an unaffected area. - Work may only resume if airborne readings in worker's breathing zone areas return to background levels. If elevated readings in worker's breathing zone persist, the PM and SSHO will be contacted to determine necessary actions and levels of protection. - Record all readings especially when values exceed action levels. Note duration of elevated readings. • Personnel shall receive training on the elements of each of the identified COCs.
	Potential contact and ingestion hazards from COCs in groundwater (RAC: M)	• Personnel shall wear two layers of nitrile rubber gloves during contact with groundwater. • Personnel shall not perform any hand to mouth contact until gloves are removed and hands thoroughly washed.

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Collecting samples for groundwater analysis (cont.)	Repetitive movements while using bailers to collect samples from wells (RAC: M)	• Bailers are used to collect groundwater. Personnel use a 3/8 inch breaded nylon rope or nylon masonry string to lower bailers into well screen. The following measures should reduce repetitive trauma to arms and hands: - Wear two layers of nitrile rubber gloves to minimize contact with contaminated material. - Rotate team members between sampling events. - Maintain a good posture position when lifting bailer out of the well casing.
Transporting purge water from transport containers into frac tank	Potential contact and ingestion hazards from COCs in groundwater (RAC: M)	• Personnel shall wear two layers of nitrile rubber gloves during contact with groundwater. • Personnel shall not perform any hand to mouth contact until gloves are removed and hands thoroughly washed. • Due to the greater potential for splash during transfer of purge water into the frac tank, personnel shall don a full face shield.
	Transfer of contamination into clean areas (RAC: M)	• Personnel shall adequately secure hose to frac tank. • Ensure cam locks are secure. • Frac containers shall be label with “Non Potable Water” stickers or hand written. • Maintain a small spill kit to handle incidental spill of purge water at the storage lay down area.
	Fall hazard (RAC: M)	• Inspect hand railing of frac tank regularly to ensure pins are secured and integrity of railing. • If railing is bent, cracked, or heavily rust, report to SM or SSO. • Always utilize a “three-point” contact when climbing railing. Do not jump off railing at anytime.
	Noise hazard while using trash pump during transfer from container to frac tank (RAC: M)	• Equipment producing sound level measurements in excess of 85 dB A-weighted may require the use of hearing protection depending on duration of exposure to the equipment. Rule of thumb, if personnel must shout to be heard at arms distance, hearing protection is required. • Personnel within 15 feet of operating generator shall wear hearing protection. Hearing protection with noise reduction statistic range between 21-32 (noise reduction rating 30) is adequate for protecting workers. • Position trash pump at least 20 feet way from railing.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
	Potential inhalation hazard from contaminants of concern in groundwater (RAC: L) The primary contaminants of concern (COC) include Benzene, Carbon Tetrachloride, Chloroform, Ethylene Ddichloride, Ethyl Benzene, Methylene chloride, Trichloroethylene (TCE), Toluene, and Xylenes (see Table 5-1 in the HASP).	• It is not anticipated that potential contaminant concentrations at outdoor sample locations will present an inhalation hazard. • A Photoionization Detector (PID) will be used to screen samples and detect the presence of any potential organics. The PID must have a 10.6 eV lamp or higher. A Flame Ionization Detector (FID) may be substituted for the PID. To the extent that contents are known, use correction factors supplied with the monitoring instrument. Source monitoring of the work area will be conducted at regular intervals as determined by the SSHO. Positive sustained results at a source of downwind location(s) which may impact operations crew will require the following actions: - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above the values listed in the APP or twice the background levels in the breathing zone areas of the a-risk employees requires site activities to be suspended and site personnel to retreat to an unaffected area. - Work may only resume if airborne readings in worker's breathing zone areas return to background levels. If elevated readings in worker's breathing zone persist, the PM and SSHO will be contacted to determine necessary actions and levels of protection. - Record all readings especially when values exceed action levels. Note duration of elevated readings. • Personnel shall receive training on the elements of each of the identified COCs.
General safety during this activity	Severe Weather (RAC: L)	• Prior to work, check the weather forecast for the day. Take cover in a building/vehicle if lightning is spotted. (EM385-1-1 06.J) • Wear appropriate clothing for weather conditions.
	Sunburn (RAC: L)	• Sunscreen will be available for use during the summer months. Use appropriate sunscreen with a SPF of no less than 30. Protect exposed areas of the skin. • Shade should be utilized when available and/or shade provided when feasible. If feasible, avoid sunlight during the hours of 10 am and 2 pm when the sunlight is most intense. (EM385-1-1 06.I) • Wear hats and other protective garments to provide shade.
	Heat/Cold Stress (RAC: L)	• Drink plenty of fluids to keep your body hydrated. • Heat stress and cold related injuries will be monitored and controls will be implemented as necessary. (EM385-1-1 06.I) • An adequate supply of drinking water shall be provided in all places of employment. Frequent rest breaks shall be taken as needed to insure proper hydration during weather extremes. (EM 385-1-1 02.C.01)
	Struck by hazards (RAC: M)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between support materials and equipment or structures. • Personnel shall not stand next to vehicles being loaded or unloaded. • Site workers on the ground will remain in the line of sight of personnel operating equipment and use high visibility reflective vest or highly-visible colored apparel.

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
General safety during this activity (cont.)	Insects, Spiders, and Ticks (RAC: L)	• Insect/tick repellant will be provided for employees to use. • Personnel will be instructed to be cautious of insects, spiders, and ticks, especially when opening well covers. • Wear clothing that covers potentially affected body parts. • Seal pants legs against contact with plants and to prevent access by organisms (examples – ticks & chiggers). • Check body thoroughly after work to detect ticks and chiggers. • Take hot shower after field work and wash thoroughly. (EM 385-1-1 06.D)
	Hypersensitivity or Allergic Reactions (RAC: L)	• Personnel who are knowingly hypersensitive or allergic to insects or plants will be identified using Medical Data Sheet and precautions taken. (EM385-1-1 06.D)
	Personnel Injury (RAC: L)	• Wear appropriate PPE. • Inspect the work area for hazards, including tripping hazards, prior to the start of survey efforts. • Keep non-essential personnel out of the work zone. Barricade as necessary. (EM385-1-1 06.A; 28.D)

ACTIVITY HAZARD ANALYSIS (AHA)
FOR EXCAVATION ACTIVITIES
FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

Title: **EXCAVATION ACTIVITIES**
Number: **AHA-03** **Revision No: 0** **Prepared by/date:**

GENERAL INFORMATION	
KEY PERSONNEL: **Project Manager:** Paula Bond **Field Manager:** Jeremy Bennett **SSHO:** Jeremy Bennett	**Training Requirements:** HAZWOPER General Worker, Site Safety and Health Plan, Respiratory Protection, AHA briefing **Medical Monitoring and Surveillance Requirements:** Hazardous Waste Operations and Emergency Response (HAZWOPER) (29 CFR 1926.65 (f))
Emergency Communication	911
Emergency Hospital/Telephone Number	St. Joseph's Hospital Telephone # **(315) 448-5111** 301 Prospect Avenue Syracuse, NY 13203
Facilities Covered	Hancock Field, MRSs SR001, Small Arms Range and Shooting-In Buttress, and SR002, Firing-In Buttress
Emergency Assembly Points	TBD based on facility location
Permits/Specialized Training Required	PPE
Special Instructions	The SSHO shall brief forecasted weather warnings during daily tailgate meeting.

AHA Preface:

**** ALL EMPLOYEES HAVE SUSPEND/STOP WORK AUTHORITY –** All employees, are reminded that they have both the authority and responsibility to stop work when they perceive that an unsafe condition exists that threatens themselves, their coworkers, or the environment. Every employee has the right to a safe workplace, safe working conditions, and to understand the hazards of the workplace.

ALL INJURIES, ILLNESSES, AND INCIDENTS MUST BE REPORTED TO THE SITE SAFETY AND HEALTH OFFICER IMMEDIATELY. See the Section 9.0 on protocol to follow found in the APP.

ALL PERSONNEL ARE ENCOURAGED TO ASK QUESTIONS AND OFFER SUGGESTIONS. Feedback on work methods, procedures, hazard controls, and preventative measures during all phases of work is essential to continuous improvement of work processes and is a part of the Integrated Safety Management System. Help us make your job easier and safer!

Signature of Site Safety and Health Officer: **Date:**

ACTIVITY HAZARD ANALYSIS (AHA)
FOR EXCAVATION ACTIVITIES
FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

Risk Assessment Code (RAC) Table							
		Probability					
Severity		Frequent	Likely	Occasional	Seldom	Unlikely	
	Catastrophic	E	E	H	H	M	E = Extremely High Risk; H = High Risk; M = Moderate Risk; L = Low Risk
	Critical	E	H	H	M	L	Noted in "Potential Hazard" Column
	Marginal	H	M	M	L	L	
	Negligible	M	L	L	L	L	

PREREQUISITES		
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
Standard PPE: ANSI Z89.1 approved hard hat (Class C), steel-toe boots (ANSI Z41), ANSI Z87.1 approved safety glasses, and reflective safety vest. Contact with potentially contaminated soil: Standard PPE plus one layer of nitrile rubber gloves with at least 4 mm thickness, Tyvex coveralls, and Tyvex booties. Eye wash station capable of providing 15 minutes of continuous service.	Inspect PPE equipment prior to donning and doffing equipment. Inspect eye wash station at least weekly. Prior to equipment demobilization, equipment used in exclusion zone areas shall be wash down in decontamination wash down station area.	Only trained and qualified personnel will be allowed to work within exclusion zone. Only trained and qualified personnel will be allowed to operate equipment. All personnel trained on the physical and health hazards associate with chemicals used on site. Source documents will be MSDSs from supplier of items.

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up decontamination area, work zones (exclusion zone, CRZ zone) and establish material lay down area for soil spoils	Slips, trips, and falls (RAC: M)	• Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow). • Personnel shall wear protective foot wear. Foot wear shall have adequate sole and tread to reduce the potential for slipping or falling on slick surfaces. • Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Maintain work area clear and in good order. • ALWAYS PLACE TRASH INTO PLASTIC BAGS and dispose of bags in proper waste receptacles.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR EXCAVATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up decontamination area, work zones (exclusion zone, CRZ zone) and establish material lay down area for soil spoils (cont.)	Heavy lifting, muscle strains and sprains involved with handling pumps, polyethylene lining rolls, and generator equipment. (RAC: L)	• No individual employee is permitted to lift any object that weighs over 50 lbs. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50 lb. limit. (EM385-1-1 14.A) • Use proper lifting techniques: - Lift with your legs, not your back, bend your knees, move as close to the load as possible, and ensure good handholds are available. - Minimize the horizontal distance to the center of the lift to your center of gravity. - Minimize turning and twisting when lifting as the lower back is especially vulnerable at this time. - Break lifts into steps if the vertical distance (from the start point to the placement of the lift) is excessive. • Other considerations defining lifting hazards - Area available to maneuver the lift. - Area of the lift – workplace clutter, slippery surfaces. - Overall physical condition.
	Use of sharp edge hand tools to cut material (e.g. heavy duty liner, boxes) (RAC: M)	• Wear cut-resistant gloves when handling items with sharp or rough edges. • Insure handles are in good construction (no cracks, splinters, loose heads/cutting apparatus). • Insure all cutting tools are maintained properly. Blades shall be sharp without knicks and gouges in the blade. • All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with a sheath to protect individuals, when not in use. • ALWAYS USE A CUTTING MOTION MOVING AWAY FROM YOU. Never cut towards your body. • All personnel will maintain a 10-foot perimeter around persons clearing brush.
	Traffic safety (RAC: M)	• Stop logs shall be installed to alarm trucks of loading position. • Warning systems such as barricades, hand or mechanical signals, or stop logs shall be utilized when mobile equipment is operated adjacent to or at the edge of an excavation. • Designated traffic pattern shall be used to ensure safe movement of trucks in and out of loading zone. A spotter shall guide drivers when backing up into congested and narrow path areas.
	Struck by hazard (RAC: L)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between trucks, and equipment or structures. • Site workers on the ground will remain in the line of sight of personnel operating trucks and use high visibility reflective vest or highly-visible colored apparel.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR EXCAVATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Excavator operator commences trenching activities of potentially contaminated soils and sediment.	Potential inhalation hazard from contaminants of concern in contaminated soils and sediments (RAC: L) The primary contaminants of concern (COC) include trichloroethylene (TCE), cis-1,2-dichloroethene (DCE), heavy metals (e.g. As, Cr, Pb, and Hg), carbon disulfide, benzene, ethylbenzene, toluene, xylenes, or diesel fuel.	• Perform air monitoring for COCs. If action levels listed in Table 7-2, implement corrective actions required. • A Photoionization Detector (PID) will be used to screen samples and detect the presence of any potential organics. The PID must have a 10.6 eV lamp or higher. To the extent that contents are known, use correction factors supplied with the monitoring instrument. Source monitoring of the work area will be conducted at regular intervals as determined by the SSHO. Positive sustained results at a source of downwind location(s) which may impact operations crew will require the following actions: - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above the values listed in the APP or twice the background levels in the breathing zone areas of the a-risk employees requires site activities to be suspended and site personnel to retreat to an unaffected area. - Work may only resume if airborne readings in worker's breathing zone areas return to background levels. If elevated readings in worker's breathing zone persist, the PHSO and SHM will be contacted to determine necessary actions and levels of protection. - Record all readings especially when values exceed action levels. Note duration of elevated readings. • Personnel shall receive training on the elements of each of the identified COCs. • Operator shall maintain excavator door/windows closed throughout the trenching activity. Whenever possible position the excavator upwind. • Operator shall minimize the amount of dust generated during the trench activities. All personnel shall remain upwind during trenching activities.
	Operating heavy equipment unsafely (RAC: M)	• Prior to operating equipment, operator shall perform daily inspection using Heavy Equipment Inspection form. • Personnel working near heavy equipment shall wear high visibility vests. • Equipment operators shall operate equipment in a safe manner at all times and wear seatbelts while operating heavy equipment. • Personnel shall only operate equipment that are in good condition and safe to operate. • Equipment found to be in need of repair, defective, or unsafe in any way, shall be tagged and taken out of service. Equipment shall not be operated with damaged windshield or glass. Equipment shall not be placed back into service until repaired and inspected and authorized to do so by SSHO. • Loads shall be lowered and power shut off when equipment is left unattended. All heavy equipment shall be required to be equipped with backup alarms. • Equipment shall have properly functioning: brake system, brake lights, audible horn, and all other safety systems specified in the operator's manual. • The equipment operators and on-site Supervisors responsible for the equipment are to ensure that the equipment have been inspected and completed, and that all moving parts are guarded if such parts are exposed. Check/test all emergency stop controls.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR EXCAVATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Excavator operator commences trenching activities of potentially contaminated soils and sediment. (cont.)	Potential for fire hazard (RAC: M)	• Fire extinguishers shall be mounted on diesel and propane powered mobile equipment. • Equipment shall be shut-off prior to refueling. • No smoking or spark sources shall be allowed near refueling or battery maintenance areas.
	Noise hazard (RAC: L)	• Equipment producing sound level measurements in excess of 85 dB A-weighted may require the use of hearing protection depending on duration of exposure to the equipment. Rule of thumb, if personnel must shout to be heard at arms distance, hearing protection is required. • Personnel within 15 feet of operating generator shall wear hearing protection. Hearing protection with noise reduction statistic range between 21-32 (noise reduction rating 30) is adequate for protecting workers.
	Cave in hazard (RAC: M)	• All excavations/trenches must have a competent person in charge that is capable of identifying existing and predictable hazards and has authorization to take prompt corrective actions. • Provide safe access and egress for excavations and trenches that are four feet or more in depth when the potential for personnel to enter trench exist. • For trenches, a stairway, ladder or ramp must be provided for every 25 feet of lateral travel. • Personnel are prohibited from entering excavations and trenches that have accumulated water. Water must be controlled to prevent accumulation before personnel can enter. • Excavations subject to run off from heavy rains must be re-inspected immediately by the competent person. • Protective systems shall be used for all excavations/trenches that are five feet or more in depth.
	Loose Soil and Rock (RAC: M)	• Personnel shall be protected from loose rock (e.g. riprap) and soil that could pose a hazard by falling or rolling from an excavation face. • Excavated or other material and equipment shall be placed at least two feet from the edge of the excavation or retaining devices shall be used. • Personnel shall not be permitted to work on the faces of sloped or benched excavations at levels above other personnel, unless personnel at the lower level are protected from falling, rolling, or sliding material or equipment.
	Hazardous atmospheres (RAC: M)	• Atmospheres in excavations and trenches that are four feet or deeper shall be tested prior to personnel entering the excavated areas. • Atmospheric results of the excavated area will be compared with the values listed in the APP.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR EXCAVATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Segregating potentially contaminated soil from not contaminated soil and control dispersement of soils using erosion control measures.	Improper management of soil spoils (RAC: H)	• Clearly demarcate soil spoils whether potentially contaminated or not contaminated (clean) using signage and color coded safety hazard tape (YELLOW-CAUTION: potentially contaminated soil; GREEN: clean soil). • Establish erosion control devices and borrow area for backfill material, as needed.
Collecting soil samples of potentially contaminated soil piles.	Potential inhalation hazard from contaminants of concern in contaminated soils and sediments (RAC: L) The primary contaminants of concern (COC) include trichloroethylene (TCE), cis-1,2-dichloroethene (DCE), heavy metals (e.g. As, Cr, Pb, and Hg), carbon disulfide, benzene, ethylbenzene, toluene, xylenes, or diesel fuel.	• Perform air monitoring for COCs. • If action levels are exceeded, implement corrective actions required. • A Photoionization Detector (PID) will be used to screen samples and detect the presence of any potential organics. The PID must have a 10.6 eV lamp or higher. To the extent that contents are known, use correction factors supplied with the monitoring instrument. Source monitoring of the work area will be conducted at regular intervals as determined by the SSHO. Positive sustained results at a source of downwind location(s) which may impact operations crew will require the following actions: - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above the values listed in the APP or twice the background levels in the breathing zone areas of the a-risk employees requires site activities to be suspended and site personnel to retreat to an unaffected area. - Work may only resume if airborne readings in worker's breathing zone areas return to background levels. If elevated readings in worker's breathing zone persist, the PHSO and SHM will be contacted to determine necessary actions and levels of protection. - Record all readings especially when values exceed action levels. Note duration of elevated readings. • Personnel shall receive training on the elements each of the identified COCs. • Operator shall maintain excavator door/windows closed throughout the trenching activity. Whenever possible position the excavator upwind. • Operator shall minimize the amount of dust generated during the trench activities. All personnel shall remain upwind during trenching activities.
	Potential contact and ingestion hazards from COCs in potentially contaminated soils (RAC: M)	• Personnel shall wear two layers of nitrile rubber gloves during contact with groundwater. • Personnel shall not perform any hand to mouth contact until gloves are removed and hands thoroughly washed.

	ACTIVITY HAZARD ANALYSIS (AHA) FOR EXCAVATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Collecting soil samples of potentially contaminated soil piles. (cont.)	Use of sharp edge hand tools to cut material (e.g. DPT liners) (RAC: M)	• Wear cut-resistant gloves when handling items with sharp or rough edges. • Insure handles are in good construction (no cracks, splinters, loose heads/cutting apparatus). • Insure all cutting tools are maintained properly. Blades shall be sharp without knicks and gouges in the blade. • All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with a sheath to protect individuals, when not in use. • ALWAYS USE A CUTTING MOTION MOVING AWAY FROM YOU. Never cut towards your body. If possible, place liners on a table or elevated platform at waist height. Use a device to secure the liners when performing cutting actions (e.g. clamps).
	Lower back strains (RAC: M)	• Utilize a table or elevated platform at waist height during sample collection.
	Slips, trips, and falls (RAC: M)	• Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow). • Personnel shall wear protective foot wear. Foot wear shall have adequate sole and tread to reduce the potential for slipping or falling on slick surfaces. • Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Maintain work area clear and in good order. • ALWAYS PLACE TRASH INTO PLASTIC BAGS and dispose of bags in proper waste receptacles.
General safety during this activity	Severe Weather (RAC: L)	• Prior to work, check the weather forecast for the day. Take cover in a building/vehicle if lightning is spotted. (EM385-1-1 06.J) • Wear appropriate clothing for weather conditions.
	Sunburn (RAC: L)	• Sunscreen will be available for use during the summer months. Use appropriate sunscreen with a SPF of no less than 30. Protect exposed areas of the skin. • Shade should be utilized when available and/or shade provided when feasible. If feasible, avoid sunlight during the hours of 10 am and 2 pm when the sunlight is most intense. (EM385-1-1 06.I) • Wear hats and other protective garments to provide shade.
	Heat/Cold Stress (RAC: L)	• Drink plenty of fluids to keep your body hydrated. • Heat stress and cold related injuries will be monitored and controls will be implemented as necessary. (EM385-1-1 06.I) • An adequate supply of drinking water shall be provided in all places of employment. Frequent rest breaks shall be taken as needed to insure proper hydration during weather extremes. (EM 385-1-1 02.C.01)
	Struck by hazards (RAC: M)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between support materials and equipment or structures. Personnel shall not stand next to vehicles being loaded or unloaded. • Site workers on the ground will remain in the line of sight of personnel operating equipment and use high visibility reflective vest or highly-visible colored apparel.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR EXCAVATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
General safety during this activity (cont.)	Insects, Spiders, and Ticks (RAC: L)	• Insect/tick repellant will be provided for employees to use. Personnel will be instructed to be cautious of insects, spiders, and ticks, especially when opening well covers. Wear clothing that covers potentially affected body parts. Seal pants legs against contact with plants and to prevent access by organisms (examples – ticks & chiggers). Check body thoroughly after work to detect ticks and chiggers. Take hot shower after field work and wash thoroughly. (EM 385-1-1 06.D) • Avoid nesting areas. • Report any insect bite to the SSHO. Follow guidance presented in Section 10 of the *SSHP*.
	Hypersensitivity or Allergic Reactions (RAC: L)	• Personnel who are knowingly hypersensitive or allergic to insects or plants will be identified using • Medical Data Sheet and precautions taken. (EM385-1-1 06.D)
	Personnel Injury (RAC: L)	• Wear appropriate PPE. • Inspect the work area for hazards, including tripping hazards, prior to the start of survey efforts. • Keep non-essential personnel out of the work zone. Barricade as necessary. (EM385-1-1 06.A; 28.D)

ACTIVITY HAZARD ANALYSIS (AHA)
FOR SOIL SAMPLING ACTIVITIES
FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

Title: **SOIL SAMPLING ACTIVITIES USING DPT DRILL RIG FOR SD-27, DP-30/SD-33, and SS-39 SITES**
Number: **AHA-04** **Revision No: 0** **Prepared by/date:**

GENERAL INFORMATION	
KEY PERSONNEL: **Project Manager:** Paula Bond **Field Manager:** Jeremy Bennett **SSHO:** Jeremy Bennett	**Training Requirements:** HAZWOPER General Worker, Site Safety and Health Plan, Respiratory Protection, AHA briefing **Medical Monitoring and Surveillance Requirements:** Hazardous Waste Operations and Emergency Response (HAZWOPER) (29 CFR 1926.65 (f))
Emergency Communication	911
Emergency Hospital/Telephone Number	St. Joseph's Hospital 301 Prospect Avenue Syracuse, NY 13203 Telephone # **(315) 448-5111**
Facilities Covered	Hancock Field, MRSs SR001, Small Arms Range and Shooting-In Buttress, and SR002, Firing-In Buttress
Emergency Assembly Points	TBD based on facility location
Permits/Specialized Training Required	PPE
Special Instructions	The SSHO shall brief forecasted weather warnings during daily tailgate meeting.

AHA Preface:

**** ALL EMPLOYEES HAVE SUSPEND/STOP WORK AUTHORITY –** All employees, are reminded that they have both the authority and responsibility to stop work when they perceive that an unsafe condition exists that threatens themselves, their coworkers, or the environment. Every employee has the right to a safe workplace, safe working conditions, and to understand the hazards of the workplace.

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Signature of Site Safety and Health Officer: **Date:**

ACTIVITY HAZARD ANALYSIS (AHA)
FOR SOIL SAMPLING ACTIVITIES
FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

Risk Assessment Code (RAC) Table							
		Probability					
Severity		Frequent	Likely	Occasional	Seldom	Unlikely	
	Catastrophic	E	E	H	H	M	E = Extremely High Risk; H = High Risk; M = Moderate Risk; L = Low Risk
	Critical	E	H	H	M	L	Noted in "Potential Hazard" Column
	Marginal	H	M	M	L	L	
	Negligible	M	L	L	L	L	

PREREQUISITES		
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
Standard PPE: ANSI Z89.1 approved hard hat (Class C), steel-toe boots (ANSI Z41), ANSI Z87.1 approved safety glasses, and reflective safety vest. Contact with potentially contaminated soil: Standard PPE plus one layer of nitrile rubber gloves with at least 4 mm thickness, Tyvex coveralls, and Tyvex booties. Eye wash station capable of providing 15 minutes of continuous service.	Inspect PPE equipment prior to donning and doffing equipment. Inspect eye wash station at least weekly. Prior to equipment demobilization, equipment used in exclusion zone areas shall be wash down in decontamination wash down station area.	Only trained and qualified personnel will be allowed to work within exclusion zone. Only trained and qualified personnel will be allowed to operate equipment. All personnel trained on the physical and health hazards associate with chemicals used on site. Source documents will be MSDSs from supplier of items.

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up decontamination area, work zones (exclusion zone, CRZ zone) and establish material lay down area for soil spoils	Slips, trips, and falls (RAC: M)	• Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow). • Personnel shall wear protective foot wear. Foot wear shall have adequate sole and tread to reduce the potential for slipping or falling on slick surfaces. • Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Maintain work area clear and in good order. • ALWAYS PLACE TRASH INTO PLASTIC BAGS and dispose of bags in proper waste receptacles.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR SOIL SAMPLING ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up decontamination area, work zones (exclusion zone, CRZ zone) and establish material lay down area for soil spoils (cont.)	Heavy lifting, muscle strains and sprains involved with handling pumps, polyethylene lining rolls, and generator equipment. (RAC: L)	• No individual employee is permitted to lift any object that weighs over 50 lbs. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50 lb. limit. (EM385-1-1 14.A) • Use proper lifting techniques: - Lift with your legs, not your back, bend your knees, move as close to the load as possible, and ensure good handholds are available. - Minimize the horizontal distance to the center of the lift to your center of gravity. - Minimize turning and twisting when lifting as the lower back is especially vulnerable at this time. - Break lifts into steps if the vertical distance (from the start point to the placement of the lift) is excessive. • Other considerations defining lifting hazards - Area available to maneuver the lift. - Area of the lift – workplace clutter, slippery surfaces. - Overall physical condition.
	Use of sharp edge hand tools to cut material (e.g. heavy duty liner, boxes) (RAC: M)	• Wear cut-resistant gloves when handling items with sharp or rough edges. • Insure handles are in good construction (no cracks, splinters, loose heads/cutting apparatus). • Insure all cutting tools are maintained properly. Blades shall be sharp without knicks and gouges in the blade. • All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with a sheath to protect individuals, when not in use. • ALWAYS USE A CUTTING MOTION MOVING AWAY FROM YOU. Never cut towards your body. • All personnel will maintain a 10-foot perimeter around persons clearing brush.
	Traffic safety (RAC: M)	• Designated traffic pattern shall be used to ensure safe movement of trucks in and out of support zone. • A spotter shall guide drivers when backing up into congested and narrow path areas. • If driver's line of sight is block when moving backwards, the vehicle should have back-up alarm and a spotter assigned to lead the driver.
	Struck by hazard (RAC: L)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between trucks, and equipment or structures. • Site workers on the ground will remain in the line of sight of personnel operating trucks and use high visibility reflective vest or highly-visible colored apparel.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR SOIL SAMPLING ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Setting up DPT drill rig	Operating unsafe equipment (RAC:H)	• Perform inspection of DPT drill rig with lead operator using the AMEC Equipment Inspection Checklist for Drill Rig. Both the SSHO and Lead operator shall sign the form indicating the drill rig is operating properly. • Validate personnel working on the drill rig are familiar with the equipment in use. • IF THE EMERGENCY STOP FUNCTION (e.g. Kill Switch) IS NOT OPERATIONAL, THE DRILL RIG WILL NOT BE ALLOWED ON SITE. • Ensure warning signs are posted in PINCH POINT locations. • Inspect the entire length of cable line or wire rope line. If the line shows signs of wear and tare, a "DO NOT USE" tag shall be place on the line and noted on the Equipment Inspection Checklist for Drill Rigs. • Equipment shall have properly functioning: brake system, brake lights, audible horn, and all other safety systems specified in the operator's manual.
Using DPT drill rig to collect samples of potentially contaminated soils and sediment.	Potential inhalation hazard from contaminants of concern in contaminated soils and sediments (RAC: L) The primary contaminants of concern (COC) include trichloroethylene (TCE), cis-1,2-dichloroethene (DCE), heavy metals (e.g. As, Cr, Pb, and Hg), carbon disulfide, benzene, ethylbenzene, toluene, xylenes, or diesel fuel.	• Perform air monitoring for COCs. • If action levels are exceeded, implement corrective actions required. • A Photoionization Detector (PID) will be used to screen samples and detect the presence of any potential organics. The PID must have a 10.6 eV lamp or higher. To the extent that contents are known, use correction factors supplied with the monitoring instrument. Source monitoring of the work area will be conducted at regular intervals as determined by the SSHO. Positive sustained results at a source of downwind location(s) which may impact operations crew will require the following actions: - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above the values listed in the APP or twice the background levels in the breathing zone areas of the a-risk employees requires site activities to be suspended and site personnel to retreat to an unaffected area. - Work may only resume if airborne readings in worker's breathing zone areas return to background levels. If elevated readings in worker's breathing zone persist, the PHSO and SHM will be contacted to determine necessary actions and levels of protection. - Record all readings especially when values exceed action levels. Note duration of elevated readings. • Personnel shall receive training on the elements of each of the identified COCs. • Operator shall maintain excavator door/windows closed throughout the trenching activity. Whenever possible position the excavator upwind. • Operator shall minimize the amount of dust generated during the trench activities. All personnel shall remain upwind during trenching activities.
	Noise hazard (RAC: M)	• Equipment producing sound level measurements in excess of 85 dB A-weighted may require the use of hearing protection depending on duration of exposure to the equipment. Rule of thumb, if personnel must shout to be heard at arms distance, hearing protection is required. • Personnel within 15 feet of operating generator shall wear hearing protection. Hearing protection with noise reduction statistic range between 21-32 (noise reduction rating 30) is adequate for protecting workers.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR SOIL SAMPLING ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Using DPT drill rig to collect samples of potentially contaminated soils and sediment (cont.)	Potential contact and ingestion hazards from COCs in potentially contaminated soils (RAC: M)	• Personnel shall wear two layers of nitrile rubber gloves during contact with groundwater. • Personnel shall not perform any hand to mouth contact until gloves are removed and hands thoroughly washed.
	Pinch point hazards (RAC: M)	• Wear leather work gloves when handling support materials. • Never place hands into bind spots of equipment. • Observe WARNING SIGNS indicating locations were pinch point hazards may exist.
	Electrocution or penetration of buried utilities from equipment coming into contact with power, gas, water or sewer lines. Overhead power lines. (RAC: M)	• Contact Hancock Field to demarcate locations of utilities prior to intrusive activities. • Operators shall stay at least 10 feet from demarcated utilities. • All underground and above utilities will be located prior to the initiation of work activities. • No equipment shall come within 15 feet of overhead power lines. If possible, personnel shall stage crusher plant activities away from utilities. • Only qualified personnel shall install temporary utilities.
	Use of sharp edge hand tools to cut material (e.g. DPT liners) (RAC: M)	• Wear cut-resistant gloves when handling items with sharp or rough edges. • Insure handles are in good construction (no cracks, splinters, loose heads/cutting apparatus). • Insure all cutting tools are maintained properly. Blades shall be sharp without knicks and gouges in the blade. • All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with a sheath to protect individuals, when not in use. • ALWAYS USE A CUTTING MOTION MOVING AWAY FROM YOU. Never cut towards your body. If possible, place liners on a table or elevated platform at waist height. Use a device to secure the liners when performing cutting actions (e.g. clamps).
	Lower back strains (RAC: M)	• Utilize a table or elevated platform at waist height during sample collection.
Collecting soil cuttings from liners.	Improper management of potentially contaminated soil (RAC: H)	• Place all soil cuttings from liners into waste collection device (e.g. 55-gal drum). • Properly label collection device with “INVESTIGATED DRIVED WASTE” label. • Ensure waste collection device is secured at the end of the day and taken to waste collection staging area noted in the work plan.
General safety during this activity	Severe Weather (RAC: L)	• Prior to work, check the weather forecast for the day. Take cover in a building/vehicle if lightning is spotted. (EM385-1-1 06.J) • Wear appropriate clothing for weather conditions.
	Sunburn (RAC: L)	• Sunscreen will be available for use during the summer months. Use appropriate sunscreen with a SPF of no less than 30. Protect exposed areas of the skin. • Shade should be utilized when available and/or shade provided when feasible. If feasible, avoid sunlight during the hours of 10 am and 2 pm when the sunlight is most intense. (EM385-1-1 06.I) • Wear hats and other protective garments to provide shade.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR SOIL SAMPLING ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
General safety during this activity (cont.)	Heat/Cold Stress (RAC: L)	• Drink plenty of fluids to keep your body hydrated. • Heat stress and cold related injuries will be monitored and controls will be implemented as necessary. (EM385-1-1 06.I) • An adequate supply of drinking water shall be provided in all places of employment. Frequent rest breaks shall be taken as needed to insure proper hydration during weather extremes. (EM 385-1-1 02.C.01)
	Struck by hazards (RAC: M)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between support materials and equipment or structures. • Personnel shall not stand next to vehicles being loaded or unloaded. • Site workers on the ground will remain in the line of sight of personnel operating equipment and use high visibility reflective vest or highly-visible colored apparel.
	Insects, Spiders, and Ticks (RAC: L)	• Insect/tick repellant will be provided for employees to use. Personnel will be instructed to be cautious of insects, spiders, and ticks, especially when opening well covers. Wear clothing that covers potentially affected body parts. Seal pants legs against contact with plants and to prevent access by organisms (examples – ticks & chiggers). Check body thoroughly after work to detect ticks and chiggers. Take hot shower after field work and wash thoroughly. (EM 385-1-1 06.D) • Avoid nesting areas. • Report any insect bite to the SSHO. Follow guidance presented in Section 10 of the *SSHP*.
	Hypersensitivity or Allergic Reactions (RAC: L)	• Personnel who are knowingly hypersensitive or allergic to insects or plants will be identified using Medical Data Sheet and precautions taken. (EM385-1-1 06.D)
	Personnel Injury (RAC: L)	• Wear appropriate PPE. • Inspect the work area for hazards, including tripping hazards, prior to the start of survey efforts. • Keep non-essential personnel out of the work zone. Barricade as necessary. (EM385-1-1 06.A; 28.D)

ACTIVITY HAZARD ANALYSIS (AHA)
FOR PERSONAL AND EQUIPMENT DECONTAMINATION ACTIVITIES
FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

Title: **EQUIPMENT AND PERSONAL DECONTAMINATION**
Number: **AHA-05** **Revision No: 0** **Prepared by/date:**

GENERAL INFORMATION	
KEY PERSONNEL: **Project Manager:** Paula Bond **Field Manager:** Jeremy Bennett **SSHO:** Jeremy Bennett	**Training Requirements:** HAZWOPER General Worker, Site Safety and Health Plan, Respiratory Protection, AHA briefing **Medical Monitoring and Surveillance Requirements:** Hazardous Waste Operations and Emergency Response (HAZWOPER) (29 CFR 1926.65 (f))
Emergency Communication	911
Emergency Hospital/Telephone Number	St. Joseph's Hospital Telephone # **(315) 448-5111** 301 Prospect Avenue Syracuse, NY 13203
Facilities Covered	Hancock Field, MRSs SR001, Small Arms Range and Shooting-In Buttress, and SR002, Firing-In Buttress
Emergency Assembly Points	TBD based on facility location
Permits/Specialized Training Required	PPE
Special Instructions	The SSHO shall brief forecasted weather warnings during daily tailgate meeting.

AHA Preface:

**** ALL EMPLOYEES HAVE SUSPEND/STOP WORK AUTHORITY –** All employees, are reminded that they have both the authority and responsibility to stop work when they perceive that an unsafe condition exists that threatens themselves, their coworkers, or the environment. Every employee has the right to a safe workplace, safe working conditions, and to understand the hazards of the workplace.

ALL INJURIES, ILLNESSES, AND INCIDENTS MUST BE REPORTED TO THE SITE SAFETY AND HEALTH OFFICER IMMEDIATELY. See the Section 9.0 on protocol to follow found in the APP.

ALL PERSONNEL ARE ENCOURAGED TO ASK QUESTIONS AND OFFER SUGGESTIONS. Feedback on work methods, procedures, hazard controls, and preventative measures during all phases of work is essential to continuous improvement of work processes and is a part of the Integrated Safety Management System. Help us make your job easier and safer!

Signature of Site Safety and Health Officer: **Date:**

ACTIVITY HAZARD ANALYSIS (AHA)
FOR PERSONAL AND EQUIPMENT DECONTAMINATION ACTIVITIES
FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

Risk Assessment Code (RAC) Table							
		Probability					
Severity		Frequent	Likely	Occasional	Seldom	Unlikely	
	Catastrophic	E	E	H	H	M	E = Extremely High Risk; H = High Risk; M = Moderate Risk; L = Low Risk
	Critical	E	H	H	M	L	Noted in "Potential Hazard" Column
	Marginal	H	M	M	L	L	
	Negligible	M	L	L	L	L	

PREREQUISITES		
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
Standard PPE: ANSI Z89.1 approved hard hat (Class C), steel-toe boots (ANSI Z41), ANSI Z87.1 approved safety glasses, and reflective safety vest. Contact with potentially contaminated soil: Standard PPE plus one layer of nitrile rubber gloves with at least 4 mm thickness, Tyvex coveralls, and Tyvex booties. Eye wash station capable of providing 15 minutes of continuous service.	Inspect PPE equipment prior to donning and doffing equipment. Inspect eye wash station at least weekly. Prior to equipment demobilization, equipment used in exclusion zone areas shall be wash down in decontamination wash down station area.	Only trained and qualified personnel will be allowed to work within exclusion zone. Only trained and qualified personnel will be allowed to operate equipment. All personnel trained on the physical and health hazards associate with chemicals used on site. Source documents will be MSDSs from supplier of items.

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up decontamination area and work zones (exclusion zone, CRZ zone).	Slips, trips, and falls (RAC: M)	• Use caution when walking around the site, look out for uneven terrain and slipper surface after increment weather conditions (e.g. rain, ice, snow). • Personnel shall wear protective foot wear. Foot wear shall have adequate sole and tread to reduce the potential for slipping or falling on slick surfaces. • Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Maintain work area clear and in good order. • ALWAYS PLACE TRASH INTO PLASTIC BAGS and dispose of bags in proper waste receptacles.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR PERSONAL AND EQUIPMENT DECONTAMINATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Set up decontamination area and work zones (exclusion zone, CRZ zone). (cont.)	Heavy lifting, muscle strains and sprains involved with handling drums, polyethylene lining rolls, and generator equipment. (RAC: M)	• No individual employee is permitted to lift any object that weighs over 50 lbs. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50 lb. limit. (EM385-1-1 14.A) • Use proper lifting techniques: - Lift with your legs, not your back, bend your knees, move as close to the load as possible, and ensure good handholds are available. - Minimize the horizontal distance to the center of the lift to your center of gravity. - Minimize turning and twisting when lifting as the lower back is especially vulnerable at this time. - Break lifts into steps if the vertical distance (from the start point to the placement of the lift) is excessive. • Other considerations defining lifting hazards - Area available to maneuver the lift. - Area of the lift – workplace clutter, slippery surfaces. - Overall physical condition.
	Use of sharp edge hand tools to cut material (e.g. heavy duty liner, boxes) (RAC: M)	• Wear cut-resistant gloves when handling items with sharp or rough edges. • Insure handles are in good construction (no cracks, splinters, loose heads/cutting apparatus). • Insure all cutting tools are maintained properly. Blades shall be sharp without knicks and gouges in the blade. • All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with a sheath to protect individuals, when not in use. • ALWAYS USE A CUTTING MOTION MOVING AWAY FROM YOU. Never cut towards your body. • All personnel will maintain a 10-foot perimeter around persons clearing brush.
	Traffic safety (RAC: M)	• Designated traffic pattern shall be used to ensure safe movement of trucks in and out of support zone. • A spotter shall guide drivers when backing up into congested and narrow path areas. • If driver's line of sight is block when moving backwards, the vehicle should have back-up alarm and a spotter assigned to lead the driver.
	Struck by hazard (RAC: L)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between trucks, and equipment or structures. • Site workers on the ground will remain in the line of sight of personnel operating trucks and use high visibility reflective vest or highly-visible colored apparel.
Personal decontamination	Cross contamination while doffing personal protective equipment (PPE) (RAC:H)	• Personnel shall be trained on the proper procedures for doffing PPE. The first PPE item removed shall be booties. Then the second layer of Nitrile gloves. After the gloves, remove the Tyvex suit by extracting arms from suit sleeves. Next remove legs from suit pants. If respirator protection is used, personnel shall doff respirator. The last PPE items for removal are the first layer of Nitrile gloves. • Place all disposable PPE items into commercial heavy duty plastic liners. Utilize double bag for disposal of PPE items. • Personnel shall doff potentially contaminated PPE in the Contamination Reduction Zone (CRZ) area only.

amec	**ACTIVITY HAZARD ANALYSIS (AHA) FOR PERSONAL AND EQUIPMENT DECONTAMINATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD**

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Decontamination of heavy equipment using pressure washer	Slips, trips, and falls (RAC: M)	• Personnel shall wear protective foot wear. Foot wear shall have adequate sole and tread to reduce the potential for slipping or falling on slick surfaces. • Clear debris from work area prior to commencing work in the area. Maintain work area clear and in good order.
	Injuries from hand and power tools (RAC: L)	• All hand and power tools shall be used in accordance with the APP. • Keep any machine guarding in place. • Avoid any moving parts and secure loose clothing, jewelry or long hair that could become entangled. Damaged tools shall be removed immediately. Tools shall be used for its designed purpose.
	Injury due to misuse or accidental contact (system is operating at pressures up to 3000 psi) (RAC: M)	• **Caution!** This equipment operates at high pressure. Accidental contact with pressurized water could cause serious injury. The spray nozzle should never be directed towards personnel. • Equipment operating pressure should never exceed that which is necessary to accomplish the job. Inspect hoses, cords and connections for deformities, cuts, leaks and other damage prior to startup. • Hoses and fittings should be supported to prevent excessive sway, vibration or stress on end connections. Hoses should be protected to prevent kinking or excessive wear. Install whip-checks on hose. • Protect hoses and cords from traffic. Do NOT allow machinery or equipment to drive over them. • At a minimum, PPE shall include requirements specified in JSA. In areas where respiratory protection is not necessary, eye and face protection (safety goggles and face-shield) and rubber gloves shall be worn. • When necessary, liquid proof coveralls (rain gear or other similar material) shall be worn. Foot wear shall include steel toe boots w/metatarsal protection; shin guards. • When not in use and when making repairs, the system shall be depressurized (both air and water). Ensure that equipment guards/covers removed for adjustments or repairs are properly installed before restarting. • Never leave the system unattended while pressurized. Only non-sparking tools shall be used in locations where sources of ignition may cause fire or explosion. • Fuel powered tools (generators, tamps, pumps, etc.) shall be turned off during refueling.
	Electric Shock (RAC: M)	• Electric tools with missing ground prongs or cut or frayed cords shall be removed from service and tagged. • Electric tools used in highly conductive locations, such as where the employee may contact water, shall be approved for use in those locations. • Power for portable electric tools shall be supplied from a GFCI receptacle. • Electric tools must be grounded, except tools, which are equipped with double insulation. • Electric tools shall not be used in hazardous locations such as flammable or explosive atmospheres unless they are approved for such locations.
	Injury to unqualified operators/on-lookers (RAC: M)	• Only trained and qualified personnel shall operate this equipment • Non-essential personnel shall remain a safe distance (at least 25 feet) from pressure washing activities. Barricade areas.

	ACTIVITY HAZARD ANALYSIS (AHA) FOR PERSONAL AND EQUIPMENT DECONTAMINATION ACTIVITIES FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
Decontamination of heavy equipment using pressure washer (cont.)	Portable energized sources (RAC: M)	• Perform all service and maintenance work with the generator engine off and the positive battery cable disconnected. Moving parts can cause severe personal injury or death, and live wires could cause fatal electrocution. • Keep the exhaust and air intake free from obstructions such as clothing, furniture or other material. • Always operate the generator in an area where the wind will carry away the exhaust fumes. • Do not overload the generator. • Use the right power cords with your portable power generators such as heavy duty, outdoor rated cords with a wire gauge adequate for the equipment load. Overloaded cords can cause fires or equipment damage. You must also not use extension cords with exposed wires or worn shielding. • Fuels and other flammable liquids should be stored away from exhaust. In addition, the container of flammable or combustible liquids shall an approved safety can.
	Noise hazard (RAC: M)	• Equipment producing sound level measurements in excess of 85 dB A-weighted may require the use of hearing protection depending on duration of exposure to the equipment. Rule of thumb, if personnel must shout to be heard at arms distance, hearing protection is required. • Place hazardous noise warning signs at least 15 feet from generators.
	Struck by hazard (RAC: L)	• Personnel shall wear protective head gear (e.g. hard hats) and faceshield to reduce risk of hazard. • Personnel shall not position themselves between trucks, and equipment or structures. • Site workers on the ground will remain in the line of sight of personnel operating equipment and use high visibility reflective vest or highly-visible colored apparel. • Personnel shall wear PPE for pressure washing activities.
Small tools and sample collection devices decontamination	Potential inhalation hazard from contaminants of concern in contaminated soils and sediments (RAC: L) The primary contaminants of concern (COC) include trichloroethylene (TCE), cis-1,2-dichloroethene (DCE), heavy metals (e.g. As, Cr, Pb, and Hg), carbon disulfide, benzene, ethylbenzene, toluene, xylenes, or diesel fuel.	• Perform air monitoring for COCs. • If action levels are exceeded, implement corrective actions required. • A Photoionization Detector (PID) will be used to screen samples and detect the presence of any potential organics. The PID must have a 10.6 eV lamp or higher. To the extent that contents are known, use correction factors supplied with the monitoring instrument. Source monitoring of the work area will be conducted at regular intervals as determined by the SSHO. Positive sustained results at a source of downwind location(s) which may impact operations crew will require the following actions: - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above the values listed in the APP or twice the background levels in the breathing zone areas of the a-risk employees requires site activities to be suspended and site personnel to retreat to an unaffected area. - Work may only resume if airborne readings in worker's breathing zone areas return to background levels. If elevated readings in worker's breathing zone persist, the PHSO and SHM will be contacted to determine necessary actions and levels of protection. - Record all readings especially when values exceed action levels. Note duration of elevated readings. • Personnel shall receive training on the elements each of the identified COCs. • Operator shall maintain excavator door/windows closed throughout the trenching activity. Whenever possible position the excavator upwind. • Operator shall minimize the amount of dust generated during the trench activities. All personnel shall remain upwind during trenching activities.

ACTIVITY HAZARD ANALYSIS (AHA)
FOR PERSONAL AND EQUIPMENT DECONTAMINATION ACTIVITIES
FOR THE NON-TIME CRITICAL REMOVAL ACTION AT HANCOCK FIELD

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
	Use of sharp edge hand tools to cut material (e.g. stainless steel augers and) (RAC: M)	• Wear cut-resistant gloves when handling items with sharp or rough edges. • Insure handles are in good construction (no cracks, splinters, loose heads/cutting apparatus). • Insure all cutting tools are maintained properly. Blades shall be sharp without knicks and gouges in the blade. • All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with a sheath to protect individuals, when not in use. • ALWAYS USE A CUTTING MOTION MOVING AWAY FROM YOU. Never cut towards your body. If possible, place liners on a table or elevated platform at waist height. Use a device to secure the liners when performing cutting actions (e.g. clamps).
	Potential contact and ingestion hazards from COCs in potentially contaminated soils (RAC: M)	• Personnel shall wear two layers of nitrile rubber gloves during contact with groundwater. • Personnel shall not perform any hand to mouth contact until gloves are removed and hands thoroughly washed.
	Cross-contamination personnel or clean areas (RAC: M)	• Decontamination tools using the following procedures: - Wash with detergent solution - Rinse with analyte-free DI water - Wipe down tools using paper towels - Final rinse with analyte-free DI water - Air dry
General safety during this activity	Severe Weather (RAC: L)	• Prior to work, check the weather forecast for the day. Take cover in a building/vehicle if lightning is spotted. (EM385-1-1 06.J) • Wear appropriate clothing for weather conditions.
	Sunburn (RAC: L)	• Sunscreen will be available for use during the summer months. Use appropriate sunscreen with a SPF of no less than 30. Protect exposed areas of the skin. • Shade should be utilized when available and/or shade provided when feasible. If feasible, avoid sunlight during the hours of 10 am and 2 pm when the sunlight is most intense. (EM385-1-1 06.I) • Wear hats and other protective garments to provide shade.
	Heat/Cold Stress (RAC: L)	• Drink plenty of fluids to keep your body hydrated. • Heat stress and cold related injuries will be monitored and controls will be implemented as necessary. (EM385-1-1 06.I) • An adequate supply of drinking water shall be provided in all places of employment. Frequent rest breaks shall be taken as needed to insure proper hydration during weather extremes. (EM 385-1-1 02.C.01)
	Struck by hazards (RAC: M)	• Personnel shall wear protective head gear (e.g. hard hats) to reduce risk of hazard. • Personnel shall not position themselves between support materials and equipment or structures. Personnel shall not stand next to vehicles being loaded or unloaded. • Site workers on the ground will remain in the line of sight of personnel operating equipment and use high visibility reflective vest or highly-visible colored apparel.

WORK ACTIVITY	POTENTIAL HAZARD	REQUIRED ACTIONS, CONTROLS, OR METHODS OF COMPLIANCE
General safety during this activity (cont.)	Insects, Spiders, and Ticks (RAC: L)	• Insect/tick repellant will be provided for employees to use. Personnel will be instructed to be cautious of insects, spiders, and ticks, especially when opening well covers. Wear clothing that covers potentially affected body parts. Seal pants legs against contact with plants and to prevent access by organisms (examples – ticks & chiggers). Check body thoroughly after work to detect ticks and chiggers. Take hot shower after field work and wash thoroughly. (EM 385-1-1 06.D) • Avoid nesting areas. • Report any insect bite to the SSHO. Follow guidance presented in Section 10 of the *SSHP*.
	Hypersensitivity or Allergic Reactions (RAC: L)	• Personnel who are knowingly hypersensitive or allergic to insects or plants will be identified using Medical Data Sheet and precautions taken. (EM385-1-1 06.D)
	Personnel Injury (RAC: L)	• Wear appropriate PPE. • Inspect the work area for hazards, including tripping hazards, prior to the start of survey efforts. • Keep non-essential personnel out of the work zone. Barricade as necessary. (EM385-1-1 06.A; 28.D)

APPENDIX B

CORPORATE SAFETY POLICY

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AMEC

Health, Safety and Environmental policy 2012

This policy applies to all **AMEC's global operations** wherever they are carried out and is reviewed, and if necessary revised, on an annual basis.

AMEC is committed to delivering a **sustainable world class performance** through the prevention of injury, ill health and harm to the environment.

In line with our **Values** and vision of achieving AMEC's '**Beyond Zero**', AMEC will promote its values both inside and outside AMEC, to influence the health, safety and the environmental behaviours of the communities in which we live and work.

AMEC is committed to continuous improvement in both our performance and management of health, safety and the environment and will deliver this through:

Our leadership by:

- Deploying the best leadership and management structure possible, to deliver this Policy and to provide a complete, unbroken chain of responsibility and accountability for health, safety and the environment.

The Chief Executive has overall responsibility for implementing this policy and has appointed a corporate director to lead the health, safety and environmental function.

Individual responsibilities of key AMEC personnel are set out clearly in supporting documents.

Samir Brikho

05/01/2012

Samir Brikho
Chief Executive

Date

Our standards by:

- Identifying and controlling all health, safety and environmental risks arising from our work activities
- Implementing systems for the management of health, safety and the environment, that they are communicated and maintained, in accordance with the AMEC HSE Management Framework
- Complying with all applicable legislative and industry requirements, pertaining to health, safety and the environment, as a minimum standard
- Setting and monitoring clear health, safety and environmental performance objectives that encompass both leading and lagging measures
- Auditing and monitoring all aspects of health, safety and environmental performance to ensure that the organisation is fully compliant with its requirements and learns and applies lessons from all relevant experiences.

Getting everyone involved by:

- Implementing effective processes for workforce consultation and engagement
- Ensuring that personnel are trained and competent to carry out their activities
- Consulting with our customers, partners, suppliers, competitors and regulators to promote continual improvement in HSE performance
- Working with clients to minimise negative and maximise positive environmental impacts from their operations.

WEAR THE CORRECT PPE | MANAGE ANY CHANGE | YOU MUST INTERVENE | ALWAYS TAKE CARE | FOLLOW THE RULES | DO A RISK ASSESSMENT

BEYOND ZERO

APPENDIX C

FORMS

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Accident Investigation Interview Report

Name of Interviewer: _____ Name of Interviewee: _____

Department of Interviewer: _____ Department of Interviewee: _____

Project: _____ Time shift began: _____ a.m/p.m.

Project activity during this shift: _____

Accident date: _____ Time of accident: _____ a.m/p.m.

Date accident was reported: _____

Any injuries involved? Yes ❑ No ❑ _____

Location of accident (include address, city, county, zip code): _____

_____

Name of witnesses: _____

_____

_____

_____

What was/were employee(s) doing when accident occurred? Be specific (e.g., walking, lifting, operating machinery, etc.)?

_____

_____

_____

Please describe fully the events that resulted in the accident. Tell what happened and how it happened (do not describe the nature of the injury or property damage).

_____

_____

_____

What machine, tool, or object was most closely connected to the accident? (e.g, machine employee struck against or which struck him, vehicle employee was driving)?

_____

_____

_____

Nature of injury or property damage.

_____

_____

_____

Additional Information or drawings can be included on the reverse side of this form.

Forward completed form to the appropriate Unit Manager and Corporate SHE Director.

Period Covered: _____

Location: _____

ACCIDENT / FIRST AID INCIDENT SUMMARY LOG

Date/Time	Employee Name	AEE Location/ Project	General[1] Description	First Aid[2] Provided?	Medical Attention?	Comments	Universal Precautions Taken?
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							

[1] Attach completed Supervisor's Report of Injury or Illness

[2] Attach completed First Aid Incident Report

Completed by: _____

Date: _____

Chemical Inventory Form - Hazard Communication

Job Number: _____ **Project:** _____ **Date:** _____

Chemical Name	Quantity	Is it labeled?	Do you have the MSDS?

Corrective Action Program Schedule

Location _____ Attention _____ Date _____

Item No.	Description of Item	Assigned To	Date Assigned	Completion Target	Date Completed	Status

Daily Backhoe Checklist

Date: _____ Backhoe Description: _____

Project #: _____ Serial or License #: _____
(Note: This # should match the # on the equipment certification form.)

Location: _____ Backhoe Owner: _____

Item Name	Requirement	OK	No*	Comment
Hydraulic systems controls and levers	Leaking fittings or connections. Levers are in good operating condition. Levels of fluid are full.			
Fuel, oil, water, and coolant lines	Any leaks.			
Hoses	Leaks in hoses or connections. Signs of excessive wear, kinked or bent hoses.			
Bucket Operations	Front loader hinge pins with lock rings. Rear bucket upper and lower shaft pins and lock rings in place. Safety vertical lock operational.			
Brake System	Foot brakes operational. Emergency brakes operational.			
Cylinders	Leaking seals, deep scratches on chrome rams.			
Outriggers	Pads in place. Engine off. Safety check of internal fluid bypass. Any leaks.			
Lights (turn signals, emergency flashers).	Operational and without cracked lenses.			

* Deficiencies (Explain all negative responses and list corrective actions; all deficiencies must be corrected before the backhoe is entered into service):

_____

_____

_____

Other Repairs or Routine Maintenance Performed this Date:

_____

_____

_____

Inspection Conducted and Certified by: _____
(SHSC or FM) (Owner/Operator)

Report Received by: _____

_____

First Aid Incident Report

Date of Report: _____ Report Completed by: _____

Date of Injury/Incident: _____

Description of the Injury/Incident: (time, location, event, description of injuries) _____

Name of Injured Person: _____ Employer: _____

Name of First Aid Provider(s): _____

Social Security Number: _____

Bloodborne Pathogen Exposure Incident Evaluation: _____

1. Was the First Aid Responder exposed to blood or other potenially infectious materials? _____

- ☐ Exposure Occurred (see question 2)
- ☐ No Exposure

2. Exposure occurred by contact with the following (check all that apply):

- ☐ Eye
- ☐ Mouth
- ☐ Other Mucous Membrane
- ☐ Broken Skin (cuts, abrasions)
- ☐ Needlestick
- ☐ Human Bite

Exposure Control Precautions Taken (check all that apply):

- ☐ None (contact SHE Coordinator or Corporate SHE Director)
- ☐ Glove
- ☐ Face Mask
- ☐ One-way CPR Valve
- ☐ Eye Protection
- ☐ Immediate Personal Hygiene
- ☐ Previous HBV Immunization
- ☐ Recommended for HBV Immunization
- ☐ Other _____

Please attach this completed form with the Supervisor's Report of Injury or Illness, and the Accident/First Aid Incident Summary Log, and forward to Human Resources, your SHE Coordinator, and the Corporate SHE Director.

Hazard Assessment and PPE Selection

Task: _____

Department: _____

HAZARDS IDENTIFIED:
Seriousness of Injury?

Impact (Explain): _____
None ☐ Lo ☐ Med ☐ Hi ☐

Penetration: _____
None ☐ Lo ☐ Med ☐ Hi ☐

Compression: _____
None ☐ Lo ☐ Med ☐ Hi ☐

Chemical: _____
None ☐ Lo ☐ Med ☐ Hi ☐

Heat, Hot Surfaces: _____
None ☐ Lo ☐ Med ☐ Hi ☐

Harmful Dust: _____
None ☐ Lo ☐ Med ☐ Hi ☐

Light Radiation: _____
None ☐ Lo ☐ Med ☐ Hi ☐

Falling Objects: _____
None ☐ Lo ☐ Med ☐ Hi ☐

Sharp Objects: _____
None ☐ Lo ☐ Med ☐ Hi ☐

Rolling or Pinching Objects: _____
None ☐ Lo ☐ Med ☐ Hi ☐

Electrical Hazards: _____
None ☐ Lo ☐ Med ☐ Hi ☐

Ergonomic/Lifting: _____
None ☐ Lo ☐ Med ☐ Hi ☐

Other: _____
None ☐ Lo ☐ Med ☐ Hi ☐

Can the task be modified to reduce/eliminate the hazard? Yes __No __If yes, how? _____

MSDS PPE RECOMMENDATIONS:

☐ **Gloves, Type:** _____

☐ **Safety-toe Boots**

☐ **Boot Covers**

☐ **Hard Hats**

☐ **Other** _____

☐ **Coveralls, Type:** _____

☐ **Apron**

☐ **Safety Glasses, Goggles, or Faceshield**
Type: _____

☐ **Respirator**
Type: _____

PPE REQUIRED FOR THE TASK:

☐ **Gloves, Type:** _____

☐ **Safety-toe Boots**

☐ **Boot Covers**

☐ **Hard Hats**

☐ **Other** _____

☐ **Coveralls, Type:** _____

☐ **Apron**

☐ **Safety Glasses, Goggles, or Faceshield**
Type: _____

☐ **Respirator**
Type: _____

Training Required for Task: _____

POST THIS FORM IN THE WORK AREA WHERE THE TASK IS ROUTINELY PERFORMED.

Instrument Calibration Log

JOB NUMBER: _____ **PROJECT:** _____ **LOCATION:** _____

DATE/TIME	INSTRUMENT	SERIAL NUMBER	SPAN GAS SUBSTANCE	SPAN CONC.	INSTRUMENT READING AT CALIBRATION	INSTRUMENT CALIBRATION READING POST SAMPLING	COMMENTS

Job Hazard Analysis

Plant _____ Department _____ Operation _____

STEPS	HAZARD	SAFE JOB PROCEDURE
Break job down to basic steps; e.g., what is done first, next and so on. You can do this by (1) observing job (2) discussing with operator (3) own knowledge of job. Describe what is done, not how it is done.	For each step, ask yourself what accident could happen to the person. Ask yourself could they be injured by machinery, overexert themselves; are they exposed to toxic chemicals, noise, etc.	For each potential hazard, ask yourself how should the person proceed to avoid injury, or what can they do to reduce the hazard. Number each step. When you have completed this column, ask yourself if there is a more efficient way to do the job. Consider such improvements as more efficient tools, equipment, materials or methods.

Lockout/Tagout Log

LOCK NO.	ISSUED TO	ISSUED BY	DATE/ TIME ISSUED	EQUIPMENT DESCRIPTION AND DATE EMPLOYEE RETURNED LOCK	LOCATION FOR USE	NAME OF EMPLOYEE WHO RETURNED LOCK	COMMENTS

Motor Vehicle Accident Report

amec

PRODUCER

AON Risk Services, Inc.
Wirth Park Center
P.O. Box 1360
Minneapolis, MN 55440-1360

PRODUCER PHONE	MISCELLANEOUS INFORMATION (Site & Location Code)		DATE
COMPANY		POLICY NUMBER	CATs
POLICY EFF. DATE	POLICY EXP. DATE	DATE/TIME OF LOSS	PREVIOUSLY REPORTED
		☐ AM ☐ YES ☐ PM ☐ NO	

INSURED

Name & Address (As it Appears on the Policy)

INSURED'S RESIDENCE PHONE (Area Code & No.)	INSURED'S BUSINESS PHONE
PERSON TO CONTACT	WHERE TO CONTACT
	WHEN TO CONTACT
CONTACT'S RESIDENCE PHONE (Area Code & No.)	CONTACT'S BUSINESS PHONE

LOSS

LOCATION OF ACCIDENT (Include City & State)	AUTHORITY CONTACTED & REPORT NO	VIOLATION/CITATION

DESCRIPTION OF OCCURRENCE (Use Reverse Side if Necessary)

POLICY INFORMATION

BODILY INJURY	PROPERTY DAMAGE	SINGLE LIMIT	MED PAY	OTC DED.	OTHER COVERAGE & DEDUCTIBLES
LOSS PAYER				COLLISION DED	

INSURED VEHICLE

CASE NO.	YEAR, MAKE, MODEL	VIN NO. (Vehicle Identification)	PLATE NO.
OWNER'S NAME & ADDRESS			PHONE

DRIVER'S NAME & ADDRESS (Check if Same as Owner) ☐	RESIDENCE PHONE	BUSINESS PHONE

RELATION TO INSURED (Employee, family)	DATE OF BIRTH	DRIVER'S LICENSE NO.	PURPOSE OF USE	USED WITH PERMISSION ☐ YES ☐ NO
DESCRIBE DAMAGE	ESTIMATE AMOUNT	WHERE CAN VEHICLE BE SEEN	WHEN?	OTHER INS ON VEHICLE

PROPERTY DAMAGED

DESCRIBE PROPERTY (If auto, year, make, model, plate no.)	OTHER VEH/PROP INS? ☐ YES ☐ NO	COMPANY OR AGENCY NAME & POLICY NO.

OWNER'S NAME & ADDRESS	RESIDENCE PHONE	BUSINESS PHONE
DRIVER'S NAME & ADDRESS (Check if same as owner) ☐	RESIDENCE PHONE	BUSINESS PHONE

DESCRIBE DAMAGE	ESTIMATE AMOUNT	WHERE CAN DAMAGE BE SEEN	OTHER INS ON VEHICLE

INJURED

NAME & ADDRESS	PHONE	Pass ☐	Ins Veh ☐	Other Veh ☐	AGE	EXTENT OF INJURY
		☐	☐	☐		

WITNESSES OR PASSENGERS

NAME & ADDRESS	PHONE	Ins Veh ☐	Other Veh ☐	OTHER (Specify)
		☐	☐	
		☐	☐	

REMARKS

REPORTED BY **REPORTED TO**

Near Miss Report

Note: The office supervisor or field supervisor will complete this form when an event occurs that could have resulted in a serious injury, but did not. The goal of Near Miss Reports is to inform coworkers and management of potentially dangerous conditions or behavior to prevent future injuries or illnesses. The completed form must be submitted to the Unit Manager, Project Manager (as applicable), the SHE Coordinator, and the Corporate SHE Director within 1 day of the occurrence.

Date of Occurrence:	Time of injury: ❑ AM ❑ PM
Location:	
Employee's brief description of occurrence:	
Employee's recommendation to prevent further occurrence:	
Signed:	Date:
Supervisor recommendations:	
Management recommendations:	
Signed:	Date:

Office Safety, Health, and Environment Checklist

Date: _____

Location: _____

Name(s) of Person/People Conducting Inspection: _____

_____

Instructions: A check mark next to any item on this list indicates a potential safety or health hazard which should be corrected.

___ Lack of an accident prevention program

ELECTRICAL

___ Use of unnecessary extension cords
___ Electrical cord tripping hazard
___ Access to the electric panel is obstructed
___ Electrical cords run through wall openings or doorways
___ Electrical cords are under rugs or mats
___ Electrical cords are frayed
___ Electrical plugs are defective
___ Electrical equipment is not grounded
___ "Live" connections in electrical equipment are exposed

EXITS AND AISLES

___ Locks or latches are on doors equipped with "panic hardware"
___ Obstructions are present in aisles or exits, or an stairways
___ Exits are locked while room is in use
___ "Panic hardware" is not present on exit doors
___ "Panic hardware" is not working on exit doors
___ Directions to exit or exits are not clearly marked
___ Lack of adequate lighting for aisles, exits, or stairways
___ Emergency lighting is not present or not working
___ Fire escape is not kept clear
___ Exits don't open on a public way
___ Not enough exits

FIRE ALARM SYSTEM

___ Fire alarm system is not tested regularly
___ Lack of evacuation plan
___ Employees are not familiar with evacuation plan or their responsibilities in case of emergency
___ Evacuation plan is not posted

FIRE EXTINGUISHERS

___ Locations of extinguishers are not clearly marked
___ Required types or number are not readily accessible
___ Extinguishers are not serviced or tagged at least yearly
___ Employees are not trained in the use of extinguishers

FIRE PROTECTION INSTALLATIONS

___ Access to standpipes, fire hoses, or sprinkler control valves is not kept clear
___ Sprinkler system is not tested regularly
___ Sprinkler valves are not kept in "open" position
___ Decorations or other material is attached to sprinkler system
___ Sprinkler heads are damaged, corroded, or have been painted over

FLAMMABLE LIQUIDS AND OTHER CHEMICALS

___ Containers are not clearly labeled
___ Flammable liquids or other chemicals are stored in open containers
___ Excess quantities of flammable liquids are stored in the building
___ Flammable liquids are stored near exits, in aisles, or on stairways

HEAT PRODUCING APPLICANCES

___ Combustible material is stored in the heater area or near another source of ignition
___ Flammable liquids are stored in the heater room

WORK AREAS/LUNCHROOM AREAS

___ Plumbing fixtures (fountains, sinks, urinals, etc.) leak
___ Floor mats are not slip-resistant
___ Stairways don't have anti-slip treads or handrails
___ Slip-resistant preparation is not used on highly polished floors
___ People smoke in non-ventilated areas
___ Non-smoking areas are not identified with "NO SMOKING" signs
___ Smoking areas do not have ash trays or sand receptacles
___ Lack of adequate space between desks and furniture to provide for safe passage
___ Desks or cabinets are arranged so that drawers open into passage areas
___ Inadequate lighting
___ Damaged floor surfaces
___ Ladders are not available to reach overhead storage areas
___ Ladders are damaged or broken
___ Riser heights on stairways are not uniform
___ Glass walls or doors are not impact resistant
___ Glass walls or doors are not clearly marked
___ Cabinets or shelves are not secured to prevent overturning

WORK AREAS/LUNCHROOM AREAS (cont'd.)

___ Heavy objects are placed on top of cabinets or partitions
___ Lack of adequate ventilation in areas with photocopiers or other similar machines
___ Video display terminal operators complain of headaches, stress, or eyestrain
___ Noise level is too high
___ Temperature level is too high or too low
___ Lack of adequate ventilation in areas where there is the use of potentially toxic materials, chemicals, or fluids
___ Noticeable dust or odors in the air (especially in "energy efficient" buildings).

Instructions for OSHA No. 200

I. Log and Summary of Occupational Injuries and Illnesses

Each employer who is subject to the recordkeeping requirements of the Occupational Safety and Health Act of 1970 must maintain for each establishment a log of all recordable occupational injuries and illnesses. This form (OSHA No. 200) may be used for that purpose. A substitute for the OSHA No. 200 is acceptable if it is as detailed, easily readable, and understandable as the OSHA No. 200.

Enter each recordable case on the log within six (6) workdays after learning of its occurrence. Although other records must be maintained at the establishment to which they refer, it is possible to prepare and maintain the log at another location, using data processing equipment if desired. If the log is prepared elsewhere, a copy updated to within 45 calendar days must be present at all times in the establishment.

Logs must be maintained and retained for five (5) years following the end of the calendar year to which they relate. Logs must be available (normally at the establishment) for inspection and copying by representatives of the Department of Labor, or the Department of Health and Human Services, or States accorded jurisdiction under the Act. Access to the log is also provided to employees, former employees and their representatives.

II. Changes in Extent of or Outcome of Injury or Illness

If, during the 5-year period the log must be retained, there is a change in an extent and outcome of an injury or illness which affects entries in columns 1, 2, 6, 8, 9, or 13, the first entry should be lined out and a new entry made. For example, if an injured employee at first required only medical treatment but later lost workdays away from work, the check in column 6 should be lined out, and checks entered in columns 2 and 3 and the number of lost workdays entered in column 4.

In another example, if an employee with an occupational illness lost workdays, returned to work, and then died of the illness, any entries in columns 9 through 12 should be lined out and the date of death entered in column 8.

The entire entry for an injury or illness should be lined out if later found to be nonrecordable. For example: an injury which is later determined not to be work related, or which was initially thought to involve medical treatment but later was determined to have involved only first aid.

III. Posting Requirements

A copy of the totals and information following the fold line of the last page for the year must be posted at each establishment in the place or places where notices to employees are customarily posted. This copy must be posted no later than ***February 1 and must remain in place until March 1.***

Even though there were no injuries or illnesses during the year, zeros must be entered on the totals line, and the form posted.

The person responsible for the ***annual summary totals*** shall certify that the totals are true and complete by signing at the bottom of the form.

IV. Instructions for Completing Log and Summary of Occupational Injuries and Illnesses

Column A – **CASE OR FILE NUMBER.** Self-explanatory.

Column B – **DATE OF INJURY OR ONSET OF ILLNESS.**
For occupational injuries, enter the date of the work accident which resulted in injury. For occupational illnesses, enter the date of initial diagnosis of illness, or, if absence from work occurred before diagnosis, enter the first day of the absence attributable to the illness which was later diagnosed or recognized.

Columns C through F – Self-explanatory.

Columns 1 and 8 – **INJURY OR ILLNESS-RELATED DEATHS.** Self-explanatory.

Columns 2 and 9 – **INJURIES OR ILLNESSES WITH LOST WORKDAYS.** Self-explanatory.

Any injury which involves days away from work, or days of restricted work activity, or both must be recorded since it always involves one or more of the criteria for recordability.

Columns 3 and 10 – **INJURIES OR ILLNESSES INVOLVING DAYS AWAY FROM WORK.** Self-explanatory.

Columns 4 and 11 – **LOST WORKDAYS—DAYS AWAY FROM WORK.**
Enter the number of workdays (consecutive or not) on which the employee would have worked but could not because of occupational injury or illness. The number of lost workdays should not include the day of injury or onset of illness or any days on which the employee would not have worked even though able to work.

NOTE: For employees not having a regularly scheduled shift, such as certain truck drivers, construction workers, farm labor, casual labor, part-time employees, etc., it may be necessary to estimate the number of lost workdays. Estimates of lost workdays shall be based on prior work history of the employee AND days worked by employees, not ill or injured, working in the department and/or occupation of the ill or injured employee.

Columns 5 and 12 – **LOST WORKDAYS—DAYS OF RESTRICTED WORK ACTIVITY.**
Enter the number of workdays (consecutive or not) on which because of injury or illness:

(1) the employee was assigned to another job on a temporary basis, or
(2) the employee worked at a permanent job less than full time, or
(3) the employee worked at a permanently assigned job but could not perform all duties normally connected with it.

The number of lost workdays should not include the day of injury or onset of illness or any days on which the employee would not have worked even though able to work.

*U.S. Government Printing Office: 1993 — 342-523/83214

Columns 6 and 13 – **INJURIES OR ILLNESSES WITHOUT LOST WORKDAYS.** Self-explanatory.

Columns 7a through 7g – **TYPE OF ILLNESS.**
Enter a check in only one column for each illness.

TERMINATION OR PERMANENT TRANSFER.-Place an asterisk to the right of the entry in columns 7a through 7g (type of illness) which represented a termination of employment or permanent transfer.

V. Totals

Add number of entries in columns 1 and 8.
Add number of checks in columns 2, 3, 6, 7, 9, 10, and 13.
Add number of days in columns 4, 5, 11, and 12.
Yearly totals for each column (1-13) are required for posting. Running or page totals may be generated at the discretion of the employer.

If an employee's loss of workdays is continuing at the time the totals are summarized, estimate the number of future workdays the employee will lose and add that estimate to the workdays already lost and include this figure in the annual totals. No further entries are to be made with respect to such cases in the next year's log.

VI. Definitions

OCCUPATIONAL INJURY is any injury such as a cut, fracture, sprain, amputation, etc., which results from a work accident or from an exposure involving a single incident in the work environment.
NOTE: Conditions resulting from animal bites, such as insect or snake bites or from one-time exposure to chemicals, are considered to be injuries.

OCCUPATIONAL ILLNESS of an employee is any abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or diseases which may be caused by inhalation, absorption, ingestion, or direct contact.

The following listing gives the categories of occupational illnesses and disorders that will be utilized for the purpose of classifying recordable illnesses. For purposes of information, examples of each category are given. These are typical examples, however, and are not to be considered the complete listing of the types of illnesses and disorders that are to be counted under each category.

7a. **Occupational Skin Diseases or Disorders**
Examples: Contact dermatitis, eczema, or rash caused by primary irritants and sensitizers or poisonous plants; oil acne; chrome ulcers; chemical burns or inflammations; etc.

7b. **Dust Diseases of the Lungs (Pneumoconioses)**
Examples: Silicosis, asbestosis and other asbestos-related diseases, coal worker's pneumoconiosis, byssinosis, siderosis, and other pneumoconioses.

7c. **Respiratory Conditions Due to Toxic Agents**
Examples: Pneumonitis, pharyngitis, rhinitis or acute congestion due to chemicals, dusts, gases, or fumes; farmer's lung; etc.

7d. **Poisoning (Systemic Effect of Toxic Materials)**
Examples: Poisoning by lead, mercury, cadmium, arsenic, or other metals; poisoning by carbon monoxide, hydrogen sulfide, or other gases; poisoning by benzol, carbon tetrachloride, or other organic solvents; poisoning by insecticide sprays such as parathion, lead arsenate; poisoning by other chemicals such as formaldehyde, plastics, and resins; etc.

7e. **Disorders Due to Physical Agents (Other than Toxic Materials)**
Examples: 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, sunburn); etc.

7f. **Disorders Associated With Repeated Trauma**
Examples: Noise-induced hearing loss; synovitis, tenosynovitis, and bursitis; Raynaud's phenomena; and other conditions due to repeated motion, vibration, or pressure.

7g. **All Other Occupational Illnesses**
Examples: Anthrax, brucellosis, infectious hepatitis, malignant and benign tumors, food poisoning, histoplasmosis, coccidioidomycosis, etc.

MEDICAL TREATMENT includes treatment (other than first aid) administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does NOT include first-aid treatment (one-time treatment and subsequent observation of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care) even though provided by a physician or registered professional personnel.

ESTABLISHMENT: A single physical location where business is conducted or where services or industrial operations are performed (for example: a factory, mill, store, hotel, restaurant, movie theater, farm, ranch, bank, sales office, warehouse, or central administrative office). Where distinctly separate activities are performed at a single physical location, such as construction activities operated from the same physical location as a lumber yard, each activity shall be treated as a separate establishment.

For firms engaged in activities which may be physically dispersed, such as agriculture; construction; transportation; communications; and electric, gas, and sanitary services, records may be maintained at a place to which employees report each day.

Records for personnel who do not primarily report or work at a single establishment, such as traveling salesmen, technicians, engineers, etc., shall be maintained at the location from which they are paid or the base from which personnel operate to carry out their activities.

WORK ENVIRONMENT is comprised of the physical location, equipment, materials processed or used, and the kinds of operations performed in the course of an employee's work, whether on or off the employer's premises.

OSHA
Forms for Recording
Work-Related Injuries and Illnesses

U.S. Department of Labor
Occupational Safety and Health Administration

What's Inside...

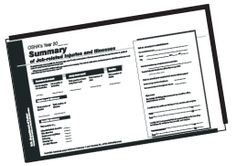
In this package, you'll find everything you need to complete OSHA's *Log* and the *Summary of Work-Related Injuries and Illnesses* for the next several years. On the following pages, you'll find:

- ***An Overview: Recording Work-Related Injuries and Illnesses*** — General instructions for filling out the forms in this package and definitions of terms you should use when you classify your cases as injuries or illnesses.

- ***How to Fill Out the Log*** — An example to guide you in filling out the *Log* properly.

- ***Log of Work-Related Injuries and Illnesses*** — Several pages of the *Log* (but you may make as many copies of the *Log* as you need.) Notice that the *Log* is separate from the *Summary*.

- ***Summary of Work-Related Injuries and Illnesses*** — Removable *Summary* pages for easy posting at the end of the year. Note that you post the *Summary* only, not the *Log*.



- ***Worksheet to Help You Fill Out the Summary*** — A worksheet for figuring the average number of employees who worked for your establishment and the total number of hours worked.

- ***OSHA's 301: Injury and Illness Incident Report*** — Several copies of the OSHA 301 to provide details about the incident. You may make as many copies as you need or use an equivalent form.

Take a few minutes to review this package. If you have any questions, ***visit us online at www.osha. gov*** or ***call your local OSHA office***. We'll be happy to help you.

An Overview: Recording Work-Related Injuries and Illnesses

The Occupational Safety and Health (OSH) Act of 1970 requires certain employers to prepare and maintain records of work-related injuries and illnesses. Use these definitions when you classify cases on the Log. OSHA's recordkeeping regulation (see 29 CFR Part 1904) provides more information about the definitions below.

The *Log of Work-Related Injuries and Illnesses* (Form 300) is used to classify work-related injuries and illnesses and to note the extent and severity of each case. When an incident occurs, use the *Log* to record specific details about what happened and how it happened. The *Summary* — a separate form (Form 300A) — shows the totals for the year in each category. At the end of the year, post the *Summary* in a visible location so that your employees are aware of the injuries and illnesses occurring in their workplace.

Employers must keep a *Log* for each establishment or site. If you have more than one establishment, you must keep a separate *Log* and *Summary* for each physical location that is expected to be in operation for one year or longer.

Note that your employees have the right to review your injury and illness records. For more information, see 29 Code of Federal Regulations Part 1904.35, *Employee Involvement*.

Cases listed on the *Log of Work-Related Injuries and Illnesses* are not necessarily eligible for workers' compensation or other insurance benefits. Listing a case on the *Log* does not mean that the employer or worker was at fault or that an OSHA standard was violated.

When is an injury or illness considered work-related?

An injury or illness is considered work-related if an event or exposure in the work environment caused or contributed to the condition or significantly aggravated a preexisting condition. Work-relatedness is presumed for injuries and illnesses resulting from events or exposures occurring in the workplace, unless an exception specifically applies. See 29 CFR Part 1904.5(b)(2) for the exceptions. The work environment includes the establishment and other locations where one or more employees are working or are present as a condition of their employment. See 29 CFR Part 1904.5(b)(1).

Which work-related injuries and illnesses should you record?

Record those work-related injuries and illnesses that result in:

- death,
- loss of consciousness,
- days away from work,
- restricted work activity or job transfer, or
- medical treatment beyond first aid.

You must also record work-related injuries and illnesses that are significant (as defined below) or meet any of the additional criteria listed below.

You must record any significant work-related injury or illness that is diagnosed by a physician or other licensed health care professional. You must record any work-related case involving cancer, chronic irreversible disease, a fractured or cracked bone, or a punctured eardrum. See 29 CFR 1904.7.

What are the additional criteria?

You must record the following conditions when they are work-related:

- any needlestick injury or cut from a sharp object that is contaminated with another person's blood or other potentially infectious material;
- any case requiring an employee to be medically removed under the requirements of an OSHA health standard;
- tuberculosis infection as evidenced by a positive skin test or diagnosis by a physician or other licensed health care professional after exposure to a known case of active tuberculosis.

What is medical treatment?

Medical treatment includes managing and caring for a patient for the purpose of combating disease or disorder. The following are not considered medical treatments and are NOT recordable:

- visits to a doctor or health care professional solely for observation or counseling;
- diagnostic procedures, including administering prescription medications that are used solely for diagnostic purposes; and
- any procedure that can be labeled first aid. (*See below for more information about first aid.*)

What do you need to do?

1. Within 7 calendar days after you receive information about a case, decide if the case is recordable under the OSHA recordkeeping requirements.
2. Determine whether the incident is a new case or a recurrence of an existing one.
3. Establish whether the case was work-related.
4. If the case is recordable, decide which form you will fill out as the injury and illness incident report.

   You may use *OSHA's 301: Injury and Illness Incident Report* or an equivalent form. Some state workers compensation, insurance, or other reports may be acceptable substitutes, as long as they provide the same information as the OSHA 301.

How to work with the Log

1. Identify the employee involved unless it is a privacy concern case as described below.
2. Identify when and where the case occurred.
3. Describe the case, as specifically as you can.
4. Classify the seriousness of the case by recording the **most serious outcome** associated with the case, with column J (Other recordable cases) being the least serious and column G (Death) being the most serious.
5. Identify whether the case is an injury or illness. If the case is an injury, check the injury category. If the case is an illness, check the appropriate illness category.

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What is first aid?

If the incident required only the following types of treatment, consider it first aid. Do NOT record the case if it involves only:

- using non-prescription medications at non-prescription strength;
- administering tetanus immunizations;
- cleaning, flushing, or soaking wounds on the skin surface;
- using wound coverings, such as bandages, BandAids™, gauze pads, etc., or using SteriStrips™ or butterfly bandages.
- using hot or cold therapy;
- using any totally non-rigid means of support, such as elastic bandages, wraps, non-rigid back belts, etc.;
- using temporary immobilization devices while transporting an accident victim (splints, slings, neck collars, or back boards).
- drilling a fingernail or toenail to relieve pressure, or draining fluids from blisters;
- using eye patches;
- using simple irrigation or a cotton swab to remove foreign bodies not embedded in or adhered to the eye;
- using irrigation, tweezers, cotton swab or other simple means to remove splinters or foreign material from areas other than the eye;
- using finger guards;
- using massages;
- drinking fluids to relieve heat stress

How do you decide if the case involved restricted work?

Restricted work activity occurs when, as the result of a work-related injury or illness, an employer or health care professional keeps, or recommends keeping, an employee from doing the routine functions of his or her job or from working the full workday that the employee would have been scheduled to work before the injury or illness occurred.

How do you count the number of days of restricted work activity or the number of days away from work?

Count the number of calendar days the employee was on restricted work activity or was away from work as a result of the recordable injury or illness. Do not count the day on which the injury or illness occurred in this number. Begin counting days from the day after the incident occurs. If a single injury or illness involved both days away from work and days of restricted work activity, enter the total number of days for each. You may stop counting days of restricted work activity or days away from work once the total of either or the combination of both reaches 180 days.

Under what circumstances should you NOT enter the employee's name on the OSHA Form 300?

You must consider the following types of injuries or illnesses to be privacy concern cases:

- an injury or illness to an intimate body part or to the reproductive system,
- an injury or illness resulting from a sexual assault,
- a mental illness,
- a case of HIV infection, hepatitis, or tuberculosis,
- a needlestick injury or cut from a sharp object that is contaminated with blood or other potentially infectious material (see 29 CFR Part 1904.8 for definition), and
- other illnesses, if the employee independently and voluntarily requests that his or her name not be entered on the log.

You must not enter the employee's name on the OSHA 300 *Log* for these cases. Instead, enter "privacy case" in the space normally used for the employee's name. You must keep a separate, confidential list of the case numbers and employee names for the establishment's privacy concern cases so that you can update the cases and provide information to the government if asked to do so.

If you have a reasonable basis to believe that information describing the privacy concern case may be personally identifiable even though the employee's name has been omitted, you may use discretion in describing the injury or illness on both the OSHA 300 and 301 forms. You must enter enough information to identify the cause of the incident and the general severity of the injury or illness, but you do not need to include details of an intimate or private nature.

What if the outcome changes after you record the case?

If the outcome or extent of an injury or illness changes after you have recorded the case, simply draw a line through the original entry or, if you wish, delete or white-out the original entry. Then write the new entry where it belongs. Remember, you need to record the most serious outcome for each case.

Classifying injuries

An injury is any wound or damage to the body resulting from an event in the work environment.

Examples: Cut, puncture, laceration, abrasion, fracture, bruise, contusion, chipped tooth, amputation, insect bite, electrocution, or a thermal, chemical, electrical, or radiation burn. Sprain and strain injuries to muscles, joints, and connective tissues are classified as injuries when they result from a slip, trip, fall or other similar accidents.

U.S. Department of Labor
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Classifying illnesses

Skin diseases or disorders

Skin diseases or disorders are illnesses involving the worker's skin that are caused by work exposure to chemicals, plants, or other substances.

Examples: Contact dermatitis, eczema, or rash caused by primary irritants and sensitizers or poisonous plants; oil acne; friction blisters, chrome ulcers; inflammation of the skin.

Respiratory conditions

Respiratory conditions are illnesses associated with breathing hazardous biological agents, chemicals, dust, gases, vapors, or fumes at work.

Examples: Silicosis, asbestosis, pneumonitis, pharyngitis, rhinitis or acute congestion; farmer's lung, beryllium disease, tuberculosis, occupational asthma, reactive airways dysfunction syndrome (RADS), chronic obstructive pulmonary disease (COPD), hypersensitivity pneumonitis, toxic inhalation injury, such as metal fume fever, chronic obstructive bronchitis, and other pneumoconioses.

Poisoning

Poisoning includes disorders evidenced by abnormal concentrations of toxic substances in blood, other tissues, other bodily fluids, or the breath that are caused by the ingestion or absorption of toxic substances into the body.

Examples: Poisoning by lead, mercury, cadmium, arsenic, or other metals; poisoning by carbon monoxide, hydrogen sulfide, or other gases; poisoning by benzene, benzol, carbon tetrachloride, or other organic solvents; poisoning by insecticide sprays, such as parathion or lead arsenate; poisoning by other chemicals, such as formaldehyde.

All other illnesses

All other occupational illnesses.

Examples: Heatstroke, sunstroke, heat exhaustion, heat stress and other effects of environmental heat; freezing, frostbite, and other effects of exposure to low temperatures; decompression sickness; effects of ionizing radiation (isotopes, x-rays, radium); effects of nonionizing radiation (welding flash, ultra-violet rays, lasers); anthrax; bloodborne pathogenic diseases, such as AIDS, HIV, hepatitis B or hepatitis C; brucellosis; malignant or benign tumors; histoplasmosis; coccidioidomycosis.

When must you post the Summary?

You must post the *Summary* only — not the *Log* — by February 1 of the year following the year covered by the form and keep it posted until April 30 of that year.

How long must you keep the Log and Summary on file?

You must keep the *Log* and *Summary* for 5 years following the year to which they pertain.

Do you have to send these forms to OSHA at the end of the year?

No. You do not have to send the completed forms to OSHA unless specifically asked to do so.

How can we help you?

If you have a question about how to fill out the *Log*,

- ❑ ***visit us online at www.osha.gov*** or
- ❑ ***call your local OSHA office.***

Optional

Calculating Injury and Illness Incidence Rates

What is an incidence rate?

An incidence rate is the number of recordable injuries and illnesses occurring among a given number of full-time workers (usually 100 full-time workers) over a given period of time (usually one year). To evaluate your firm's injury and illness experience over time or to compare your firm's experience with that of your industry as a whole, you need to compute your incidence rate. Because a specific number of workers and a specific period of time are involved, these rates can help you identify problems in your workplace and/or progress you may have made in preventing work-related injuries and illnesses.

How do you calculate an incidence rate?

You can compute an occupational injury and illness incidence rate for all recordable cases or for cases that involved days away from work for your firm quickly and easily. The formula requires that you follow instructions in paragraph (a) below for the total recordable cases or those in paragraph (b) for cases that involved days away from work, *and* for both rates the instructions in paragraph (c).

(a) *To find out the total number of recordable injuries and illnesses that occurred during the year,* count the number of line entries on your OSHA Form 300, or refer to the OSHA Form 300A and sum the entries for columns (G), (H), (I), and (J).

(b) *To find out the number of injuries and illnesses that involved days away from work,* count the number of line entries on your OSHA Form 300 that received a check mark in column (H), or refer to the entry for column (H) on the OSHA Form 300A.

(c) *The number of hours all employees actually worked during the year*. Refer to OSHA Form 300A and optional worksheet to calculate this number.

You can compute the incidence rate for all recordable cases of injuries and illnesses using the following formula:

Total number of injuries and illnesses ÷ Number of hours worked by all employees x *200,000 hours = Total recordable case rate*

(The 200,000 figure in the formula represents the number of hours 100 employees working 40 hours per week, 50 weeks per year would work, and provides the standard base for calculating incidence rates.)

You can compute the incidence rate for recordable cases involving days away from work, days of restricted work activity or job transfer (DART) using the following formula:

(Number of entries in column H + Number of entries in column I) ÷ Number of hours worked by all employees x *200,000 hours = DART incidence rate*

You can use the same formula to calculate incidence rates for other variables such as cases involving restricted work activity (column (I) on Form 300A), cases involving skin disorders (column (M-2) on Form 300A), etc. Just substitute the appropriate total for these cases, from Form 300A, into the formula in place of the total number of injuries and illnesses.

What can I compare my incidence rate to?

The Bureau of Labor Statistics (BLS) conducts a survey of occupational injuries and illnesses each year and publishes incidence rate data by various classifications (e.g., by industry, by employer size, etc.). You can obtain these published data at www.bls.gov or by calling a BLS Regional Office.

Worksheet

Total number of recordable injuries and illnesses in your establishment

[ ] ÷ [ ] Hours worked by all your employees

X 200,000 =

Total recordable cases incidence rate [ ]

Total number of recordable injuries and illnesses with a checkmark in column H or column I

[ ] ÷ [ ] Hours worked by all your employees

X 200,000 =

DART incidence rate [ ]

U.S. Department of Labor
Occupational Safety and Health Administration

How to Fill Out the Log

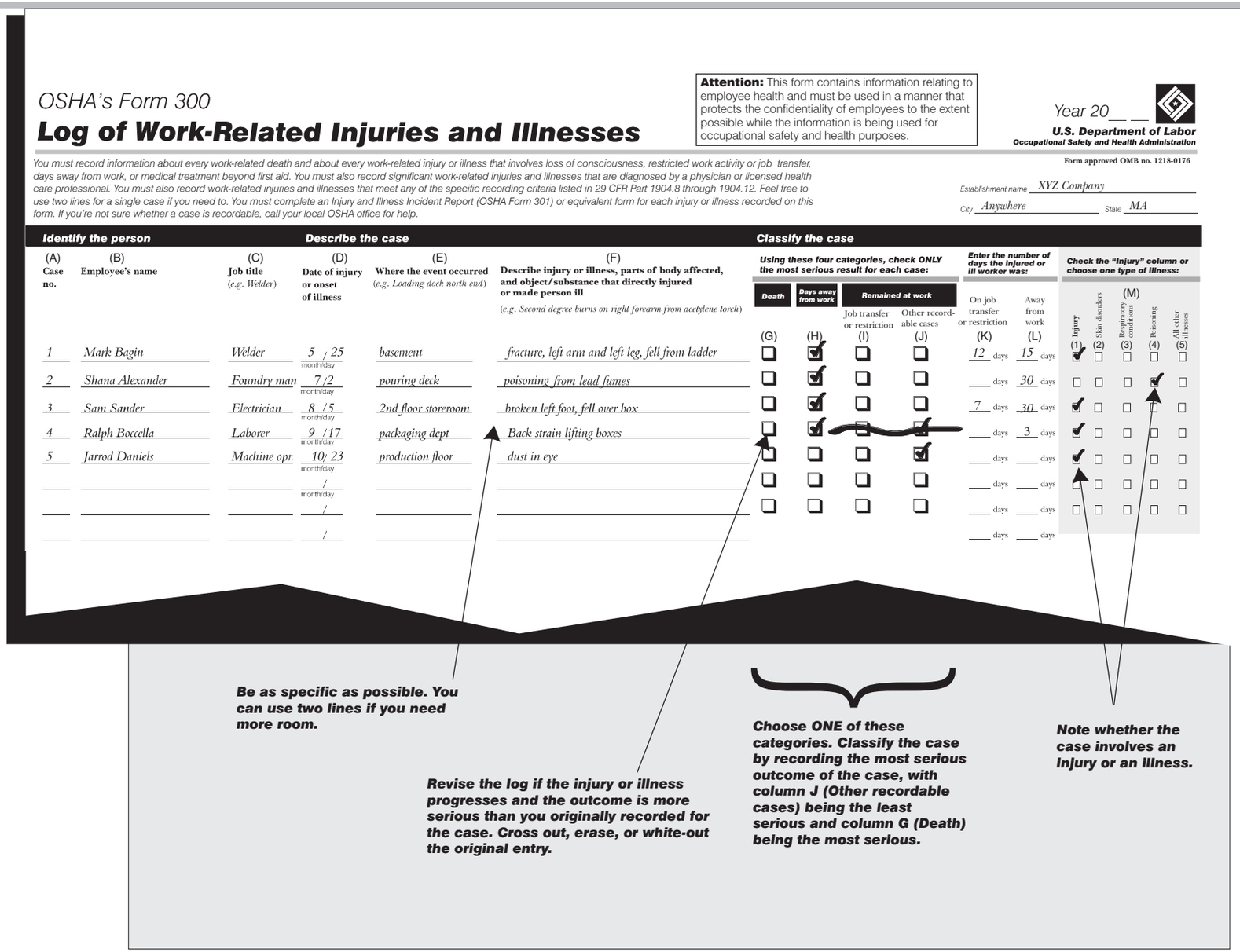
The *Log of Work-Related Injuries and Illnesses* is used to classify work-related injuries and illnesses and to note the extent and severity of each case. When an incident occurs, use the *Log* to record specific details about what happened and how it happened.

If your company has more than one establishment or site, you must keep separate records for each physical location that is expected to remain in operation for one year or longer.

We have given you several copies of the *Log* in this package. If you need more than we provided, you may photocopy and use as many as you need.

The *Summary* — a separate form — shows the work-related injury and illness totals for the year in each category. At the end of the year, count the number of incidents in each category and transfer the totals from the *Log* to the *Summary*. Then post the *Summary* in a visible location so that your employees are aware of injuries and illnesses occurring in their workplace.

You don't post the Log. You post only the Summary at the end of the year.



OSHA's Form 300

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name XYZ Company
City Anywhere State MA

Identify the person			Describe the case			Classify the case				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness:				
(A) Case no.	(B) Employee's name	(C) Job title (*e.g. Welder*)	(D) Date of injury or onset of illness	(E) Where the event occurred (*e.g. Loading dock north end*)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (*e.g. Second degree burns on right forearm from acetylene torch*)	Using these four categories, check ONLY the most serious result for each case: Death (G)	Days away from work (H)	Remained at work: Job transfer or restriction (I)	Remained at work: Other recordable cases (J)	On job transfer or restriction (K)	Away from work (L)	(M) Injury (1)	Skin disorders (2)	Respiratory conditions (3)	Poisoning (4)	All other illnesses (5)
1	Mark Bagin	Welder	5 / 25	basement	fracture, left arm and left leg, fell from ladder	☐	☑	☐	☐	12 days	15 days	☑	☐	☐	☐	☐
2	Shana Alexander	Foundry man	7 /2	pouring deck	poisoning from lead fumes	☐	☑	☐	☐	___ days	30 days	☐	☐	☐	☑	☐
3	Sam Sander	Electrician	8 / 5	2nd floor storeroom	broken left foot, fell over box	☐	☑	☐	☐	7 days	30 days	☑	☐	☐	☐	☐
4	Ralph Boccella	Laborer	9 /17	packaging dept	Back strain lifting boxes	☐	☑	☐	☐	___ days	3 days	☑	☐	☐	☐	☐
5	Jarrod Daniels	Machine opr.	10/ 23	production floor	dust in eye	☐	☐	☐	☑	___ days	___ days	☑	☐	☐	☐	☐
			/			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/							___ days	___ days					

Be as specific as possible. You can use two lines if you need more room.

Revise the log if the injury or illness progresses and the outcome is more serious than you originally recorded for the case. Cross out, erase, or white-out the original entry.

Choose ONE of these categories. Classify the case by recording the most serious outcome of the case, with column J (Other recordable cases) being the least serious and column G (Death) being the most serious.

Note whether the case involves an injury or an illness.

U.S. Department of Labor
Occupational Safety and Health Administration

OSHA's Form 300

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name ______________________

City ______________________ State ______________

Identify the person			Describe the case			Classify the case										
						Using these four categories, check ONLY the most serious result for each case:				Enter the number of days the injured or ill worker was:		Check the "Injury" column or choose one type of illness: (M)				
(A) Case no.	(B) Employee's name	(C) Job title (e.g., *Welder*)	(D) Date of injury or onset of illness	(E) Where the event occurred (e.g., *Loading dock north end*)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g., *Second degree burns on right forearm from acetylene torch*)	(G) Death	(H) Days away from work	(I) Remained at work: Job transfer or restriction	(J) Remained at work: Other record-able cases	(K) On job transfer or restriction	(L) Away from work	(1) Injury	(2) Skin disorder	(3) Respiratory condition	(4) Poisoning	(5) All other illnesses
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
					Page totals ➤	___	___	___	___	___	___	(1) Injury	(2) Skin disorder	(3) Respiratory condition	(4) Poisoning	(5) All other illnesses

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

OSHA's Form 300A

Summary of Work-Related Injuries and Illnesses

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no work-related injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete and accurate before completing this summary.

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the Log. If you had no cases, write "0."

Employees, former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR Part 1904.35, in OSHA's recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
_____	_____	_____	_____
(G)	(H)	(I)	(J)

Number of Days

Total number of days of job transfer or restriction	Total number of days away from work
_____	_____
(K)	(L)

Injury and Illness Types

Total number of . . .

	(M)		
(1) Injuries	_____	(4) Poisonings	_____
		(5) All other illnesses	_____
(2) Skin disorders	_____		
(3) Respiratory conditions	_____		

Establishment information

Your establishment name _____

Street _____

City _____ State _____ ZIP _____

Industry description (*e.g., Manufacture of motor truck trailers*)

_____

Standard Industrial Classification (SIC), if known (*e.g., SIC 3715*)

___ ___ ___ ___

Employment information *(If you don't have these figures, see the Worksheet on the back of this page to estimate.)*

Annual average number of employees _____

Total hours worked by all employees last year _____

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

_____
Company executive Title

( ) - / /
Phone Date

Post this Summary page from February 1 to April 30 of the year following the year covered by the form.

Optional

Worksheet to Help You Fill Out the Summary

At the end of the year, OSHA requires you to enter the average number of employees and the total hours worked by your employees on the summary. If you don't have these figures, you can use the information on this page to estimate the numbers you will need to enter on the Summary page at the end of the year.

How to figure the average number of employees who worked for your establishment during the year:

❶ ***Add*** the total number of employees your establishment paid in all pay periods during the year. Include all employees: full-time, part-time, temporary, seasonal, salaried, and hourly.

The number of employees paid in all pay periods = ❶ _____

❷ ***Count*** the number of pay periods your establishment had during the year. Be sure to include any pay periods when you had no employees.

The number of pay periods during the year = ❷ _____

❸ ***Divide*** the number of employees by the number of pay periods.

❶ / ❷ _____ = ❸ _____

❹ ***Round the answer*** to the next highest whole number. Write the rounded number in the blank marked *Annual average number of employees*.

The number rounded = ❹ _____

For example, Acme Construction figured its average employment this way:

For pay period...	Acme paid this number of employees...
1	10
2	0
3	15
4	30
5	40
▼	▼
24	20
25	15
26	+10
	830

Number of employees paid = 830 ❶

Number of pay periods = 26 ❷

830 / 26 = 31.92 ❸

31.92 rounds to 32 ❹

32 is the annual average number of employees

How to figure the total hours worked by all employees:

Include hours worked by salaried, hourly, part-time and seasonal workers, as well as hours worked by other workers subject to day to day supervision by your establishment (e.g., temporary help services workers).

Do not include vacation, sick leave, holidays, or any other non-work time, even if employees were paid for it. If your establishment keeps records of only the hours paid or if you have employees who are not paid by the hour, please estimate the hours that the employees actually worked.

If this number isn't available, you can use this optional worksheet to estimate it.

Optional Worksheet

_____ ***Find*** the number of full-time employees in your establishment for the year.

X _____ ***Multiply*** by the number of work hours for a full-time employee in a year.

_____ This is the number of full-time hours worked.

\+ _____ ***Add*** the number of any overtime hours as well as the hours worked by other employees (part-time, temporary, seasonal)

_____ ***Round*** the answer to the next highest whole number. Write the rounded number in the blank marked *Total hours worked by all employees last year.*

U.S. Department of Labor
Occupational Safety and Health Administration

OSHA's Form 301
Injury and Illness Incident Report

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

This *Injury and Illness Incident Report* is one of the first forms you must fill out when a recordable work-related injury or illness has occurred. Together with the *Log of Work-Related Injuries and Illnesses* and the accompanying *Summary,* these forms help the employer and OSHA develop a picture of the extent and severity of work-related incidents.

Within 7 calendar days after you receive information that a recordable work-related injury or illness has occurred, you must fill out this form or an equivalent. Some state workers' compensation, insurance, or other reports may be acceptable substitutes. To be considered an equivalent form, any substitute must contain all the information asked for on this form.

According to Public Law 91-596 and 29 CFR 1904, OSHA's recordkeeping rule, you must keep this form on file for 5 years following the year to which it pertains.

If you need additional copies of this form, you may photocopy and use as many as you need.

Completed by _____

Title _____

Phone (_____)_____--_____ **Date** ____/ ____/ ____

Information about the employee

1) **Full name** _____

2) **Street** _____

City _____ **State** _____ **ZIP** _____

3) **Date of birth** _____ / _____ / _____

4) **Date hired** _____ / _____ / _____

5) ❒ **Male**
❒ **Female**

Information about the physician or other health care professional

6) **Name of physician or other health care professional** _____

_____

7) **If treatment was given away from the worksite, where was it given?**

Facility _____

Street _____

City _____ **State** _____ **ZIP** _____

8) **Was employee treated in an emergency room?**
❒ **Yes**
❒ **No**

9) **Was employee hospitalized overnight as an in-patient?**
❒ **Yes**
❒ **No**

Information about the case

10) **Case number from the *Log*** _____ *(Transfer the case number from the Log after you record the case.)*

11) **Date of injury or illness** _____ / _____ / _____

12) **Time employee began work** _____ **AM / PM**

13) **Time of event** _____ **AM / PM** ☐ **Check if time cannot be determined**

14) ***What was the employee doing just before the incident occurred?*** **Describe the activity, as well as the tools, equipment, or material the employee was using. Be specific.** ***Examples:*** **"climbing a ladder while carrying roofing materials"; "spraying chlorine from hand sprayer"; "daily computer key-entry."**

15) ***What happened?*** **Tell us how the injury occurred.** ***Examples:*** **"When ladder slipped on wet floor, worker fell 20 feet"; "Worker was sprayed with chlorine when gasket broke during replacement"; "Worker developed soreness in wrist over time."**

16) ***What was the injury or illness?*** **Tell us the part of the body that was affected and how it was affected; be more specific than "hurt," "pain," or sore."** ***Examples:*** **"strained back"; "chemical burn, hand"; "carpal tunnel syndrome."**

17) ***What object or substance directly harmed the employee?*** ***Examples:*** **"concrete floor"; "chlorine"; "radial arm saw."** ***If this question does not apply to the incident, leave it blank.***

18) ***If the employee died, when did death occur?*** **Date of death** _____ / _____ / _____

If You Need Help...

If you need help deciding whether a case is recordable, or if you have questions about the information in this package, feel free to contact us. We'll gladly answer any questions you have.

- **Visit us online at www.osha.gov**
- **Call your OSHA Regional office and ask for the recordkeeping coordinator**

  or

- **Call your State Plan office**

Federal Jurisdiction

Region 1 - 617 / 565-9860
Connecticut; Massachusetts; Maine; New Hampshire; Rhode Island

Region 2 - 212 / 337-2378
New York; New Jersey

Region 3 - 215 / 861-4900
DC; Delaware; Pennsylvania; West Virginia

Region 4 - 404 / 562-2300
Alabama; Florida; Georgia; Mississippi

Region 5 - 312 / 353-2220
Illinois; Ohio; Wisconsin

Region 6 - 214 / 767-4731
Arkansas; Louisiana; Oklahoma; Texas

Region 7 - 816 / 426-5861
Kansas; Missouri; Nebraska

Region 8 - 303 / 844-1600
Colorado; Montana; North Dakota; South Dakota

Region 9 - 415 / 975-4310

Region 10 - 206 / 553-5930
Idaho

State Plan States

Alaska - 907 / 269-4957

Arizona - 602 / 542-5795

California - 415 / 703-5100

*Connecticut - 860 / 566-4380

Hawaii - 808 / 586-9100

Indiana - 317 / 232-2688

Iowa - 515 / 281-3661

Kentucky - 502 / 564-3070

Maryland - 410 / 767-2371

Michigan - 517 / 322-1848

Minnesota - 651 / 284-5050

Nevada - 702 / 486-9020

*New Jersey - 609 / 984-1389

New Mexico - 505 / 827-4230

*New York - 518 / 457-2574

North Carolina - 919 / 807-2875

Oregon - 503 / 378-3272

Puerto Rico - 787 / 754-2172

South Carolina - 803 / 734-9669

Tennessee - 615 / 741-2793

Utah - 801 / 530-6901

Vermont - 802 / 828-2765

Virginia - 804 / 786-6613

Virgin Islands - 340 / 772-1315

Washington - 360 / 902-5554

Wyoming - 307 / 777-7786

*Public Sector only

U.S. Department of Labor
Occupational Safety and Health Administration

U.S. Department of Labor
Occupational Safety and Health Administration

Have questions?

If you need help in filling out the *Log* or *Summary,* or if you have questions about whether a case is recordable, contact us. We'll be happy to help you. You can:

- Visit us online at: **www.osha.gov**
- Call your regional or state plan office. You'll find the phone number listed inside this cover.

Record of Change
Site-Specific Health and Safety Plan

GENERAL SITE INFORMATION

Site Name: _____ Date: _____

Project Number: _____

Site Health and Safety Coordinator: _____

Project Manager: _____ Field Manager: _____

DESCRIPTION OF AND JUSTIFICATION FOR CHANGE

_____

_____

_____

_____

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_____

SHSC Signature: _____ Date: _____

Authorization: _____ Title: _____ Date: _____

Safety Inspection

Location | Department or Area | Date

The following list is intended as a reminder. Look for all unsafe acts and conditions and report them below.

MACHINERY
- ☐ Point of operation guards
- ☐ Belts, pulleys, gears, shafts, etc.
- ☐ Oiling, cleaning, and adjusting
- ☐ Maintenance and oil leakage

UNSAFE PRACTICES
- ☐ Excessive speed of vehicles
- ☐ Improper lifting
- ☐ Smoking in danger areas
- ☐ Horseplay
- ☐ Running in aisles or on stairs
- ☐ Improper use of air hoses
- ☐ Removing machine or other guards
- ☐ Work on unguarded moving machinery

HOUSEKEEPING
- ☐ Aisles, stairs, and floors
- ☐ Storage and piling of material
- ☐ Wash and locker rooms
- ☐ Light and ventilation
- ☐ Disposal or waste
- ☐ Yards and parking lots

PERSONAL PROTECTIVE EQUIPMENT
- ☐ Goggles or face shields
- ☐ Safety-toe shoes
- ☐ Gloves
- ☐ Respirators or gas masks
- ☐ Protective clothing

TOOLS
- ☐ Power tools wiring
- ☐ Hand tool
- ☐ Use and storage of tools

PRESSURE EQUIPMENT
- ☐ Steam Equipment
- ☐ Air receivers and compressors
- ☐ Gas cylinders and hose

FIRE PROTECTION
- ☐ Extinguishing equipment
- ☐ Standpipes, hoses, sprinkler heads and valves
- ☐ Exits, stairs, and signs
- ☐ Storage and flammable material

FIRST AID AND MISCELLANEOUS
- ☐ First aid kits
- ☐ Stretchers and fire blankets
- ☐ Emergency showers
- ☐ All injuries reported

MISCELLANEOUS
- ☐ Material safety data sheets; all chemicals
- ☐ Acids and caustics
- ☐ New processes, chemicals, and solvents
- ☐ Dusts, vapors, or fumes
- ☐ Ladders and scaffolds

Signature/Title

Unsafe Condition/Act Observed	Corrective Action Assigned To	Date Completed

Safety, Health, and Environmental Coordinator
Monthly Status Report

Date: _____ Name of SHE Coordinator: _____

Location: _____ For Report Month: _____

Medical Surveillance Program

The following employees were sent for physicals this month: _____

_____

_____

The Data Entry Sheets reflecting this information are:

____ Attached

____ Sent previously

____ Will be sent by ___/___/___ (date)

Training

The staff at this office attended the following health and safety training this month:

____ Safety Meeting, Date: _____

____ Hazardous Waste Worker 40 hr. Course, Date: _____

____ Hazardous Waste Worker 8 hr. Refresher, Date: _____

____ Hazardous Waste Worker 8 hr. Supervisory, Date: _____

____ First Aid, Date: _____

____ CPR, Date: _____

____ Hazard Communication, Date: _____

____ Office Safety, Date: _____

____ Fire Safety, Extinguishers/ Emergency Plan, Date: _____

____ Confined Space Entry, Date: _____

____ Other, _____ Date: _____

____ Other, _____ Date: _____

The Data Entry Sheets reflecting this information are:

____ Attached

____ Sent previously

____ Will be sent by ___/___/___ (date)

New Hire Orientations

Did any new employees receive health and safety New Hire Orientation this month? ____ Yes ____ No

Names: _____

_____

_____

_____

Note: Send completed orientation forms to the Corporate SHE Department for recordkeeping.

Inspections

Did you inspect the emergency equipment in the office this month? (fire extinguishers, first aid kits, emergency lighting, SCBAs, as applicable) ____ Yes ____ No Date: _____

Did you inspect any other areas of the office for health and safety compliance? ____ Yes ____ No

If yes, please describe: _____

_____

Did you identify or initiate any corrective action to rectify a possible safety concern uncovered during your inspection or brought to your attention by employees? ____ Yes ____ No

If yes, please describe: _____

_____

Injuries or Illnesses

Were there any near-misses reported this month? ____ Yes ____ No

If yes, please describe: _____

_____

Did any employees receive first aid for an injury (even minor) at the office or in the field? ____ Yes ____ No

If yes, please describe: _____

_____

_____

Note: Please transmit the Supervisor's Report of an Injury to Human Resources in Kirkland, WA and the Corporate SHE Department in San Diego, CA within 24 hours of an injury or illness requiring medical attention or hospitalization.

Emergency Situations

Did any health- and safety-related emergency situation arise this month? ____ Yes ____ No

If yes, please describe: _____

_____

_____

Miscellaneous

Did you receive any health- and safety-related request or complaints this month? (e.g., odors, ergonomics concerns, requests for MSDSs, etc.) ____ Yes ____ No

If yes, please describe: _____

_____

_____

Additional Comments, Requests, and/or Observations

_____

_____

_____

_____

AMEC Earth & Environmental, Inc. (AEE)
Safety, Health, and Environment Orientation

It is the policy of AMEC Earth & Environmental, Inc. (AEE) to provide all employees with a safe and healthful working environment. AEE's goal is the prevention of all occupation-related accidents and illnesses. To assist in this goal, AEE has implemented the Safety, Health, and Environment Program that is outlined in the AEE Corporate Safety, Health, and Environment Manual. As a new employee, it will be your responsibility to follow the established procedures for your own personal protection and also the protection of coworkers.

AEE Safety, Health, and Environment Policy

Accordingly, it is AEE policy to

- provide safe working conditions
- conduct all company operations within the guidelines of established health and safety procedures
- comply with all government regulations related to employee health and safety
- maintain high standards in the areas of industrial health, environmental protection, and safety

AEE Safety, Health, and Environment Rules

AEE has safety rules that are to be adhered to at all times while an employee is involved in AEE business. They are as follows:

1. No employee shall report to work or be permitted to work while he/she is in any way unfit to perform his/her duties in a safe and efficient manner.
2. All injuries and accidents (even near misses) must be reported to your supervisor immediately.
3. Immediately report all unsafe or unhealthful conditions in the workplace, including defective tools or other equipment to your supervisor.
4. Take all reasonable precautions to ensure your own safety and the safety of fellow workers during the course of employment.
5. All threats, intimidation, harassment, or acts of violence shall be reported to your supervisor; Human Resources; or the Safety, Health, and Environment Coordinator (SHE Coordinator).
6. No person shall engage in any improper activity or behavior that might create or constitute a hazard to him/herself or any other worker. For the purposes of this rule, improper activities include horseplay, fighting, practical jokes, unnecessary running or jumping, or similar conduct.
7. Established safe job procedures must be followed by all employees.
8. Changes in regular job procedures require the approval of your immediate supervisor.
9. If unsure how to perform any assigned task or operate any equipment, ask your supervisor before proceeding.
10. Do not remove guards from machines.
11. Personal protective equipment (PPE) must be worn or used in any area where it is required.
12. Disposal of hazardous materials and wastes must be in accordance with applicable environmental regulations. If there is any doubt about proper disposal, discuss this with your supervisor.
13. Report all spills of hazardous wastes or materials to your supervisor. Consult the material safety data sheet for appropriate cleanup procedures.
14. Use only the proper tool for the job. Do not use defective tools or equipment. If the proper tool is not available, ask for help from your supervisor before doing the job.
15. When required to clean, repair, or adjust machinery, the machinery shall be shut off and locked out both mechanically and/or electrically to prevent operation of the equipment.
16. Get help in lifting any item that is so bulky, awkward, or heavy that you feel you cannot lift it safely.
17. If a repetitive task causes you discomfort, or you feel it is unsafe or unhealthy, report it to your supervisor immediately.
18. Employees are not to report to work under the influence of alcohol, illegal drugs, or drugs for which the employees do not have a lawful prescription, or drugs that affect the employee's ability to drive safely. Employees are not to consume alcohol, illegal drugs, or drugs for which they do not have a lawful prescription during the working day.
19. Employees must conduct themselves in a safe manner to prevent injury to themselves and others and to minimize damage to AEE property. Each employee is responsible for the care and safe operation of AEE equipment.
20. Obey all safety warning signs and signals. Do not remove any safety warning signs or signals until the danger is eliminated.

AEE Safety, Health, and Environment Rules (cont'd.)

21. Maintain good housekeeping in your work area.
22. Employees are responsible for safe use of any vehicles, machines, and equipment that they may operate, and for the quality of the work they produce.
23. Wear seat belts at all times when in vehicles used for company business. This includes drivers and passengers in rental cars, personal vehicles used for business activities, and company-provided vehicles.
24. Do not engage in any activities that interfere with your ability to operate a vehicle safely.

Disciplinary Action

OSHA regulations require employers to have "a system for ensuring that employees comply with all safe and healthy work practices, which may include disciplinary action." AEE has a disciplinary policy that all levels of management are expected to apply uniformly and without exception. AEE's disciplinary policy states: "All supervisors are to enforce the AEE safety rules and ensure that employees comply with established safe work practices (including use of personal protective equipment)." AEE's system of ensuring compliance starts with this policy. The system relies on good management practices and resorts to disciplinary action as a last alternative. The company will normally follow the progressive discipline procedure outlined below; however, the company reserves the right to determine the action to be taken, from verbal reprimand up to and including dismissal, as circumstances warrant. The sequence of steps is a guideline, not a rigid requirement, and must be applied, if at all, commensurate with the circumstances of each situation. When disciplinary action must be taken, one or more of the following steps will normally be followed:

1. The first time an infraction (unsafe behavior) is noted, the supervisor shall
   - meet with the employee to discuss the matter
   - inform the employee of the nature of the infraction
   - inform the employee of the action necessary to correct the infraction
   - if warranted, prepare a memorandum of the meeting for the employee's personnel file
2. Should a second violation occur, the supervisor shall take the following actions:
   - hold a second meeting with the employee
   - issue a written reprimand covering the nature of the infraction and the actions to correct it
   - place the employee on probation
   - warn the employee that a third incident will result in more severe disciplinary action and could result in dismissal
   - prepare and forward to Human Resources a written report documenting verbal or written warnings or reprimands given to the employee
3. Should additional incidents occur, the supervisor shall place the employee on probation or suspension. The supervisor may recommend dismissal. These actions must be taken in cooperation with Human Resources.

Accident Reporting

If you or one of your coworkers should be involved in an accident/injury while on AEE business, after seeking medical treatment, immediately report the following information to your supervisor:

1. Date, time, location, and description of the accident/injury
2. Names of other persons involved in the accident/injury
3. Extent of the injury
4. Medical treatment that was administered
5. Names of any witnesses
6. Description of any property damage

AEE Safety, Health, and Environment Orientation **(continued)**

Acknowledgement

By my signature below, I acknowledge that I have participated in the AEE Safety, Health, and Environment Orientation. The AEE Safety, Health, and Environment Policy; AEE Safety, Health, and Environment Rules; Disciplinary Action procedure; and Accident Reporting procedure have been explained to me. I have had the opportunity to ask questions and received adequate answers.

Name (print)	*Signature*	*Date*

Site Air Surveillance Record

SITE INFORMATION		
Job Number:	**Date:**	**Site Location:**
Field Manager:	**Site Health and Safety Coordinator:**	

SITE CONDITIONS		
Temperature:	**Relative Humidity:**	**Wind Speed and Direction:**

Sample No.	Time	Sample Description	Location	Instrument	Reading	Comments

Supervisor's Report of Injury or Illness

Note: To prevent accidents, it is necessary to know how and why they occur. Please complete both sides of this report. State facts as accurately as possible. Accurate reporting of all facts will help in the preparation of the "Employer's Report." Submit your complete report within 24 hours to Human Resources, your SHE Coordinator, and the Corporate SHE Director.

Name of injured employee		Department in which regularly employed
Injury date	Time of injury ❑ AM ❑ PM	Date and time employer was notified of injury
Did accident occur on employer's premises? ❑ YES ❑ NO	Where? (specify dept., job site, etc.)	Name of witness

What was employee doing when injured? (walking, lifting, operating machines, etc.) Be specific.

Please describe fully the events that resulted in injury or occupational disease. Tell what happened and how it happened. (Do not describe nature of injury)

What machine, tool, substance, or object was most closely connected with the injury? (e.g., machine the employee struck against or was struck by; the chemical in use; the object the employee was lifting, pulling, etc.)

Nature of injury and part of body affected.

Causes of Accident: Check All That Apply

Unsafe Building or Working Conditions

- ❑ Layout of Operations
- ❑ Layout of Machinery
- ❑ Unsafe Processes
- ❑ Improper Ventilation
- ❑ Improper Sanitation/Hygiene
- ❑ Improper Light
- ❑ Excessive Noise
- ❑ Floors or Platforms
- ❑ Miscellaneous

Housekeeping

- ❑ Improperly Piled or Stored Material
- ❑ Congestion

Physical Hazards or Equipment

- ❑ Ineffectively Guarded
- ❑ Unguarded
- ❑ Guard Removed
- ❑ Defective Tools
- ❑ Defective Machines
- ❑ Defective Materials

Discipline

- ❑ Not Following Safety Rules
- ❑ Horseplay

Apparel or Personal Protective Equipment

- ❑ Protective Equipment Not Used
- ❑ Unsuitable Protective Equipment
- ❑ Unsuitable Clothing or Footwear

Instructions and Training

- ❑ None
- ❑ Incomplete
- ❑ Erroneous
- ❑ Not Following Instructions
- ❑ Operating Without Authority
- ❑ Working at Unsafe Speed
- ❑ Inexperience
- ❑ Untrained in Procedure
- ❑ Incorrect Use of Tool or Equipment
- ❑ Improper Judgement
- ❑ Improper Lifting
- ❑ Lifting Excessive Weight

What can be done to prevent such an accident from happening again?

Approximate date condition will be corrected?

Additional Information

NOTE: The information requested below is important for complete documentation of a reported occupational injury or illness.

ACCIDENT/INCIDENT INFORMATION		
To whom was the injury reported?	Injured worker's shift times START _____ AM _____ PM END _____ AM _____ PM	
Is the accident/incident questionable to the supervisor? ❑ YES ❑ NO	Were there any signs of the involvement of drugs or alcohol? ❑ YES ❑ NO ❑ Unknown	
Was the employee permanently disabled as a result of the accident/incident?	If accident resulted in a fatality, date of death. ❑ NA Date:	
Last date worked and time employee left work	First day missed?	Number of days employee is expected to miss, if applicable.
Has the employee returned to work? ❑ YES Date:	❑ NO Expected return date:	
ACCIDENT INVESTIGATION INFORMATION		
Was any safety equipment provided? If yes, was it used?		
Was a third party responsible for the accident/incident? If yes, list name, address, and phone number.		
MEDICAL CARE PROVIDER INFORMATION		
Was first aid administered on-site? ❑ YES ❑ NO If yes, describe.		
Name of clinic and/or doctor employee saw. Include address, city, state, zip code, and phone number.		
Name of hospital employee was taken to, if applicable. Include address, city, state, zip code, and phone number.		
Was the employee admitted to the hospital? ❑ YES ❑ NO If yes, on what date?		
Was the employee treated as an outpatient, receive emergency treatment, or ambulance service?		
Supervisor's Name (please print)	Supervisor's Signature	Date

AMEC Earth & Environmental, Inc.
Tailgate Safety Meeting Report

Check One:

❑ Initial Kickoff Safety Meeting ❑ Regular/Daily Tailgate Safety Meeting ❑ Unscheduled Tailgate Safety Meeting

Date: _____ Site: _____

Field Manager: _____ Site Health and Safety Coordinator: _____
(print) *(print)*

Order of Business

Topics Discussed (check all that apply):

❑ Site History/Site Layout
❑ Scope of Work
❑ Personnel Responsibilities
❑ Medical Surveillance Requirements
❑ Training Requirements
❑ Safe Work Practices
❑ Logs, Reports, Recordkeeping
❑ Sanitation and Illumination
❑ Air Surveillance Type and Frequency
❑ Monitoring Instruments and Personal Monitoring
❑ Action Levels
❑ Accident Reporting Procedures
❑ Site Control (visitor access, buddy system, work zones, security, communications)
❑ Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
❑ Engineering Controls
❑ PPE Required/PPE Used
❑ Define PPE Levels, Donning, Doffing Procedures
❑ Physical Hazards and Controls (e.g., overhead utility lines)
❑ Decontamination Procedures for Personnel and Equipment
❑ General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
❑ Site/Regional Emergency Procedures (e.g., earthquake response, typhoon response, etc.)
❑ Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
❑ Hazardous Materials Spill Procedures
❑ Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
❑ Injury/Illness Reporting Procedures
❑ Route to Hospital and Medical Care Provider Visit Guidelines
❑ Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)

Safety suggestions by site workers: _____

_____

_____

Action taken on previous suggestions: _____

_____

_____

Injuries/accidents/personnel changes since previous meeting: _____

_____

_____

AMEC Earth & Environmental, Inc.
Tailgate Safety Meeting Report *(continued)*

Observations of unsafe work practices/conditions that have developed since previous meeting: _____

_____

_____

Location of (or changes in the locations of) evacuation routes/safe refuge areas: _____

_____

_____

Additional comments: _____

_____

_____

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Name (print)	Company	Signature

Meeting conducted by: _____ Title: _____
(print)

Signature: _____ Time: _____

Workplace Exposure Sampling Record

Name _____ Project No. _____

Social Security Number _____ Project Name _____

Employer/Officer _____ Project Dates _____

Job Function _____ Project Location _____

SAMPLING METHOD	SAMPLE TYPE	WORK ZONE
❑ Adsorber _____	❑ Area	❑ Contamination Reduction
❑ Detector Tube _____	❑ Background	❑ Exclusion
❑ Dosimeter Badge _____	❑ Biological	❑ Support
❑ Filter _____	❑ Personal	❑ Other _____
❑ Impinger _____		_____
❑ Meter _____		
❑ Other _____		

SAMPLE COLLECTION

Sample No. _____ Sample Duration _____ (min.)

Instrument Make/Model _____ Sample Rate _____ (mL/min.)

Calibration Date _____ Sample Volume _____ (L)

Sample Date _____

Collected By _____

Analyzed By _____

(Use reverse side for calculation and sketches as necessary.)

ATMOSPHERIC CONDITIONS

Humidity (%) ❑ Low 0-30 ❑ Med 30-70 ❑ High 70-100

Wind (mph) ❑ Light 0-5 ❑ Moderate 5-20 ❑ High >20

Temperature _____ °F Direction _____

ANALYTICAL RESULTS

Contaminant	OSHA PEL (TWA)	Concentration (Total)	Concentration (TWA)	Analytical Method	Detection Limit (Method)

PPE WORN (✔ = Yes)

❑ Half-Face Purifying Respirator
❑ Full-Face Purifying Respirator
❑ Air-Supplied Respirator
❑ Disposable Respirator
❑ Chemical Cartridge
❑ HEPA Cartridge
❑ Disposable Coverall
❑ Chemical Gloves
❑ Chemical Boots
❑ Slicker
❑ Unknown
❑ Safety Glasses
❑ Goggles
❑ Hearing Protection
❑ Other _____

OTHER REPRESENTATIVE PERSONNEL	GENERAL COMMENTS
_____ _____	_____
_____ _____	_____
_____ _____	_____

Distribution: H & S Personnel File, Project File, Employee, Other 4/01

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APPENDIX D

MATERIAL SAFETY DATA SHEETS

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MATERIAL SAFETY DATA SHEET

PREMIER CHEMICALS

MSDS No.: 2650
Date Prepared: 02/08
This Revision:

Phone: PREMIER CHEMICALS: 1-800-227-4287
CHEMTREC, 24-Hr Emergency Assistance: 1-800-424-9300

SECTION 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Material / Product Name(s): **ENVIRO BLEND®**
CAS Number: Mixture
Chemical Family: Inorganic - Mineral
General Use: A varying mix of magnesium oxide and calcium phosphates. Mix ratio depends on customer requirement and may vary from 1-99. Product used for metal containing waste stabilization.
Manufacturer / Supplier: PREMIER CHEMICALS, LLC
300 Barr Harbor
Suite 250
West Conshohocken, PA 19428-2998

SECTION 2. INGREDIENTS / COMPOSITION

Ingredient name:	CAS Number:	Percent:	IARC/NTP/OSHA:	Exposure Limits:
Nonhazardous Ingredients: A variable blend of magnesium oxide and calcium phosphates &	1309-48-4 7758-23-8 7758-87-4	99-100	No	Nuisance Particulate OSHA PEL:TWA 15mg/m^3;respirable: 5mg/m^3. ACGIH TLV:TWA Total dust:10mg/m^3; respirable dust: 5mg/m^3.
Phosphoric Acid	7664-38-2	0 - 1	No	OSHA PEL:TWA 1.0mg/m^3; STEL 3.0mg/m^3 as mist.
Quartz*	14808-60-7	<1	Yes	ACGIH TLV:TWA respirable quartz 0.05mg/m^3.

***Quartz.** Product may contain a trace of quartz, a polymorph of crystalline silica, which is classified by IARC as a "Known Human Carcinogen - Group 1.". NTP lists respirable crystalline silica amongst substances which may "reasonably be anticipated to be carcinogens".

SECTION 3. HAZARDS IDENTIFICATION

HMIS

HEALTH HAZARD	1 - SLIGHT
FLAMMABILITY HAZARD	0 - MINIMAL
REACTIVITY HAZARD	1 - SLIGHT
PERSONAL PROTECTION	B - Glasses, Gloves

EMERGENCY OVERVIEW:

Off-white to gray free flowing powder. Blends high in magnesium oxide. Will react with water generating some heat. Not a fire or spill hazard. Low toxicity. Dust is classified as a "nuisance particulate not otherwise regulated".

Target Organs: Chronic overexposure may cause lung damage.
Primary route(s) of entry: Inhalation
Acute effects: Excessive exposure to airborne particulate may cause eye and upper respiratory irritation.
Chronic effects: Product dust is classified as a "nuisance particulate, not otherwise regulated" as specified by ACGIH and OSHA. The excessive, long-term inhalation of mineral dusts may contribute to the development of industrial bronchitis, reduced breathing capacity, and may lead to the increased susceptibility to lung disease.

HAZARD IDENTIFICATION continued from page 1

Signs & symptoms of overexposure:

Eye contact: Particulate is a physical eye irritant.

Skin contact: Low toxicity by skin contact.

Inhalation: Chronic overexposure by inhalation of airborne particulate may irritate upper respiratory system as well as the throat.

Ingestion: An unlikely route of exposure. If ingested in sufficient quantity, may cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea.

SECTION 4. FIRST AID MEASURES

Eye contact: Flush eyes, including under the eyelids, with large amounts of water. If irritation persists, seek medical attention.

Skin contact: Wash affected areas with mild soap and water.

Inhalation: Remove victim to fresh air. If not breathing, give artificial respiration. Get immediate medical attention.

Ingestion: Ingestion is an unlikely route of exposure. If ingested in sufficient quantity and victim is conscious, give 1-2 glasses of water or milk. Never give anything by mouth to an unconscious person. Leave decision to induce vomiting to qualified medical personnel, since particles may be aspirated into the lungs. Seek immediate medical attention.

SECTION 5. FIRE FIGHTING MEASURES

NFPA code: Flammability: 0, **Health:** 0, **Reactivity:** 1, **Special:** 0.

Flash point: Not Combustible

Unusual Fire Hazard / Extinguishing Media: Product will react with water generating some heat. Use sufficient water to dissipate any excessive heat buildup.

Hazardous Decomposition Products: None

Firefighting Instructions: Firefighters should wear NIOSH-approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Spill procedures: Product is not harmful to the environment. Carefully, clean up and place spilled material into a suitable container, being careful to avoid creating excessive dust. If conditions warrant, clean up personnel should wear approved respiratory protection, gloves, and goggles to prevent irritation from contact and/or inhalation.

SECTION 7. HANDLING AND STORAGE

Storage: Store in dry, protected storage. Do not allow water to get inside containers; reaction with water will cause product to swell, generate heat, and burst its container. Exposed and unprotected the product will absorb moisture from the air. Minimize dust generation during material handling and transfer.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering controls: Provide sufficient ventilation, in both volume and air flow patterns to control mist/dust concentrations below allowable exposure limits.

Personal protective equipment: The use of eye protection, gloves and long sleeve clothing is recommended.

Respiration protection: Provide workers with NIOSH approved respirators in accordance with requirements of 29 CFR 1910.134 for level of exposure incurred.

Hygienic Practices: Avoid contact with skin eyes and clothing. After handling this product, wash hands before eating or drinking.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: A grayish-brown free flowing powder; odorless.
Boiling Point: Not Applicable **Specific Gravity (g/cc):** Mixture
Melting Point: >3800°F (>2100°C) **% Volatile by volume:** 0
Water Solubility: Slight <1% **Evaporation rate:** Not Applicable
pH (10% aqueous slurry): 2.5-10 (depending on blend ratio)
Bulk Density (lbs./cu.ft.): 45-70 (depending on blend ratio)

SECTION 10. STABILITY AND REACTIVITY

Hazardous Polymerization: Will not occur
Chemical Incompatibilities: The magnesium oxide component is soluble in aqueous acids generating heat and steam; violent reaction or ignition with interhalogens (e.g., bromine pentifluoride; chlorine trifluoride). Incandescent reaction with phosphorus pentachloride. Will react with water generating some heat.
Hazardous Decomposition Products: None

SECTION 11. TOXICOLOGICAL INFORMATION

Magnesium Oxide CAS #1309-48-4 Toxic and Hazard Review: low toxicity - a nutrient and/or dietary supplement food additive. THERAP CAT: antacid. (Sax) an experimental tumorigen. Inhalation of fume (not MgO dust particular) produced upon decomposition of magnesium compounds can produce a febrile reaction and leukocytosis in humans.

TOXICITY DATA: ihl-hmn TCLo:400mg/m^3; itr-ham TDLo:480 mg/kg/30w-I:ETA.

Triple Super Phosphate CAS#65996-95-4. Produced by addition of phosphoric acid to phosphate rock. Can contain up to 1% phosphoric acid. Phosphoric acid is cited as a human poison by unspecified route. Moderately toxic by ingestion and skin contact. A corrosive irritant to eyes, skin and mucous membranes and a systemic irritant by inhalation. (Please note, any free phosphoric acid in the triple super phosphate will react with the magnesium oxide component of the product forming a magnesium phosphate - the product will not contain any free acid.)

TOXICITY DATA: No LD_{50} or LC_{50} found for oral, dermal, or inhalation routes of administration.

Quartz CAS #14808-60-7. Toxic and Hazard Review (Sax): Experimental poison by inratracheal and intravenous routes. An experimental carcinogen, tumorigen, and neoplastigen. Human systemic effects by inhalation: cough, dyspnea, liver effects. Listed by IARC as a "Known Human Carcinogen" Group 1. Listed by NTP. No LD_{50} in RTECS. Inhalation human: TCLo 16 million particles per cubic centimeter per 8 hours per 17.9 Years-Intermittent:: Pulmonary system effects; Inhalation-human LCLo: 300 micrograms/m^3 per 10 years-intermittent liver. Other species toxicity data (NIOSH RTECS): intravenous-rat LDLo: 90mg/kg; intraperitoneal-rat LDLo: 20mg/kg; intravenous-mouse LDLo: 40mg/kg; intravenous-dog LDLo: 20mg/kg.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicological / Chemical Fate Information:
No data available on any adverse effects of this material on the environment.

SECTION 13. DISPOSAL INFORMATION

Waste Management/Disposal: This product, as manufactured will not exhibit any characteristics of a hazardous waste, and is suitable for landfill disposal. Please be advised, however, that state and local requirements for waste disposal may be more restrictive or otherwise different from federal regulations. Consult state and local regulations regarding the proper disposal of this material. If, however, the product has been altered or contaminated with other hazardous materials, appropriate waste analysis may be necessary to determine the proper method for disposal. Waste characterization and disposal/treatment methods should be determined by a qualified environmental professional in accordance with applicable federal, state and local regulations.

SECTION 14. TRANSPORT INFORMATION

US Department of Transportation: Not regulated by DOT as a hazardous material. No hazard class, no label or placard required, no UN or NA number assigned.
Canadian TDG Hazard Class & Pin: Not regulated.

SECTION 15. REGULATORY INFORMATION

Product or components of mixture regulated under following lists:
SARA TITLE III:

Section 302: NO (Extremely Hazardous Substances)
Section 304: NO (Emergency Release)
Section 311: YES (*Community Right-to-Know*, MSDSs or List of Chemicals)
Section 312: YES (*Community Right-to-Know*, Inventory and Location, (Tier I/II))
Section 313: NO (Toxic Chemicals, Toxic Chemical Release Reporting, Form R)

TSCA: All substances in this product are listed in the Chemical Substance Inventory of the Toxic Substances Control Act.
CERCLA Hazardous Substance List, RQ: No
California Proposition 65: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive toxins.

SECTION 16. OTHER INFORMATION

ACRONYMS AND REFERENCES USED IN PREPARATION OF MSDS':

ACGIH:	American Conference of Governmental Industrial Hygienists
CAS#:	CAS Registration Number is an assigned number to identify a material. CAS stands for Chemical Abstracts Service.
CERCLA:	Comprehensive Environmental Response, Compensation & Liability Act
EPCRA:	Emergency Planning and Community Right-to-Know Act of 1986
HMIS™:	Hazardous Materials Identification System (National Paint & Coatings Association)
IARC:	International Agency for Research on Cancer
MSHA:	Mine Safety and Health Administration

mg/m^3:	Milligrams per cubic meter
NIOSH:	National Institute for Occupational Safety and Health
NFPA:	National Fire Protection Association
NTP:	National Toxicology Program
OSHA:	Occupational Safety and Health Administration
PEL:	Permissible Exposure Limit (OSHA)
REL:	Recommended Exposure Limit (OSHA)
SARA:	Superfund Amendments and Reauthorization Act
TITLE III:	Emergency Planning and Community Right-to-Know Act
Section 302:	Extremely Hazardous Substances
Section 304:	Emergency Release
Section 311:	*Community Right-to-Know*, MSDSs or List of Chemicals
Section 312:	*Community Right-to-Know*, Inventory and Location, (Tier I/II)
Section 313:	Toxic Chemicals, Toxic Chemical Release Reporting, Form R
TLV:	Threshold Limit Values (ACGIH)
TWA:	Time Weighted Average
29CFR1910.134:	OSHA Respiratory Protection Standard

REFERENCES:

Sax, N. Irving: Dangerous Properties of Industrial Materials, Ninth Edition, Van Nostrand Reinhold Co., Inc., 1996.
Kirk, R. and Othmer, D., Encyclopedia of Chemical Technology, Third Edition, Wiley-Interscience, New York, NY 1982.
Clansky, K.B., Suspect Chemicals Sourcebook, 1992-2nd Edition, Roytech Publications, Bethesda, Maryland.
Sax, N. Irving and Lewis, R.J. Hawley's Condensed Chemical Dictionary, Eleventh Ed., Van Nostrand Reinhold Co., Inc., NY
Manufacturers / Suppliers, Material Safety Data Sheets on Raw Materials Used
American National Standard for Hazardous Industrial Chemicals - Material Safety Data Sheets - Preparation, American National Standards Institute, Inc., 11 West 42nd St, New York, NY 10036.

Prepared/revised: Mark A. Shand February 14, 2008

MATERIAL SAFETY DATA SHEET

PREMIER CHEMICALS

MSDS No.: EnviroPhos
Date Prepared: 3/04
This Revision:

Phone: PREMIER CHEMICALS: 1-419-986-5126
CHEMTREC, 24-Hr Emergency Assistance: 1-800-424-9300

SECTION 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Material/Product Names: ENVIRO-PHOS®
CAS Number: Mixture
Chemical family: Inorganic Oxide
Description/use: Enviro-Phos is a product composed primarily of a special grade of calcium phosphate and is manufactured for use in treatment of hazardous waste.
Manufacturer / Supplier: PREMIER CHEMICALS
Research Center
495 Emma Street
PO Box 392
Bettsville, OH 44815 Phone: 1-419-986-5126

SECTION 2. INGREDIENTS / COMPOSITION

Ingredient name:	CAS Number:	Percent:	IARC/NTP/OSHA:	Exposure Limits:
Nonhazardous Ingredients: calcium phosphates, primarily.....	65996-95-4	99-100	No	Nuisance Particulate Not Otherwise Regulated. OSHA PEL:TWA 15mg/m^3; respirable: 5mg/m^3. ACGIH TLV:TWA Total dust: 10mg/m^3; respirable dust: 5mg/m^3.
Phosphoric Acid	7664-38-2	0-1	No	OSHA PEL:TWA 1.0mg/m^3; STEL 3.0mg/m^3 as mist.
Quartz (SiO_2)	14808-60-7	0-1	Yes	OSHA PEL:TWA respirable quartz: 0.10mg/m^3.

[1]Quartz, a polymorph of crystalline silica, is classified by IARC as "Known Human Carcinogen - Group 1". NTP lists respirable crystalline silica amongst substances which may "reasonably be anticipated to be carcinogens".

SECTION 3. HAZARDS IDENTIFICATION

HMIS

HEALTH HAZARD	1 - SLIGHT
FLAMMABILITY HAZARD	0 - MINIMAL
REACTIVITY HAZARD	1 - SLIGHT
PERSONAL PROTECTION	B - Glasses, Gloves

EMERGENCY OVERVIEW:

A gray to off-white powder or crushed material available in various sizes. Product is of low toxicity. Dust is classified as a "nuisance particulate". Not a fire, spill, or environmental hazard.
Target Organs: Chronic overexposure to respirable dust may cause lung damage.
Primary route(s) of entry: Inhalation
Acute effects: Excessive exposure to airborne particulate may cause eye and upper respiratory irritation.

Chronic effects: Product dust is classified as a “nuisance particulate, not otherwise regulated” as specified by ACGIH and OSHA. The excessive, long-term inhalation of mineral dusts may contribute to the development of industrial bronchitis, reduced breathing capacity, and may lead to the increased susceptibility to lung disease.

HAZARD IDENTIFICATION continued from page 1

Signs & symptoms of overexposure:

Eye contact: Particulate is a physical eye irritant.

Skin contact: Low toxicity by skin contact.

Inhalation: Chronic overexposure by inhalation of airborne particulate may irritate upper respiratory system as well as the throat.

Ingestion: An unlikely route of exposure. If ingested in sufficient quantity, may cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea.

SECTION 4. FIRST AID MEASURES

Eye contact: Flush eyes, including under the eyelids, with large amounts of water. If irritation persists, seek medical attention.

Skin contact: Wash affected areas with mild soap and water.

Inhalation: Remove victim to fresh air. If not breathing, give artificial respiration. Get immediate medical attention.

Ingestion: Ingestion is an unlikely route of exposure. If ingested in sufficient quantity and victim is conscious, give 1-2 glasses of water or milk. Never give anything by mouth to an unconscious person. Leave decision to induce vomiting to qualified medical personnel, since particles may be aspirated into the lungs. Seek immediate medical attention.

SECTION 5. FIRE FIGHTING MEASURES

NFPA code: Flammability: 0, **Health:** 0, **Reactivity:** 1, **Special:** 0.

Flash point: Not Combustible

Unusual Fire Hazard / Extinguishing Media: Use extinguishing media appropriate to combustibles in immediate area of fire.

Hazardous Decomposition Products: None

Firefighting Instructions: Firefighters should wear NIOSH-approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Spill procedures: Product is not harmful to the environment. Carefully, clean up and place spilled material into a suitable container, being careful to avoid creating excessive dust. If conditions warrant, clean up personnel should
wear approved respiratory protection, gloves, and goggles to prevent irritation from contact and/or inhalation.

SECTION 7. HANDLING AND STORAGE

Storage: Store in dry, protected storage. Do not allow water to get inside containers; reaction with water will cause product to swell, generate heat, and burst its container. Minimize dust generation during material handling and transfer.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering controls: Provide sufficient ventilation, in both volume and air flow patterns to control mist/dust concentrations below allowable exposure limits.

Personal protective equipment: The use of eye protection, gloves and long sleeve clothing is recommended.

Respiration protection: Provide workers with NIOSH approved respirators in accordance with requirements of 29 CFR 1910.134 for level of exposure incurred.

Hygienic Practices: Avoid contact with skin, eyes and clothing. After handling this product, wash hands before eating or drinking.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: The product is a gray to off-white. Available in powder or crushed and sized granules. Product is odorless.
Boiling Point: Not Applicable
Specific Gravity (g/cc): Mixture
Melting Point: >976°C (>1788°F)
% Volatile by volume: 0
Water Solubility: Slight <1%
Evaporation rate: Not Applicable
pH (10% aqueous slurry): 2.3 - 2.6

SECTION 10. STABILITY AND REACTIVITY

Hazardous Polymerization: Will not occur
Chemical Incompatibilities: None
Hazardous Decomposition Products: None

SECTION 11. TOXICOLOGICAL INFORMATION

Calcium Phosphate *CAS#65996-95-4*. Produced by addition of phosphoric acid to phosphate rock. Can contain up to 1% phosphoric acid. Phosphoric acid is cited as a human poison by unspecified route. Moderately toxic by ingestion and skin contact. A corrosive irritant to eyes, skin, mucous membranes and a systemic irritant by inhalation.
Toxicity Data: No LD_{50} or LC_{50} found for oral, dermal, or inhalation routes of administration.

Quartz CAS #14808-60-7. Toxic and Hazard Review (Sax): Experimental poison by inratracheal and intravenous routes. An experimental carcinogen, tumorigen, and neoplastigen. Human systemic effects by inhalation: cough, dyspnea, liver effects. Listed by IARC as a "Known Human Carcinogen" Group 1. Listed by NTP.
TOXICITY DATA: No LD_{50} in RTECS. ihl-hmn: TCLo 16 mppcf / 8 hrs / 17.9Y-I: PUL; ihh:hmn LCLo: 300 $\mu g / m^3$ / 10 Y-I;LVR; Other species toxicity data (NIOSH RTECS): inv-rat LDLo: 90mg/kg; itr-rat LDLo: 20mg/kg; ivn-mus LDLo: 40mg/kg; inv-mus: 20mg/kg.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicological / Chemical Fate Information:
No data available on any adverse effects of this material on the environment.

SECTION 13. DISPOSAL INFORMATION

Waste Management/Disposal: This product, as manufactured will not exhibit any characteristics of a hazardous waste, and is suitable for landfill disposal. Pleased by advised, however, that state and local requirements for waste
disposal may be more restrictive or otherwise different from federal regulations. Consult state and local regulations

regarding the proper disposal of this material. If, however, the product has been altered or contaminated with other

hazardous materials, appropriate waste analysis may be necessary to determine proper method for disposal. Waste characterization and disposal/treatment methods should be determined by a qualified environmental professional in accordance with applicable federal, state and local regulations.

SECTION 14. TRANSPORT INFORMATION

US Department of Transportation: Not regulated by DOT as a hazardous material. No hazard class, no label or placard required, no UN or NA number assigned.
Canadian TDG Hazard Class & Pin: Not regulated.

SECTION 15. REGULATORY INFORMATION

SARA TITLE III:
Section 302: NO (Extremely Hazardous Substances)
Section 304: NO (Emergency Release)
Section 311: YES (*Community Right-to-Know*, MSDSs or List of Chemicals)
Section 312: YES (*Community Right-to-Know*, Inventory and Location, (Tier I/II))
Section 313: NO (Toxic Chemicals, Toxic Chemical Release Reporting, Form R)
TSCA: All substances in this product are listed in the Chemical Substance Inventory of the Toxic Substances Control Act.
CERCLA Hazardous Substance List, RQ: No
California Proposition 65: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive toxins.

SECTION 16. OTHER INFORMATION

ACRONYMS AND REFERENCES USED IN PREPARATION OF MSDS':

ACGIH:	American Conference of Governmental Industrial Hygienists
CAS#:	CAS Registration Number is an assigned number to identify a material. CAS stands for Chemical Abstracts Service.
CERCLA:	Comprehensive Environmental Response, Compensation & Liability Act
EPCRA:	Emergency Planning and Community Right-to-Know Act of 1986
HMIS™:	Hazardous Materials Identification System (National Paint & Coatings Association)
IARC:	International Agency for Research on Cancer
MSHA:	Mine Safety and Health Administration
mg/m^3:	Milligrams per cubic meter
NIOSH:	National Institute for Occupational Safety and Health
NFPA:	National Fire Protection Association
NTP:	National Toxicology Program
OSHA:	Occupational Safety and Health Administration
PEL:	Permissible Exposure Limit (OSHA)
REL:	Recommended Exposure Limit (OSHA)
SARA:	Superfund Amendments and Reauthorization Act
TITLE III:	Emergency Planning and Community Right-to-Know Act
Section 302:	Extremely Hazardous Substances
Section 304:	Emergency Release
Section 311:	*Community Right-to-Know*, MSDSs or List of Chemicals
Section 312:	*Community Right-to-Know*, Inventory and Location, (Tier I/II)
Section 313:	Toxic Chemicals, Toxic Chemical Release Reporting, Form R
TLV:	Threshold Limit Values (ACGIH)
TWA:	Time Weighted Average
29CFR1910.134:	OSHA Respiratory Protection Standard

MATERIAL SAFETY DATA SHEET

PREMIER CHEMICALS

MSDS No.: EnviroPhos
Date Prepared: 3/04
This Revision:

Phone: PREMIER CHEMICALS: 1-419-986-5126
CHEMTRAC, 24-Hr Emergency Assistance: 1-800-424-9300

REFERENCES:

Sax, N. Irving: Dangerous Properties of Industrial Materials, Ninth Edition, Van Nostrand Reinhold Co., Inc., 1996.

Kirk, R. and Othmer, D., Encyclopedia of Chemical Technology, Third Edition, Wiley-Interscience, New York, NY 1982.

Clansky, K.B., Suspect Chemicals Sourcebook, 1992-2nd Edition, Roytech Publications, Bethesda, Maryland.

Sax, N. Irving and Lewis, R.J. Hawley's Condensed Chemical Dictionary, Eleventh Ed., Van Nostrand Reinhold Co., Inc., NY

Manufacturers / Suppliers, Material Safety Data Sheets on Raw Materials Used

American National Standard for Hazardous Industrial Chemicals - Material Safety Data Sheets - Preparation, American National Standards Institute, Inc., 11 West 42nd St, New York, NY 10036.

Prepared/revised: J.E. ROWELL March 11, 2004

End of MSDS

MATERIAL SAFETY DATA SHEET

PREMIER CHEMICALS

MSDS No.: EM Coarse
Date Prepared: 11/09
This Revision:

Phone: PREMIER CHEMICALS: 1-800-227-4287
CHEMTREC, 24-Hr Emergency Assistance: 1-800-424-9300

SECTION 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Material / Product Name(s): **EnviroMag Coarse**
CAS Number: 1309-48-4
Chemical Family: Inorganic Oxide
General Use: A granular magnesium oxide used in heavy metals remediation.
Manufacturer / Supplier: PREMIER CHEMICALS
300 Barr Harbor
Suite 250
West Conshohocken, PA 19428-2998

SECTION 2. INGREDIENTS / COMPOSITION

Ingredient name:	CAS Number:	Percent:	IARC/NTP/OSHA:	Exposure Limits:
Magnesium Oxide	1309-48-4	100	No	Nuisance Particulate OSHA PEL:TWA 15mg/m^3;respirable: 5mg/m^3. ACGIH TLV:TWA Total dust:10mg/m^3; respirable dust: 5mg/m^3.

SECTION 3. HAZARDS IDENTIFICATION

HMIS

HEALTH HAZARD	1 - SLIGHT
FLAMMABILITY HAZARD	0 - MINIMAL
REACTIVITY HAZARD	1 - SLIGHT
PERSONAL PROTECTION	B - Glasses, Gloves

EMERGENCY OVERVIEW:

A tan granular material. Will react with water generating heat. Not a fire or spill hazard. Low toxicity. Dust is classified as a “nuisance particulate not otherwise regulated”.

Target Organs: Chronic overexposure may cause lung damage.
Primary route(s) of entry: Inhalation
Acute effects: Excessive exposure to airborne particulate may cause eye and upper respiratory irritation.
Chronic effects: Product dust is classified as a “nuisance particulate, not otherwise regulated” as specified by ACGIH and OSHA. The excessive, long-term inhalation of mineral dusts may contribute to the development of industrial bronchitis, reduced breathing capacity, and may lead to the increased susceptibility to lung disease.

HAZARD IDENTIFICATION continued from page 1

Signs & symptoms of overexposure:

Eye contact: Particulate is a physical eye irritant.

Skin contact: Prolonged contact may cause slight skin irritation.

Inhalation: Chronic overexposure by inhalation of airborne particulate may irritate upper respiratory system as well as the throat.

Ingestion: An unlikely route of exposure. If ingested in sufficient quantity, may cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea.

SECTION 4. FIRST AID MEASURES

Eye contact: Flush eyes, including under the eyelids, with large amounts of water. If irritation persists, seek medical attention.

Skin contact: Wash affected areas with mild soap and water.

Inhalation: Remove victim to fresh air. If not breathing, give artificial respiration. Get immediate medical attention.

Ingestion: Ingestion is an unlikely route of exposure. If ingested in sufficient quantity and victim is conscious, give 1-2 glasses of water or milk. Never give anything by mouth to an unconscious person. Leave decision to induce vomiting to qualified medical personnel, since particles may be aspirated into the lungs. Seek immediate medical attention.

SECTION 5. FIRE FIGHTING MEASURES

NFPA code: Flammability: 0, **Health:** 0, **Reactivity:** 1, **Special:** 0.

Flash point: Not Combustible

Unusual Fire Hazard / Extinguishing Media: Product will react with water generating heat. If contact with water is unavoidable, use sufficient water to dissipate any excessive heat buildup.

Hazardous Decomposition Products: None

Firefighting Instructions: Firefighters should wear NIOSH-approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Spill procedures: Carefully, clean up and place material into a suitable container, being careful to avoid creating excessive dust from dried product. If conditions warrant, clean up personnel should wear approved respiratory protection, gloves, and goggles to prevent irritation from contact and/or inhalation.

SECTION 7. HANDLING AND STORAGE

Storage: Store in dry, protected storage. Do not allow water to get inside containers; reaction with water will cause product to swell, generate heat, and burst its container. Exposed, unprotected magnesium oxide will absorb moisture and carbon dioxide from the air. Minimize dust generation during material handling and transfer.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering controls: Provide sufficient ventilation, in both volume and air flow patterns to control mist/dust concentrations below allowable exposure limits.

Personal protective equipment: The use of eye protection, gloves and long sleeve clothing is recommended.

Respiration protection: **For dust concentrations above allowable nuisance particulates limit p**rovide employee with NIOSH/MSHA approved particulate dust respirator in accordance with requirements of 29 CFR 1910.134.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Tan granular; odorless.
Boiling Point: Not Applicable
Melting Point: >3800°F (>2100°C)
Water Solubility: Slight <1%
pH (10% aqueous slurry): 10-11
Specific Gravity (g/cc): 3.56
Bulk Density (lbs./cu.ft.): 70-80
% Volatile by volume: 0
Evaporation rate: Not Applicable

SECTION 10. STABILITY AND REACTIVITY

Hazardous Polymerization: Will not occur
Chemical Incompatibilities: Magnesium oxide is soluble in aqueous acids generating heat and steam; violent reaction or ignition with interhalogens (e.g., bromine pentifluoride; chlorine trifluoride). Incandescent reaction with phosphorus pentachloride. Will react with water generating some heat.
Hazardous Decomposition Products: None

SECTION 11. TOXICOLOGICAL INFORMATION

Magnesium Oxide CAS #1309-48-4 Toxic and Hazard Review: low toxicity - a nutrient and/or dietary supplement food additive. THERAP CAT: antacid. (Sax) an experimental tumorigen. Inhalation of fume (not MgO dust particular) produced upon decomposition of magnesium compounds can produce a febrile reaction and leukocytosis in humans.

TOXICITY DATA: ihl-hmn TCLo:400mg/m^3; itr-ham TDLo:480 mg/kg/30w-I:ETA.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicological / Chemical Fate Information:
No data available on any adverse effects of this material on the environment.

SECTION 13. DISPOSAL INFORMATION

Waste Management/Disposal: This product does not exhibit any characteristics of a hazardous waste. The product is suitable for landfill disposal. Follow all applicable federal, state and local regulations for safe disposal.

SECTION 14. TRANSPORT INFORMATION

US Department of Transportation: Not regulated by DOT as a hazardous material. No hazard class, no label or placard required, no UN or NA number assigned.
Canadian TDG Hazard Class & Pin: Not regulated.

SECTION 15. REGULATORY INFORMATION

SARA TITLE III: This product does not contain any substances reportable under Sections 302, 304 or 313. Sections 311 and 312 do apply. (Routine Reporting and Chemical Inventories)
TSCA: All substances in this product are listed in the Chemical Substance Inventory of the Toxic Substances Control Act.

SECTION 16. OTHER INFORMATION

ACRONYMS AND REFERENCES USED IN PREPARATION OF MSDS':

ACGIH:	American Conference of Governmental Industrial Hygienists
CAS#:	CAS Registration Number is an assigned number to identify a material. CAS stands for Chemical Abstracts Service.
CERCLA:	Comprehensive Environmental Response, Compensation & Liability Act
EPCRA:	Emergency Planning and Community Right-to-Know Act of 1986
HMIS™:	Hazardous Materials Identification System (National Paint & Coatings Association)
IARC:	International Agency for Research on Cancer
MSHA:	Mine Safety and Health Administration
mg/m^3:	Milligrams per cubic meter
NIOSH:	National Institute for Occupational Safety and Health
NFPA:	National Fire Protection Association
NTP:	National Toxicology Program
OSHA:	Occupational Safety and Health Administration
PEL:	Permissible Exposure Limit (OSHA)
REL:	Recommended Exposure Limit (OSHA)
SARA:	Superfund Amendments and Reauthorization Act
TITLE III:	Emergency Planning and Community Right-to-Know Act
Section 302:	Extremely Hazardous Substances
Section 304:	Emergency Release
Section 311:	*Community Right-to-Know*, MSDSs or List of Chemicals
Section 312:	*Community Right-to-Know*, Inventory and Location, (Tier I/II)
Section 313:	Toxic Chemicals, Toxic Chemical Release Reporting, Form R
TLV:	Threshold Limit Values (ACGIH)
TWA:	Time Weighted Average
29CFR1910.134:	OSHA Respiratory Protection Standard

REFERENCES:

Sax, N. Irving: Dangerous Properties of Industrial Materials, Ninth Edition, Van Nostrand Reinhold Co., Inc., 1996.
Kirk, R. and Othmer, D., Encyclopedia of Chemical Technology, Third Edition, Wiley-Interscience, New York, NY 1982.
Clansky, K.B., Suspect Chemicals Sourcebook, 1992-2nd Edition, Roytech Publications, Bethesda, Maryland.
Sax, N. Irving and Lewis, R.J. Hawley's Condensed Chemical Dictionary, Eleventh Ed., Van Nostrand Reinhold Co., Inc., NY
Manufacturers / Suppliers, Material Safety Data Sheets on Raw Materials Used
American National Standard for Hazardous Industrial Chemicals - Material Safety Data Sheets - Preparation, American National Standards Institute, Inc., 11 West 42nd St, New York, NY 10036.

Prepared/revised: Mark A. Shand November 12, 2009

M A T E R I A L S A F E T Y D A T A S H E E T

PITCH ROOF COATING Page: 1

PRODUCT NAME: PITCH ROOF COATING
PRODUCT CODE: #168 AF

========== SECTION I - MANUFACTURER IDENTIFICATION ==========

MANUFACTURER'S NAME: KARNAK CORPORATION
ADDRESS : 330 CENTRAL AVE.
CLARK, N.J. 07066

EMERGENCY PHONE : (800)424-9300 DATE PRINTED : 08/20/97
INFORMATION PHONE : (732)388-0300 NAME OF PREPARER : N/A

========== SECTION II - COMPOSITION/ WORKPLACE EXPOSURE LIMITS ==========

	Component	CAS Reg. Number	Appr. Pct.	OSHA-PEL TWA	OSHA-PEL Ceiling	AC
1.	Coal tar pitch, high temp.	65996-93-2	50	0.2 mg/m3*	NE	
	Including:					
	Acenaphthene	83-32-9		NE	NE	NE
	Acenaphthylene	208-96-8		NE	NE	NE
	Anthracene	120-12-7		NE	NE	
	Benzo[a]anthracene	56-55-3		NE	NE	
	Benzo[a]pyrene	50-32-8		0.2 mg/m3*	NE	
	Benzo[b]fluoranthene	205-99-2		NE	NE	A2
	Benzo[ghi]perylene	191-24-2		NE	NE	
	Benzo[k]fluoranthene	207-08-9		NE	NE	NE
	Carbazole	86-74-8		NE	NE	
	Chrysene	218-01-9		0.2 mg/m3*		NE
	Dibenz[a,h]anthracene	53-70-3		NE	NE	NE
	Dibenzofuran	132-64-9		NE	NE	NE
	Fluoranthene	206-44-0		NE	NE	NE
	Fluorene	86-73-7		NE	NE	
	Indene	95-13-6		NE	NE	10 p
	lndeno[1,2,3-cd]pyrene	193-39-5		NE	NE	
	1-Methylnaphthalene	90-12-0		NE	NE	
	2-Methylnaphthalene	91-57-6		NE	NE	
	Naphthalene	91-20-3		10 ppm		NE
	Phenanthrene	85-01-8		0.2 mg/m3*	NE	
	Pyrene	129-00-0		0.2 mg/m3*	NE	
2.	Heavy petroleum dist.	64742-04-7	17	5 mg/m3	NE	5 mg
3.	Petroleum dist., C9-C30	64741-59-9	25	5 mg/m3	NE	
4.	Allapulgite clay	8031-18-3	3	5 mg/m3**	NE	
5.	Cellulose	9004-34-6	3	5 mg/m3**	NE	
6.	Limestone	1317-65-3	2	5 mg/m3**	NE	

NOTES ON EXPOSURE LIMITS: NE = NOT ESTABLISHED.
TD = TOTAL DUST RF = RESPIRABLE FRACTION
*FOR COAL-TAR PITCH VOLATILES, BENZENE-SOLUBLE FRACTION
**RF. PEL-TWA FOR TD = 15 PPM.

========== SECTION III - HEALTH HAZARDS ==========

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM (HMIS) CLASSIFICATION:

HEALTH: 2* FLAMMABILITY: 2 REACTIVITY: 0 PERSONAL PROTECTION: DEPENDS

INHALATION:
HIGH VAPOR CONCENTRATIONS ARE IRRITATING TO THE NOSE AND THROAT. OVEREXPOSURE CAN CA

EYE EXPOSURE:

VAPOR CAN IRRITATE EYES. LIQUID CONTACT CAN CAUSE REDNESS, TEARING, AND IRRITATION. SOLIDS MAY SCRATCH EYEBALL. REPEATED OR PROLONGED EXPOSURE MAY CAUSE EYE DAMAGE. HOT MATERIAL CAN BURN EYE TISSUE, POSSIBLY RESULTING IN LOSS OF EYESIGHT.

SKIN EXPOSURE:
LIQUID AND VAPORS CAN CAUSE SKIN IRRITATION AND DERMATITIS, INCLUDING ACNE. COAL TAR IS A PHOTOTOXIC SUBSTANCE THAT, IN THE PRESENCE OF ULTRAVIOLET LIGHT (SUNLIGHT), CAN SKIN REACTION SIMILAR TO AN EXAGGERATED SUNBURN, FREQUENTLY CAUSING BLISTERS. EXISTI DISORDERS (E.G., ECZEMA OR SKIN ALLERGY) MAY BE AGGRAVATED BY EXPOSURE TO THIS MATER MATERIAL CAN CAUSE SEVERE HEAT BURNS.

INGESTION:
SWALLOWING CAN CAUSE SEVERE GASTROINTESTINAL IRRITATION, NAUSEA, VOMITING, AND DEPRE OF THE CENTRAL NERVOUS SYSTEM. SOLVENT CAN ENTER THE LUNGS DURING SWALLOWING OR VOMI CAUSING LUNG INFLAMMATION AND DAMAGE.

DELAYED EFFECTS:
LONG-TERM OVEREXPOSURE TO COAL TAR PITCH CAN AFFECT SKIN PIGMENTATION. IT CAN CAUSE ON THE SKIN OR SKIN CANCER. IT MAY CAUSE CANCER OF THE LUNGS, KIDNEYS, OR BLADDER.

CARCINOGENICITY DETERMINATIONS:
COAL TAR PITCH HAS BEEN DETERMINED BY IARC TO BE A HUMAN CARCINOGEN. COAL TAR PITCH SEVERAL OF ITS SPECIFIC INGREDIENTS, INCLUDING BENZO[A]PYRENE, HAVE BEEN DETERMINED TO CAUSE CANCER IN EXPERIMENTAL ANIMALS.

========== SECTION V - FIRST AID MEASURES ==========

INHALATION:
REMOVE SUBJECT TO FRESH AIR IMMEDIATELY. GIVE ARTIFICIAL RESPIRATION IF BREATHING HA STOPPED. ADMINISTER OXYGEN IF BREATHING IS DIFFICULT. CONSULT A PHYSICIAN IF SYMPTOM

EYE CONTACT:
FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. CONSULT A PHYSICIAN AT ONCE MATERIAL HAS CONTACTED EYE. OTHERWISE, SEEK MEDICAL ATTENTION IF IRRITATION PERSISTS

SKIN CONTACT:
IF CONTACTED BY UNHEATED MATERIAL OR LIGHT SPRAY, REMOVE CONTAMINATED CLOTHING, INCL THEN REMOVE MATERIAL FROM SKIN WITH VEGETABLE OIL AND WASH THOROUGHLY WITH SOAP AND HYDROCORTISONE CREAM MAY BE USED FOR RELIEF OF SKIN IRRITATION. CONSULT A PHYSICIAN IRRITATION PERSISTS.

IF CONTACTED BY HOT LIQUID, DO NOT REMOVE CLOTHING IN AFFECTED AREAS. INSTEAD, IMMER AFFECTED AREAS IMMEDIATELY IN ICE-COLD WATER UNTIL ALL HEAT HAS DISSIPATED. THEN WRA IN GAUZE AND GET MEDICAL ATTENTION PROMPTLY.

INGESTION:
DO NOT GIVE ANYTHING BY MOUTH. DO NOT INDUCE VOMITING; PULMONARY COMPLICATIONS CAN R

CONSULT A PHYSICIAN OR POISON CONTROL CENTER AT ONCE.

SECTION 5 - FIRE HAZARDS AND THEIR MANAGEMENT
IGNITION DATA:
FLASH POINT: 180 DEGR. F, 82 DEGR. C
LOWER FLAMMABLE LIMIT: NOT DETERMINED
UPPER FLAMMABLE LIMIT: NOT DETERMINED
AUTOIGNITION TEMPERATURE: ABOVE 210 C / 410 F
COMBUSTION PRODUCTS: CAN INCLUDE OXIDES OF NITROGEN, CARBON, AND POSSIBLY SULFUR.

FIRE FIGHTING GUIDELINES:
EXTINGUISHING MEDIA: USE CLASS B EXTINGUISHANT, E.G., DRY CHEMICAL, FOAM, CARBON DIO OR WATER FOG. IN CLOSED TANKS, WATER OR FOAM MAY CAUSE FROTHING OR ERUPTION.

WEAR RESPIRATOR (PRESSURE DEMAND, SELF-CONTAINED BREATHING APPARATUS, MSHA/NIOSH-APP AND FULL PROTECTIVE GEAR FOR WORKING FIRES. COOL EXPOSED CONTAINERS WITH WATER SPRAY

M A T E R I A L S A F E T Y D A T A S H E E T

========== SECTION VI - ACCIDENTAL RELEASE MEASURES ==========

PERSONAL PROTECTION:
FOLLOW ALL PRECAUTIONS GIVEN IN SECTION 8, AND, IN ADDITION, WEAR PERMEATION-RESISTA ELASTOMERIC BOOTS OR OVERSHOES.

CLEAN-UP:
ELIMINATE ALL SOURCES OF IGNITION AND, IF INDOORS, VENTILATE SPILL AREA. STOP SOURCE SPILL OR LEAK IF POSSIBLE. CONTAIN SPILLAGE BY DIKING WITH SAND, EARTH, PIGS, OR OTH INERT MATERIAL IN ORDER TO PREVENT SPILLAGE FROM ENTERING SEWERS OR OPEN BODIES OF W AND/OR TO PREVENT SOIL CONTAMINATION.

IN COMPLIANCE WITH 40 CFR PART 302, REPORT THE RELEASE IMMEDIATELY TO THE NATIONAL RESPONSE CENTER IF AMOUNT RELEASED EXCEEDS 148 POUNDS, AN AMOUNT BASED UPON THE CONC OF BENZO[B]FLUORANTHENE (RQ - 1 LB.) PRESENT IN THIS MATERIAL AND LISTED IN TABLE 30

ALLOW HOT MATERIAL TO COOL, THEN TRANSFER SPILLAGE TO LABELED RECOVERY CONTAINERS.

========== SECTION VII - HANDLING AND STORAGE ==========

ELIMINATE IGNITION SOURCES. STORE IN TIGHTLY CLOSED, LABELED CONTAINERS PROTECTED FR DAMAGE AND SEPARATED FROM OXIDIZERS. STORAGE LOCATIONS MUST MEET, AS A MINIMUM, ALL REQUIREMENTS OF ANSI/NFPA 30 - FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE (1993) AS IT A CLASS LILA LIQUIDS.

========== SECTION VIII - PROTECTION FROM OVER EXPOSURE ==========

VENTILATION AND CONTAINMENT:
KEEP CONTAINERS CLOSED WHEN NOT IN USE. IF INDOORS, USE EITHER LOCAL OR GENERAL EXHA VENTILATION SUFFICIENT TO KEEP VAPOR AND FUME LEVELS BELOW APPLICABLE EXPOSURE LIMIT OUTDOORS, STAY UPWIND WHENEVER PRACTICAL TO DO SO.

RESPIRATORY PROTECTION:
IF VENTILATION/CONTAINMENT MEASURES DO NOT RELIABLY PROTECT AGAINST INHALATION OVERE WEAR MSHA/NIOSH-APPROVED RESPIRATOR SUITABLE FOR PROTECTION FROM THE VAPOR CONCENTRA ENCOUNTERED.

EYE PROTECTION:
WEAR SPLASH GOGGLES (ANSI Z87.1A-1991) WHEN POURING OR TRANSFERRING THIS MATERIAL. D
WEAR CONTACT LENSES.

SKIN PROTECTION:
AVOID SKIN CONTACT BY WEARING PERMEATION-RESISTANT, ELASTOMERIC GLOVES AND CLOTHES W
LONG SLEEVES AND PANTS. REPLACE ELASTOMERIC PROTECTIVE EQUIPMENT WHENEVER IT BECOMES
GUMMY, TORN, OR SHOWS EVIDENCE OF BARRIER LOSS. APPLY A SOLVENT-RESISTANT SKIN BARRI
TO AREAS OF SKIN THAT MAY COME INTO CONTACT WITH MATERIAL. IF WORKING OUT-OF-DOORS,
APPLY SUNSCREEN LOTION WITH A HIGH SUN BLOCK PROTECTION FACTOR TO SKIN EXPOSED TO SU
THEN APPLY BARRIER CREAM.

OTHER PROTECTIVE MEASURES:
AN EYEWASH STATION AND EMERGENCY SHOWER (ANSI Z358.1-1990) SHOULD BE READILY AVAILAB

PERSONAL HYGIENE:
REMOVE PRODUCT FROM SKIN WITH VEGETABLE OIL WHENEVER OBSERVED; REAPPLY BARRIER CREAM
APPROPRIATE. WASH HANDS AND FOREARMS WITH SOAP AND WATER AFTER HANDLING, AND ESPECIA
BEFORE EATING OR SMOKING. SHOWER AT THE END OF EACH WORK SHIFT. LAUNDER CONTAMINATED
SEPARATE FROM OTHER LAUNDRY BEFORE REUSE.

========== SECTION IX - PHYSICAL AND CHEMICAL DATA ==========

APPEARANCE:	BLACK, SEMI-SOLID PASTE
SPECIFIC GRAVITY:	1.0-1.2
ODOR:	PETROLEUM HYDROCARBON
PCT. VOLATILES:	25 (APPROX.)
WATER SOLUBILITY:	NEGLIGIBLE I
NTITIAL BOILING PT.:	150 C / 302 F
VAPOR DENSITY:	ABOVE 1.0
VAPOR PRESSURE:	2 MM HG @ 20 C (EST.)

========== SECTION X - STABILITY AND REACTIVITY ==========

STABILITY:
THIS MATERIAL IS STABLE UNDER NORMAL CONDITIONS OF STORAGE AND HANDLING. THAT IS, IT
DOES NOT REACT WITH COMMON SUBSTANCES (AIR, WATER, ETC.), NOR POLYMERIZE, NOR DECOMP
DURING FORESEEABLE CONDITIONS OF STORAGE OR USE.

REACTIVITY:
MATERIAL REACTS VIOLENTLY WITH STRONG OXIDIZERS SUCH AS LIQUID CHLORINE, SODIUM OR P
HYPOCHLORITE, NITRIC ACID AND PEROXIDES.

========== SECTION XIII - DISPOSAL ==========

CONTAINERS:
EMPTY CONTAINERS MAY CONTAIN RESIDUES THAT COULD BURN OR CAUSE CONTAINER TO RUPTURE
IF HEATED OR IGNITED. OBSERVE ALL MSDS AND LABEL PRECAUTIONS UNTIL CONTAINERS ARE RE
DO NOT WELD ON OR APPLY HEAT OR FLAME TO CONTAINER. PREVENT UNAUTHORIZED REUSE OF CO
FOLLOW ALL APPLICABLE FEDERAL, STATE, AND LOCAL REGULATIONS IN DISPOSING OF CONTAIN

WASTE DISPOSAL:
INCINERATE AT A PERMITTED FACILITY IN ACCORDANCE WITH LOCAL AND STATE REGULATIONS. I
POINT OF WASTE LIQUID IS BELOW 140 F, STORE AND SHIP WASTE AS UNLISTED HAZARDOUS WAS
CHARACTERISTIC OF LGNITABILITY, RCRA #D-001, RQ: 100 LBS. (PER 40 CFR PARTS 261 AND
IF WASTE IS A SOLVENT-FREE DRY SOLID, IT IS NOT CLASSIFIED AS HAZARDOUS WASTE.

========== SECTION XIV - TRANSPORTATION REGULATIONS ==========

THE FOLLOWING INFORMATION APPLIES TO GROUND SHIPMENTS WITHIN NORTH AMERICA, BUT MAY
OTHERWISE.

PACKAGED SHIPMENTS - BILL OF LADING DESCRIPTIONS
UP TO 5 GAL:
NOT DOT-REGULATED

DRUMS:
RQ, COMBUSTIBLE LIQUID, NOS, NA1993, PG III
(PETROLEUM DISTILLATES, TAR PITCH/HAZ SUB: BENZO[A]PYRENE, BENZO[B]FLUORANTHENE)
BULK SHIPMENTS - BILL OF LADING DESCRIPTIONS
LOADING TEMPERATURE RANGE: BELOW 180 DEGR. F:
RQ COMBUSTIBLE LIQUID, NOS, NA1993, PG III
(PETROLEUM DISTILLATES, TAR PITCH/HAZ SUB: BENZO[A]PYRENE, BENZO[B]FLUORANTHENE)

LOADING TEMPERATURE RANGE: 180-211 DEGR. F:
RQ TARS, LIQUID, 3 (FLAMMABLE LIQUID), UN1999, PG III
(TAR PITCH/CONTAINS BENZO[B]FLUORANTHENE, BENZO[A]PYRENE)
LOADING TEMPERATURE RANGE: ABOVE 211 DEGR. F:
RQ, HOT, FLAMMABLE LIQUID, ELEVATED TEMPERATURE MATERIAL, NOS, 3, UN3256, PG III
(PETROLEUM DISTILLATES, TAR PITCH/HAZ SUB: BENZO[A]PYRENE, BENZO[B]FLUORANTHENE)

SECTION 15 - OTHER REGULATORY INFORMATION
ALL INGREDIENTS OF THIS PRODUCT ARE LISTED ON THE TSCA INVENTORY IN ACCORDANCE WITH

THE FOLLOWING INGREDIENTS ARE REPORTABLE UNDER SARA SECTION 313 (40 CFR PART 372, SU

NAME	CAS NUMBER	CONCENTRATION, WT. PCT
POLYCYCLIC AROMATIC COMPOUND CATEGORY	NONE	1.7

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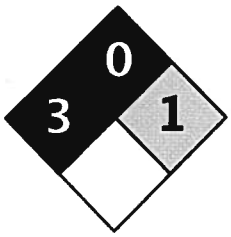

Health	3
Fire	0
Reactivity	1
Personal Protection	

Material Safety Data Sheet
Hydrochloric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrochloric acid

Catalog Codes: SLH1462, SLH3154

CAS#: Mixture.

RTECS: MW4025000

TSCA: TSCA 8(b) inventory: Hydrochloric acid

CI#: Not applicable.

Synonym: Hydrochloric Acid; Muriatic Acid

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Hydrogen chloride	7647-01-0	20-38
Water	7732-18-5	62-80

Toxicological Data on Ingredients: Hydrogen chloride: GAS (LC50): Acute: 4701 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer).
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid].
MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of metals

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Non combustible.
Calcium carbide reacts with hydrogen chloride gas with incandescence.
Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine.
Rubidium acetylene carbides burns with slightly warm hydrochloric acid.
Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved.
Magnesium boride treated with concentrated hydrochloric acid produces spontaneously flammble gas.
Cesium acetylene carbide burns hydrogen chloride gas.
Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute.
Reacts with most metals to produce flammable Hydrodgen gas.

Special Remarks on Explosion Hazards:
Hydrogen chloride in contact with the following can cause an explosion, ignition on contact, or other violent/vigorous reaction: Acetic anhydride AgClO + CCl4 Alcohols + hydrogen cyanide, Aluminum Aluminum-titanium alloys (with HCl vapor), 2-Amino ethanol, Ammonium hydroxide, Calcium carbide Ca3P2 Chlorine + dinitroanilines (evolves gas), Chlorosulfonic acid Cesium carbide Cesium acetylene carbide, 1,1-Difluoroethylene Ethylene diamine Ethylene imine, Fluorine, HClO4 Hexalithium disilicide H2SO4 Metal acetylides or carbides, Magnesium boride, Mercuric sulfate, Oleum, Potassium permanganate, beta-Propiolactone Propylene oxide Rubidium carbide, Rubidium, acetylene carbide Sodium (with aqueous HCl), Sodium hydroxide Sodium tetraselenium, Sulfonic acid, Tetraselenium tetranitride, U3P4 , Vinyl acetate.
Silver perchlorate with carbon tetrachloride in the presence of hydrochloric acid produces trichloromethyl perchlorate which detonates at 40 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Poisonous liquid.
Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture.
May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
CEIL: 5 (ppm) from OSHA (PEL) [United States]
CEIL: 7 (mg/m3) from OSHA (PEL) [United States]
CEIL: 5 from NIOSH
CEIL: 7 (mg/m3) from NIOSH
TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)]
TWA: 2 STEL: 8 (mg/m3) [United Kingdom (UK)]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pungent. Irritating (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point:
108.58 C @ 760 mm Hg (for 20.22% HCl in water)
83 C @ 760 mm Hg (for 31% HCl in water)
50.5 C (for 37% HCl in water)

Melting Point:
-62.25°C (-80°F) (20.69% HCl in water)
-46.2 C (31.24% HCl in water)
-25.4 C (39.17% HCl in water)

Critical Temperature: Not available.

Specific Gravity:
1.1- 1.19 (Water = 1)
1.10 (20%and 22% HCl solutions)
1.12 (24% HCl solution)
1.15 (29.57% HCl solution)
1.16 (32% HCl solution)
1.19 (37% and 38%HCl solutions)

Vapor Pressure: 16 kPa (@ 20°C) average

Vapor Density: 1.267 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.25 to 10 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility: Soluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, water

Incompatibility with various substances:
Highly reactive with metals.
Reactive with oxidizing agents, organic materials, alkalis, water.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316).
Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Reacts with water especially when water is added to the product.
Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent @ 125 deg. C.
Sodium reacts very violently with gaseous hydrogen chloride.
Calcium phosphide and hydrochloric acid undergo very energetic reaction.
It reacts with oxidizers releasing chlorine gas.
Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates.
Reacts with most metals to produce flammable Hydrogen gas.
Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalies (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper and alloys (e.g. brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid(increase in temperature and pressure)
Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid.
Adsorption of Hydrochloric Acid onto silicon dioxide results in exothmeric reaction.
Hydrogen chloride causes aldehydes and epoxides to violently polymerize.
Hydrogen chloride or Hydrochloric Acid in contact with the folloiwng can cause explosion or ignition on contact or

Special Remarks on Corrosivity:
Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinium, tantalum, silver, and certain alloys are exceptions).
It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys.
No corrosivity data on zinc, steel.
Severe Corrosive effect on brass and bronze

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
Acute oral toxicity (LD50): 900 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse].
Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid].
May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin,

eyes, Circulatory System, teeth.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, .
Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Doses (LDL/LCL)
LDL [Man] -Route: Oral; 2857 ug/kg
LCL [Human] - Route: Inhalation; Dose: 1300 ppm/30M
LCL [Rabbit] - Route: Inhalation; Dose: 4413 ppm/30M

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (fetoxicity).
May affect genetic material.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Corrosive. Causes severe skin irritation and burns.
Eyes: Corrosive. Causes severe eye irritation/conjuntivitis, burns, corneal necrosis.
Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and larryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract edema, chest pains, as well has headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nasospetal perforation, glottal closure,
occur, particularly if exposure is prolonged. May affect the liver.
Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric hemorrhage and infection. Can also cause nausea, vomitting (with "coffee ground" emesis), diarrhea, thirst, difficulty swallowing, salivation, chills, fever, uneasiness, shock, strictures and stenosis (esophogeal, gastric, pyloric). May affect behavior (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis).
Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel.
Chronic Potential Health Effects:
dyspnea, bronchitis. Chemical pneumonitis and pulmonary edema can also

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hydrochloric acid, solution UNNA: 1789 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Hydrochloric acid
Illinois toxic substances disclosure to employee act: Hydrochloric acid
Illinois chemical safety act: Hydrochloric acid
New York release reporting list: Hydrochloric acid
Rhode Island RTK hazardous substances: Hydrochloric acid
Pennsylvania RTK: Hydrochloric acid
Minnesota: Hydrochloric acid
Massachusetts RTK: Hydrochloric acid
Massachusetts spill list: Hydrochloric acid
New Jersey: Hydrochloric acid
New Jersey spill list: Hydrochloric acid
Louisiana RTK reporting list: Hydrochloric acid
Louisiana spill reporting: Hydrochloric acid
California Director's List of Hazardous Substances: Hydrochloric acid
TSCA 8(b) inventory: Hydrochloric acid
TSCA 4(a) proposed test rules: Hydrochloric acid
SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid
SARA 313 toxic chemical notification and release reporting: Hydrochloric acid
CERCLA: Hazardous substances.: Hydrochloric acid: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
CLASS E: Corrosive liquid.

DSCL (EEC):
R34- Causes burns.
R37- Irritating to respiratory system.
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves.
Full suit.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Face shield.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

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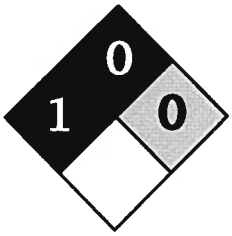

Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Lead MSDS

Section 1: Chemical Product and Company Identification

Product Name: Lead

Catalog Codes: SLL1291, SLL1669, SLL1081, SLL1459, SLL1834

CAS#: 7439-92-1

RTECS: OF7525000

TSCA: TSCA 8(b) inventory: Lead

CI#: Not available.

Synonym: Lead Metal, granular; Lead Metal, foil; Lead Metal, sheet; Lead Metal, shot

Chemical Name: Lead

Chemical Formula: Pb

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Lead	7439-92-1	100

Toxicological Data on Ingredients: Lead LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (permeator).
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to blood, kidneys, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Non-flammable in presence of open flames and sparks, of shocks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: When heated to decomposition it emits highly toxic fumes of lead.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not

present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.05 (mg/m3) from ACGIH (TLV) [United States]
TWA: 0.05 (mg/m3) from OSHA (PEL) [United States]
TWA: 0.03 (mg/m3) from NIOSH [United States]
TWA: 0.05 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 207.21 g/mole

Color: Bluish-white. Silvery. Gray

pH (1% soln/water): Not applicable.

Boiling Point: 1740°C (3164°F)

Melting Point: 327.43°C (621.4°F)

Critical Temperature: Not available.

Specific Gravity: 11.3 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, excess heat

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials.
Incompatible with sodium carbide, chlorine trifluoride, trioxane + hydrogen peroxide, ammonium nitrate, sodium azide, disodium acetylide, sodium acetylide, hot concentrated nitric acid, hot concentrated hydrochloric acid, hot concentrated sulfuric acid, zirconium.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC.
May cause damage to the following organs: blood, kidneys, central nervous system (CNS).

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential:
Skin:
Lead metal granules or dust: May cause skin irritation by mechanical action.
Lead metal foil, shot or sheets: Not likely to cause skin irritation
Eyes:
Lead metal granules or dust: Can irritate eyes by mechanical action.

Lead metal foil, shot or sheets: No hazard. Will not cause eye irritation.
Inhalation:
In an industrial setting, exposure to lead mainly occurs from inhalation of dust or fumes.
Lead dust or fumes: Can irritate the upper respiratory tract (nose, throat) as well as the bronchi and lungsby mechanical action. Lead dust can be absorbed through the respiratory system. However, inhaled lead does not accumulate in the lungs. All of an inhaled dose is eventually abssorbed or transferred to the gastrointestinal tract. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include metallic taste, chest pain, decreased physical fitness, fatigue, sleep disturbance, headache, irritability, reduces memory, mood and personality changes, aching bones and muscles, constipation, abdominal pains, decreasing appetite. Inhalation of large amounts may lead to ataxia, deliriuim, convulsions/seizures, coma, and death.
Lead metal foil, shot, or sheets: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count.
Ingestion:
Lead metal granules or dust: The symptoms of lead poisoning include abdominal pain or cramps (lead cholic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases.
Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Lead
California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead
California prop. 65: This product contains the following ingredients for which the State of California has found to

cause reproductive harm (male) which would require a warning under the statute: Lead
California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value)
California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Lead
Connecticut hazardous material survey.: Lead
Illinois toxic substances disclosure to employee act: Lead
Illinois chemical safety act: Lead
New York release reporting list: Lead
Rhode Island RTK hazardous substances: Lead
Pennsylvania RTK: Lead

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R20/22- Harmful by inhalation and if swallowed.
R33- Danger of cumulative effects.
R61- May cause harm to the unborn child.
R62- Possible risk of impaired fertility.
S36/37- Wear suitable protective clothing and gloves.
S44- If you feel unwell, seek medical advice (show the label when possible).
S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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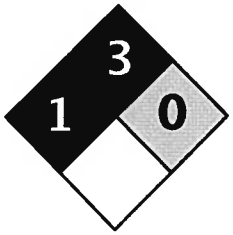

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Methyl alcohol MSDS

Section 1: Chemical Product and Company Identification

Product Name: Methyl alcohol

Catalog Codes: SLM3064, SLM3952

CAS#: 67-56-1

RTECS: PC1400000

TSCA: TSCA 8(b) inventory: Methyl alcohol

CI#: Not applicable.

Synonym: Wood alcohol, Methanol; Methylol; Wood Spirit; Carbinol

Chemical Name: Methanol

Chemical Formula: CH3OH

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Methyl alcohol	67-56-1	100

Toxicological Data on Ingredients: Methyl alcohol: ORAL (LD50): Acute: 5628 mg/kg [Rat]. DERMAL (LD50): Acute: 15800 mg/kg [Rabbit]. VAPOR (LC50): Acute: 64000 ppm 4 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator). Severe over-exposure can result in death.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer).
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Classified POSSIBLE for human.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to eyes.
The substance may be toxic to blood, kidneys, liver, brain, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS), optic nerve.

Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 464°C (867.2°F)

Flash Points: CLOSED CUP: 12°C (53.6°F). OPEN CUP: 16°C (60.8°F).

Flammable Limits: LOWER: 6% UPPER: 36.5%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Explosive in presence of open flames and sparks, of heat.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition, it emits acrid smoke and irritating fumes. CAUTION: MAY BURN WITH NEAR INVISIBLE FLAME

Special Remarks on Explosion Hazards:
Forms an explosive mixture with air due to its low flash point.
Explosive when mixed with Choroform + sodium methoxide and diethyl zinc. It boils violently and explodes.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:
Flammable liquid. Poisonous liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, metals, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 200 from OSHA (PEL) [United States]
TWA: 200 STEL: 250 (ppm) from ACGIH (TLV) [United States] [1999]
STEL: 250 from NIOSH [United States]

TWA: 200 STEL: 250 (ppm) from NIOSH SKIN
TWA: 200 STEL: 250 (ppm) [Canada]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Alcohol like. Pungent when crude.

Taste: Not available.

Molecular Weight: 32.04 g/mole

Color: Colorless.

pH (1% soln/water): Not available.

Boiling Point: 64.5°C (148.1°F)

Melting Point: -97.8°C (-144°F)

Critical Temperature: 240°C (464°F)

Specific Gravity: 0.7915 (Water = 1)

Vapor Pressure: 12.3 kPa (@ 20°C)

Vapor Density: 1.11 (Air = 1)

Volatility: Not available.

Odor Threshold: 100 ppm

Water/Oil Dist. Coeff.: The product is more soluble in water; log(oil/water) = -0.8

Ionicity (in Water): Non-ionic.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ingnition sources, incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizers. Violent reaction with alkyl aluminum salts, acetyl bromide, chloroform + sodium methoxide, chromic anhydride, cyanuirc chlorite, lead perchlorate, phosphorous trioxide, nitric acid. Exothermic reaction with sodium hydroxide + chloroform.
Incompatible with beryllium dihydride, metals (potassium and magnesium), oxidants (barium perchlorate, bromine, sodium hypochlorite, chlorine, hydrogen peroxide), potassium tert-butoxide, carbon tetrachloride, alkali metals,

metals (aluminum, potassium magnesium, zinc), and dichlormethane.
Rapid autocatalytic dissolution of aluminum, magnesium or zinc in 9:1 methanol + carbon tetrachloride - sufficiently vigorous to be rated as potentially hazardous.
May attack some plastics, rubber, and coatings.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 5628 mg/kg [Rat].
Acute dermal toxicity (LD50): 15800 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 64000 4 hours [Rat].

Chronic Effects on Humans:
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Classified POSSIBLE for human.
Causes damage to the following organs: eyes.
May cause damage to the following organs: blood, kidneys, liver, brain, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS), optic nerve.

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation.
Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
Passes through the placental barrier.
May affect genetic material.
May cause birth defects and adverse reproductive effects(paternal and maternal effects and fetotoxicity) based on animal studies.

Special Remarks on other Toxic Effects on Humans:

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 29400 mg/l 96 hours [Fathead Minnow].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation:
Methanol in water is rapidly biodegraded and volatilized. Aquatic hydrolysis, oxidation, photolysis, adsorption to sediment, and bioconcentration are not significant fate processes. The half-life of methanol in surfact water ranges from 24 hrs. to 168 hrs.
Based on its vapor pressure, methanol exists almost entirely in the vapor phase in the ambient atmosphere. It is degraded by reaction with photochemically produced hydroxyl radicals and has an estimated half-life of 17.8 days. Methanol is physically removed from air by rain due to its solubility. Methanol can react with NO2 in pollulted to

form methyl nitrate.
The half-life of methanol in air ranges from 71 hrs. (3 days) to 713 hrs. (29.7 days) based on photooxidation half-life in air.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Methyl alcohol UNNA: 1230 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Methyl alcohol
Illinois toxic substances disclosure to employee act: Methyl alcohol
Illinois chemical safety act: Methyl alcohol
New York release reporting list: Methyl alcohol
Rhode Island RTK hazardous substances: Methyl alcohol
Pennsylvania RTK: Methyl alcohol
Minnesota: Methyl alcohol
Massachusetts RTK: Methyl alcohol
Massachusetts spill list: Methyl alcohol
New Jersey: Methyl alcohol
New Jersey spill list: Methyl alcohol
Louisiana spill reporting: Methyl alcohol
California Directors List of Hazardous Substances (8CCR 339): Methyl alcohol
Tennesse Hazardous Right to Know : Methyl alcohol
TSCA 8(b) inventory: Methyl alcohol
SARA 313 toxic chemical notification and release reporting: Methyl alcohol
CERCLA: Hazardous substances.: Methyl alcohol: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
Class D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable.
R23/24/25- Toxic by inhalation, in contact with skin and if swallowed.
R39- Danger of very serious irreversible effects. R39/23/24/25- Toxic: danger of very serious

irreversible effects through inhalation, in contact with skin and if swallowed.
S7- Keep container tightly closed.
S16- Keep away from sources of ignition - No smoking.
S36/37- Wear suitable protective clothing and gloves.
S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References:
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-Material safety data sheet emitted by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec.
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
LOLI, HSDB, RTECS, HAZARDTEXT, REPROTOX databases

Other Special Considerations: Not available.

Created: 10/10/2005 08:23 PM

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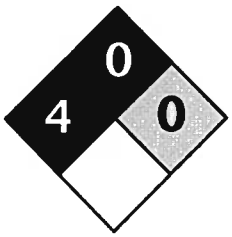

Health	3
Fire	0
Reactivity	0
Personal Protection	

Material Safety Data Sheet
Nitric acid, 65% MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nitric acid, 65%

Catalog Codes: SLN2161

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Water; Nitric acid, fuming

CI#: Not applicable.

Synonym: Nitric Acid, 65%

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

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Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Water	7732-18-5	35
Nitric acid, fuming	7697-37-2	65

Toxicological Data on Ingredients: Nitric acid, fuming: VAPOR (LC50): Acute: 244 ppm 0.5 hours [Rat]. 344 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to lungs, mucous membranes, upper respiratory tract, skin, eyes, teeth. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of combustible materials

Explosion Hazards in Presence of Various Substances:
Explosive in presence of reducing materials, of organic materials, of metals, of alkalis.
Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Flammable in presence of cellulose or other combustible materials.
Phosphine, hydrogen sulfide, selenide all ignite when fuming nitric acid is dripped into gas.
(Nitric Acid, fuming)

Special Remarks on Explosion Hazards:
Reacts exlposively with metallic powders, carbides, cyanides, sulfides, alkalies and turpentine.
Can react explosively with many reducing agents.
Arsine, phosphine, tetraborane all oxidized explosively in presence of nitric acid.
Cesium and rubidium acetylides explode in contact with nitric acid.
Explosive reaction with Nitric Acid + Nitrobenzene + water.
Detonation with Nitric Acid + 4-Methylcyclohexane.
(Nitric acid, fuming)

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Oxidizing material. Poisonous liquid.
Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material.. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as reducing agents, combustible materials, organic materials, metals, acids, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage:
Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers. Do not store above 23°C (73.4°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be

used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 2 STEL: 4 (ppm) from ACGIH (TLV) [United States]
TWA: 2 STEL: 4 from OSHA (PEL) [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Acrid. Disagreeable and choking. (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point: 121°C (249.8°F)

Melting Point: -41.6°C (-42.9°F)

Critical Temperature: Not available.

Specific Gravity: 1.408 (Water = 1)

Vapor Pressure: 6 kPa (@ 20°C)

Vapor Density: 2.5 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.29 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:
Easily soluble in cold water, hot water.
Soluble in diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances:
Highly reactive with alkalis.
Reactive with reducing agents, combustible materials, organic materials, metals, acids.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper.
Non-corrosive in presence of glass, of stainless steel(304), of stainless steel(316), of brass.

Special Remarks on Reactivity:
A strong oxidizer.
Reacts violently with alcohol, organic material, turpene, charcoal.
Violent reaction with Nitric acid + Acetone and Sulfuric acid.
Nitric Acid will react with water or steam to produce heat and toxic, corrosive and flammable vapors.
(Nitric acid, fuming)

Special Remarks on Corrosivity:
In presence of traces of oxides, it attacks all base metals except aluminum and special chromium steels.
It will attack some forms of plastics, rubber, and coatings.
No corrosive effect on bronze.
No corrosivity data for zinc, and steel

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans:
Contains material which may cause damage to the following organs: lungs, mucous membranes, upper respiratory tract, skin, eyes, teeth.

Other Toxic Effects on Humans:
Extremely hazardous in case of inhalation (lung corrosive).
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (corrosive), of ingestion, .

Special Remarks on Toxicity to Animals: LDL - Lowest Published Lethal Dose [Human] - Route: Oral; Dose: 430 mg/kg
(Nitric acid, fuming)

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (effects on newborn and fetotoxicity) based on animal data. (Nitric acid, fuming)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Severely irritates skin. Causes skin burns and may cause deep and penetrating ulcers of the skin with a characteristic yellow to brownish discoloration. May be fatal if absorbed through skin.
Eyes: Severely irritates eyes. Causes eye burns. May cause irreversible eye injury.
Ingestion: May be fatal if swallowed. Causes serious gastrointestinal tract irritation or burns with nausea, vomiting, severe abdominal pain, and possible "coffee grounds" appearance of the vomitus . May cause perforation of the digestive tract.
Inhalation: May be fatal if inhaled. Vapor is extremely hazardous. Vapor may cause nitrous gas poisoning. Effects may be delayed. May cause irritation of the mucous membranes and respiratory tract with burning pain in the nose and throat, coughing, sneezing, wheezing, shortness of breath and pulmonary edema. Other symptoms may include nausea, and vomiting.
Chronic Potential Health Effects:
Repeated inhalation may produce changes in pulmonary function and/or chronic bronchitis. It may also affect behavior (headache, dizziness, drowsiness, muscle contaction or spasticity, weakness, loss of coordinaton, mental confusion), and urinary system (kidney faillure, decreased urinary output after several hours of

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Nitric acid UNNA: 2031 PG: II

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
New York release reporting list: Nitric acid, fuming
Rhode Island RTK hazardous substances: Nitric acid, fuming
Pennsylvania RTK: Nitric acid, fuming
Florida: Nitric acid, fuming
Minnesota: Nitric acid, fuming
Massachusetts RTK: Nitric acid, fuming
New Jersey: Nitric acid, fuming
TSCA 8(b) inventory: Water; Nitric acid, fuming
SARA 302/304/311/312 extremely hazardous substances: Nitric acid, fuming
SARA 313 toxic chemical notification and release reporting: Nitric acid, fuming 65%
CERCLA: Hazardous substances.: Nitric acid, fuming: 1000 lbs. (453.6 kg);

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
CLASS E: Corrosive liquid.

DSCL (EEC):
R8- Contact with combustible material
may cause fire.
R35- Causes severe burns.
S23- Do not breathe gas/fumes/vapour/spray
[***]

S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S36- Wear suitable protective clothing.
S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 4

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Full suit.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Last Updated: 11/06/2008 12:00 PM

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MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION

Trade Name:	Antimony	**Synonym:**	Stibium, Antimony Metal
Chemical Nature:	Metallic element	**Formula:**	Sb
CAS #:	7440-36-0	**Molecular Weight:**	121.75

II HAZARDOUS INGREDIENTS

Hazardous Component	%	OSHA/PEL	ACGIH/TLV
Antimony	0-100	0.5 mg/m^3	0.5 mg/m^3

SARA Title III Sec. 313: Yes

III PHYSICAL DATA

Boiling Point:	1587 °C	**Melting Point:**	630 °C
Specific Gravity:	6.6 g/cc	**Vapor Density:**	N/A
Vapor Pressure:	1 mm Hg at 886 °C	**% Volatiles:**	N/A
Solubility in H_2O:	Insoluble	**pH:**	N/A
Appearance and Odor:	Silver grey metal, odorless		

IV FIRE AND EXPLOSION HAZARDS DATA

Flash Point: N/A **Autoignition Temperature**: N/A
Flammable Limits: **Upper**: N/A **Lower**: N/A

Extinguishing Media: Do not use halogenated extinguishers or water. Smother flames with dry powdered dolomite or other suitable dry powdered extinguishing agents.

Special Fire Fighting Procedures: Use NIOSH/MSHA approved self-contained breathing apparatus and full protective clothing - hats, boots and gloves.

Unusual Fire & Explosion Hazard: In solid form, antimony is not readily flammable. If ground to a powder, or if vapors are produced, it presents a moderate fire and explosion hazard.

V HEALTH HAZARD INFORMATION

Effects of Exposure:

Antimony and its compounds are irritating to the skin and mucous membranes and are systemic poisons. Effects are reported to include a metallic taste in the mouth, vomiting, colic, loss of appetite and weight, and diarrhea. In addition, dermatitis may result which starts as an inflammation of the hair follicles and can progress through pus formation and sloughing to leave a contracted scar.

Acute Effects:

Inhalation: Inhalation may cause upper respiratory tract irritation and systemic poisoning with symptoms including abdominal pain, nausea, dizziness and dry throat.
Ingestion: May cause severe irritation of lining of stomach and intestines.
Skin: Dermatitis may result from repeated skin contact with antimony compounds.
Eye: May cause severe eye irritation.

Chronic Effects: Liver and kidney abnormalities or pneumonitis may result from chronic antimony exposure. Some animal studies indicate that inhalation of antimony trioxide may pose an increased risk of lung cancer. Chronic inhalation of antimony trioxide is reported to produce a reduction in white blood cells and damage to the liver.

Primary Routes of Entry: Ingestion
Carcinogenicity: IARC classifies Antimony Trioxide as a Group 2B carcinogen (possibly carcinogenic to humans).
Medical Conditions Possibly Aggravated: Disease of the lung, kidney, liver and nervous system.

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION: Remove to fresh air; get medical attention.
INGESTION: Give 1-2 glasses of water and induce vomiting. Never induce vomiting or give anything by mouth to an unconscious person. Get immediate medical attention.
SKIN: Vacuum off excess dust. Wash well with soap and water. Avoid blowing particulate in the atmosphere.
EYE: Flush well with running water to remove particulate. Consult a physician.

VI REACTIVITY DATA

Stability: Stable

Conditions to Avoid: Thermal decomposition
Incompatibility (Material to Avoid): Strong acids, bases, nascent hydrogen or reducing agents.

Hazardous Decomposition Products: At temperatures above the melting point, metal oxide fumes may be evolved. Under reducing conditions (i.e. any strong acid or base plus an active metal) or in the presence of nascent hydrogen, highly toxic stibine gas may be evolved. With nitric acid may emit NOx; with other acids may emit toxic antimony hydride or stibine. Use adequate hood facilities.
Hazardous Polymerization: Will not occur

VII SPILL OR LEAK PROCEDURES

Steps to Be Taken in Case Material Is Released or Spilled: Any method which keeps dusts to a minimum is acceptable. Vacuuming is preferred for dust. Use approved respiratory protection if possibility of dust/fume exposure exists. Do not use compressed air for cleaning.

Waste Disposal Method: Dispose of in accordance with all State, Federal and Local regulations.

DOT Regulations: This material is only regulated by the DOT if in a powder form with a particle size <100 microns. The Reportable Quantity(RQ) is 1 pound.

VIII SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type): Where airborne exposures may exceed OSHA/ACGIH permissible air concentrations, the minimum respiratory protection recommended is negative pressure air purifying respirator with cartridges that are NIOSH/MSHA approved against dusts, fumes and mists having a TWA less than 0.05 mg/m^3

Ventilation: Local exhaust - melt metal under hood with inert gas cover. Mechanical - use filters to trap oxide smoke generated.

Protective Gloves: Rubber for chemical treatment; high temperature for melting.
Eye/Face Protection: Safety glasses recommended where the possibility of getting dust particles in eyes exists.

Other Clothing and Equipment: Full protective clothing is recommended for exposures that exceed permissible air concentrations. All contaminated clothing should be removed before leaving plant premises.

IX SPECIAL PRECAUTIONS

Normal Handling: Use of approved respirators is required for applications where adequate ventilation cannot be provided. Activities which generate dust or fume should be avoided. When melted, the temperature should be kept as low as possible.

Engineering Controls: Local exhaust ventilation is recommended for dust and/or fume generating operations where airborne exposures may exceed permissible air concentrations.

Storage: Avoid storage near acids, bases or reducing agents.

Special: Precautions/Procedures/Label Instructions: There is currently no substance specific standard for antimony and its compounds other than the air contaminant tables in 1910.1000.

Work Practices: Avoid inhalation or ingestion. Practice good housekeeping and personal hygiene procedures. No tobacco or food in the work area. Wash thoroughly before eating or smoking. Shower and change clothes at end of work shift. Do not wear contaminated clothing home. Do not blow dust off with compressed air.

The above information is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI shall not be held liable for any damage resulting from handling or from contact with the above product.

Issued by: S. Dierks
Date: August 1999

Material Safety Data Sheet

Benzo[a]pyrene, 98%

https://fscimage.fishersci.com/msds/37175.htm

ACC# 37175

Section 1 - Chemical Product and Company Identification

MSDS Name: Benzo[a]pyrene, 98%
Catalog Numbers: AC105600000, AC105600010, AC105601000, AC377200000, AC377200010, AC377201000 AC377201000
Synonyms: 3,4-Benzopyrene; 3,4-Benzpyrene; Benzo[def]chrysene.
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
50-32-8	Benzo[a]pyrene	>96	200-028-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: yellow to brown powder.
Danger! May cause harm to the unborn child. May impair fertility. May cause eye, skin, and respiratory tract irritation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Cancer hazard. May cause allergic skin reaction. May cause heritable genetic damage.
Target Organs: Reproductive system, skin.

Potential Health Effects
Eye: May cause eye irritation.
Skin: May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.
Ingestion: May cause irritation of the digestive tract. The toxicological properties of

this substance have not been fully investigated. May be harmful if swallowed.
Inhalation: May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated. May be harmful if inhaled.
Chronic: May cause cancer in humans. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
Ingestion: Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.
Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: Not available.
Autoignition Temperature: Not available.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 2; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.
Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Benzo[a]pyrene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m3 IDLH (listed under Coal tar pitches).	0.2 mg/m3 TWA (as benzene soluble fraction) (listed under Coal tar pitches).

OSHA Vacated PELs: Benzo[a]pyrene: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Powder
Appearance: yellow to brown

Odor: faint aromatic odor
pH: Not available.
Vapor Pressure: Not available.
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 495 deg C @ 760 mm Hg
Freezing/Melting Point:175 - 179 deg C
Decomposition Temperature: Not available.
Solubility: 1.60x10-3 mg/l @25°C
Specific Gravity/Density: Not available.
Molecular Formula:C20H12
Molecular Weight:252.31

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Dust generation.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 50-32-8: DJ3675000
LD50/LC50:
Not available.

Carcinogenicity:
CAS# 50-32-8:

- **ACGIH:** A2 - Suspected Human Carcinogen
- **California:** carcinogen, initial date 7/1/87
- **NTP:** Suspect carcinogen
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

Epidemiology: No information found
Teratogenicity: No information found
Reproductive Effects: Adverse reproductive effects have occurred in experimental animals.
Mutagenicity: Mutagenic effects have occurred in humans.Mutagenic effects have occurred in experimental animals.

Neurotoxicity: No information found
Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 50-32-8: waste number U022.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	NOT REGULATED FOR DOMESTIC TRANSPORT	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOL (Benzo{a} pyrene)
Hazard Class:		9
UN Number:		UN3077
Packing Group:		III

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 50-32-8 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 50-32-8: 1 lb final RQ; 0.454 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 50-32-8: immediate, delayed.

Section 313

This material contains Benzo[a]pyrene (CAS# 50-32-8, >96%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 50-32-8 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 50-32-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Benzo[a]pyrene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 50-32-8: 0.06 æg/day NSRL

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T N

Risk Phrases:

R 43 May cause sensitization by skin contact.

R 45 May cause cancer.

R 46 May cause heritable genetic damage.

R 60 May impair fertility.

R 61 May cause harm to the unborn child.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.

S 60 This material and its container must be disposed of as hazardou s waste.
S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)
CAS# 50-32-8: No information available.

Canada - DSL/NDSL
CAS# 50-32-8 is listed on Canada's DSL List.

Canada - WHMIS
This product has a WHMIS classification of D2A.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List
CAS# 50-32-8 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 9/02/1997
Revision #7 Date: 6/30/2006

AMERADA HESS CORPORATION

MATERIAL SAFETY DATA SHEET

Gasoline, All Grades **MSDS No. 9950**

EMERGENCY OVERVIEW
DANGER!
EXTREMELY FLAMMABLE - EYE AND MUCOUS MEMBRANE IRRITANT - EFFECTS CENTRAL NERVOUS SYSTEM - HARMFUL OR FATAL IF SWALLOWED - ASPIRATION HAZARD

NFPA 704 (Section 16)

High fire hazard. Keep away from heat, spark, open flame, and other ignition sources.

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs). Contact may cause eye, skin and mucous membrane irritation. Harmful if absorbed through the skin. Avoid prolonged breathing of vapors or mists. Inhalation may cause irritation, anesthetic effects (dizziness, nausea, headache, intoxication), and respiratory system effects.

Long-term exposure may cause effects to specific organs, such as to the liver, kidneys, blood, nervous system, and skin. Contains benzene, which can cause blood disease, including anemia and leukemia.

1. CHEMICAL PRODUCT and COMPANY INFORMATION (rev. Jan-04)

Amerada Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

EMERGENCY TELEPHONE NUMBER (24 hrs): **CHEMTREC (800)424-9300**
COMPANY CONTACT (business hours): Corporate Safety (732)750-6000
MSDS Internet Website www.hess.com/about/environ.html

SYNONYMS: Hess Conventional (Oxygenated and Non-oxygenated) Gasoline; Reformulated Gasoline (RFG); Reformulated Gasoline Blendstock for Oxygenate Blending (RBOB); Unleaded Motor or Automotive Gasoline

See Section 16 for abbreviations and acronyms.

2. COMPOSITION and INFORMATION ON INGREDIENTS * (rev. Jan-04)

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Gasoline (86290-81-5)	100
Benzene (71-43-2)	0.1 - 4.9 (0.1 - 1.3 reformulated gasoline)
n-Butane (106-97-8)	< 10
Ethyl Alcohol (Ethanol) (64-17-5)	0 - 10
Ethyl benzene (100-41-4)	< 3
n-Hexane (110-54-3)	0.5 to 4
Methyl-tertiary butyl ether (MTBE) (1634-04-4)	0 to 15.0
Tertiary-amyl methyl ether (TAME) (994-05-8)	0 to 17.2
Toluene (108-88-3)	1 - 25
1,2,4- Trimethylbenzene (95-63-6)	< 6
Xylene, mixed isomers (1330-20-7)	1 - 15

A complex blend of petroleum-derived normal and branched-chain alkane, cycloalkane, alkene, and aromatic hydrocarbons. May contain antioxidant and multifunctional additives. Non-oxygenated Conventional Gasoline and RBOB do not have oxygenates (Ethanol or MTBE and/or TAME). Oxygenated Conventional and Reformulated Gasoline will have oxygenates for octane enhancement or as legally required.

3. HAZARDS IDENTIFICATION (rev. Dec-97)

EYES
Moderate irritant. Contact with liquid or vapor may cause irritation.

SKIN
Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are exposed repeatedly.

INGESTION
The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION
Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

CHRONIC EFFECTS and CARCINOGENICITY
Contains benzene, a regulated human carcinogen. Benzene has the potential to cause anemia and other blood diseases, including leukemia, after repeated and prolonged exposure. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with systemic toxicity. See also Section 11 - Toxicological Information.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash). Chronic respiratory disease, liver or kidney dysfunction, or pre-existing central nervous system disorders may be aggravated by exposure.

4. FIRST AID MEASURES (rev. Dec-97)

EYES
In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN
Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION
DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION
Remove person to fresh air. If person is not breathing, ensure an open airway and provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES (rev. Dec-97)

FLAMMABLE PROPERTIES:

FLASH POINT:	-45 °F (-43°C)
AUTOIGNITION TEMPERATURE:	highly variable; > 530 °F (>280 °C)
OSHA/NFPA FLAMMABILITY CLASS:	1A (flammable liquid)
LOWER EXPLOSIVE LIMIT (%):	1.4%
UPPER EXPLOSIVE LIMIT (%):	7.6%

FIRE AND EXPLOSION HAZARDS

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

During certain times of the year and/or in certain geographical locations, gasoline may contain MTBE and/or TAME. Firefighting foam suitable for polar solvents is recommended for fuel with greater than 10% oxygenate concentration - refer to NFPA 11 "Low Expansion Foam - 1994 Edition."

FIRE FIGHTING INSTRUCTIONS

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES (rev. Dec-97)

ACTIVATE FACILITY SPILL CONTINGENCY or EMERGENCY PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product

vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal - caution, flammable vapors may accumulate in closed containers. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE (rev. Dec-97)

HANDLING PRECAUTIONS

******USE ONLY AS A MOTOR FUEL******
******DO NOT SIPHON BY MOUTH******

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION (rev. Jan-04)

EXPOSURE LIMITS

Component (CAS No.)	Exposure Limits			
	Source	TWA (ppm)	STEL (ppm)	Note
Gasoline (86290-81-5)	ACGIH	300	500	A3
Benzene (71-43-2)	OSHA	1	5	Carcinogen
	ACGIH	0.5	2.5	A1, skin
	USCG	1	5	
n-Butane (106-97-8)	ACGIH	800	--	2003 NOIC: 1000 ppm (TWA) Aliphatic Hydrocarbon Gases Alkane (C1-C4)
Ethyl Alcohol (ethanol) (64-17-5)	OSHA	1000	--	
	ACGIH	1000	--	A4
Ethyl benzene (100-41-4)	OSHA	100	--	
	ACGIH	100	125	A3

Component (CAS No.)	Exposure Limits			
	Source	TWA (ppm)	STEL (ppm)	Note
n-Hexane (110-54-3)	OSHA	500	--	
	ACGIH	50	--	skin
Methyl-tertiary butyl ether [MTBE] (1634-04-4)	ACGIH	50		A3
Tertiary-amyl methyl ether [TAME] (994-05-8)				None established
Toluene (108-88-3)	OSHA	200		Ceiling: 300 ppm; Peak: 500 ppm (10 min.)
	ACGIH	50	--	A4 (skin)
1,2,4- Trimethylbenzene (95-63-6)	ACGIH	25	--	
Xylene, mixed isomers (1330-20-7)	OSHA	100	--	
	ACGIH	100	150	A4

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION

Gloves constructed of nitrile or neoprene are recommended. Chemical protective clothing such as that made of of E.I. DuPont Tychem ®, products or equivalent is recommended based on degree of exposure.

Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION

A NIOSH-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection and limitations.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

9. PHYSICAL and CHEMICAL PROPERTIES (rev. Jan-04)

APPEARANCE

A translucent, straw-colored or light yellow liquid

ODOR

A strong, characteristic aromatic hydrocarbon odor. Oxygenated gasoline with MTBE and/or TAME may have a sweet, ether-like odor and is detectable at a lower concentration than non-oxygenated gasoline.

ODOR THRESHOLD

	Odor Detection	Odor Recognition
Non-oxygenated gasoline:	0.5 - 0.6 ppm	0.8 - 1.1 ppm
Gasoline with 15% MTBE:	0.2 - 0.3 ppm	0.4 - 0.7 ppm
Gasoline with 15% TAME:	0.1 ppm	0.2 ppm

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	85 to 437 °F (39 to 200 °C)
VAPOR PRESSURE:	6.4 - 15 RVP @ 100 °F (38 °C) (275-475 mm Hg @ 68 °F (20 °C)
VAPOR DENSITY (air = 1):	AP 3 to 4
SPECIFIC GRAVITY (H_2O = 1):	0.70 – 0.78
EVAPORATION RATE:	10-11 (n-butyl acetate = 1)
PERCENT VOLATILES:	100 %

SOLUBILITY (H_2O): Non-oxygenated gasoline - negligible (< 0.1% @ 77 °F). Gasoline with 15% MTBE - slight (0.1 - 3% @ 77 °F); ethanol is readily soluble in water

10. STABILITY and REACTIVITY (rev. Dec-94)

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources

INCOMPATIBLE MATERIALS

Keep away from strong oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

11. TOXICOLOGICAL PROPERTIES (rev. Dec-97)

ACUTE TOXICITY

Acute Dermal LD50 (rabbits): > 5 ml/kg
Acute Oral LD50 (rat): 18.75 ml/kg
Primary dermal irritation (rabbits): slightly irritating
Draize eye irritation (rabbits): non-irritating
Guinea pig sensitization: negative

CHRONIC EFFECTS AND CARCINOGENICITY

Carcinogenicity: OSHA: NO IARC: YES - 2B NTP: NO ACGIH: YES (A3)

IARC has determined that gasoline and gasoline exhaust are possibly carcinogenic in humans. Inhalation exposure to completely vaporized unleaded gasoline caused kidney cancers in male rats and liver tumors in female mice. The U.S. EPA has determined that the male kidney tumors are species-specific and are irrelevant for human health risk assessment. The significance of the tumors seen in female mice is not known. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with effects to the central and peripheral nervous systems, liver, and kidneys. The significance of these animal models to predict similar human response to gasoline is uncertain.

This product contains benzene. Human health studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-forming system (particularly bone marrow), and serious blood disorders such as aplastic anemia and leukemia. Benzene is listed as a human carcinogen by the NTP, IARC, OSHA and ACGIH.

This product may contain methyl tertiary butyl ether (MTBE): animal and human health effects studies indicate that MTBE may cause eye, skin, and respiratory tract irritation, central nervous system depression and neurotoxicity. MTBE is classified as an animal carcinogen (A3) by the ACGIH.

12. ECOLOGICAL INFORMATION (rev. Jan-04)

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations. If released, oxygenates such as ethers and alcohols will be expected to exhibit fairly high mobility in soil, and therefore may leach into groundwater. The API (www.api.org) provides a number of useful references addressing petroleum and oxygenate contamination of groundwater.

13. DISPOSAL CONSIDERATIONS (rev. Dec-97)

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION (rev. Jan-04)

DOT PROPER SHIPPING NAME:	Gasoline
DOT HAZARD CLASS and PACKING GROUP:	3, PG II
DOT IDENTIFICATION NUMBER:	UN 1203
DOT SHIPPING LABEL:	FLAMMABLE LIQUID

PLACARD:

15. REGULATORY INFORMATION (rev. Jan-04)

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION

This product and its constituents listed herein are on the EPA TSCA Inventory. Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other federal, state, or local regulations; consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)

Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) or, if not practical, the U.S. Coast Guard with follow-up to the National Response Center, as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)

The CERCLA definition of hazardous substances contains a "petroleum exclusion" clause which exempts crude oil, refined, and unrefined petroleum products and any indigenous components of such. However, other federal reporting requirements (e.g., SARA Section 304 as well as the Clean Water Act if the spill occurs on navigable waters) may still apply.

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION WT. PERCENT
Benzene (71-43-2)	0.1 to 4.9 (0.1 to 1.3 for reformulated gasoline)
Ethyl benzene (100-41-4)	< 3
n-Hexane (110-54-3)	0.5 to 4
Methyl-tertiary butyl ether (MTBE) (1634-04-4)	0 to 15.0
Toluene (108-88-3)	1 to 15
1,2,4- Trimethylbenzene (95-63-6)	< 6
Xylene, mixed isomers (1330-20-7)	1 to 15

US EPA guidance documents (www.epa.gov/tri) for reporting Persistent Bioaccumulating Toxics (PBTs) indicate this product may contain the following deminimis levels of toxic chemicals subject to Section 313 reporting:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION - Parts per million (ppm) by weight
Polycyclic aromatic compounds (PACs)	17
Benzo (g,h,i) perylene (191-24-2)	2.55
Lead (7439-92-1)	0.079

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B, Division 2 (Flammable Liquid)

Class D, Division 2A (Very toxic by other means) and Class D, Division 2B (Toxic by other means)

16. OTHER INFORMATION (rev. Jan-04)

NFPA® HAZARD RATING	HEALTH:	1	Slight
	FIRE:	3	Serious
	REACTIVITY:	0	Minimal
HMIS® HAZARD RATING	HEALTH:	1 *	Slight
	FIRE:	3	Serious
	REACTIVITY:	0	Minimal
	* CHRONIC		

SUPERSEDES MSDS DATED: 12/30/97

ABBREVIATIONS:

AP = Approximately < = Less than > = Greater than

N/A = Not Applicable N/D = Not Determined ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute (212)642-4900
API	American Petroleum Institute (202)682-8000
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation [General Info: (800)467-4922]
EPA	U.S. Environmental Protection Agency
HMIS	Hazardous Materials Information System
IARC	International Agency For Research On Cancer
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association (617)770-3000
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit (NIOSH)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
SCBA	Self-Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Workplace Hazardous Materials Information System (Canada)

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

AIRGAS INC -- ISOBUTYLENE-C4H8 -- 6665-01-448-3250

========== Product Identification ==========

Product ID:ISOBUTYLENE-C4H8
MSDS Date:01/16/1998
FSC:6665
NIIN:01-448-3250
Status Code:A
MSDS Number: CLCVZ
=== Responsible Party ===
Company Name:AIRGAS INC
Address:259 RADNOR-CHESTER RD SUITE 100
City:RADNOR
State:PA
ZIP:19087-5240
Country:US
Info Phone Num:1-610-687-5253
Emergency Phone Num:(800)424-9300
Resp. Party Other MSDS Num.:DOCUMENT NUMBER: 1031
Preparer's Name:CHEMICAL SAFETY ASSOCIATE
Chemtrec Ind/Phone:(800)424-9300
CAGE:UO451
=== Contractor Identification ===
Company Name:AIRGAS INC
Address:259 RADNOR-CHESTER RD SUITE 100
Box:City:RADNOR
State:PA
ZIP:19087-5240
Country:US
Phone:1-610-687-5253
CAGE:UO451
Company Name:KAMPI COMPONENTS CO., INC.
Address:210 RT 13
Box:721
City:BRISTOL
State:PA
ZIP:19007-3517
Country:US
Phone:215-736-2000
CAGE:7Z016

========== Composition/Information on Ingredients ==========

Ingred Name:ISOBUTYLENE
CAS:115-11-7
RTECS #:UD0890000
> Wt:99.

Ingred Name:MAXIMUM IMPURITIES
< Wt:1.

========== Hazards Identification ==========

Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:ACUTE: THE MOST SIGNIFICANT HAZARD IS
OXYGEN-DEFICIENT ATOMSPHERES. AT HIGH CONCENTRATIONS
UNCONSCIOUSNESS OR DEATH MAY OCCUR. CONTACT WITH LIQUIDFIED GAS OR
RAPIDLY EXPANDING GASES MAY CAUSE FROSTBIT E. ISOBUTYLENE ALSO HAS

SOME DEGREE OF ANESTHETIC ACTION AND CAN BE MILDLY IRRITATING TO THE MUCOUS MEMBRANES. CHRONIC: NO KNOWN ADVERSE HEALTH EFFECTS ASSOCIATED WITH CHRONIC EXPOSURE TO ISOBUTYLENE. TARGET ORGANS: RESPIRATORY SYSTEM.

Explanation of Carcinogenicity:ISOBUTYLENE IS NOT FOUND ON THE FOLLOWING LISTS: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA, AND THEREFORE IS NEITHER CONSIDERED TO BE NOR SUSPECTED TO BE A CANCER-CAUSING AGENT BY THESE AGENCIES.

Effects of Overexposure:INHALATION: SYMPTOMS OF OXYGEN DEFICIENCY INCLUDE RESPIRATORY DIFFICULTY, HEADACHES, RINGING IN EARS, DIZZINESS, DROWSINESS, UNCONSCIOUSNESS, NAUSEA, VOMITING, AND DEPRESSION OF ALL THE SENSES. UNDER SOME CIRCUSTANCES OF OVEREXPOSURE, DEATH MAY OCCUR.

========== First Aid Measures ==========

First Aid:RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO ISOBUTYLENE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. AT A MINIMUM, SELF-CONTAINED BREATHING APPARATUS AND FIRE-RETARDANT PERSONAL PROTECTIVE EQUIPMENT SHOULD BE WORN. FIRE PROTECTION MUST BE PROVIDED DURING RESCUE SITUATIONS. REMOVE VICTIMS(S) TO FRESH AIR. TRAINED PERSONNEL SHOULD ADMINISTER OXYGEN AND/OR CARDIO-PULMONARY RESUS CITATION, IF NECESSARY. IN CASE OF FROSTBITE, PLACE FROSTBITEN PART IN WARM WATER. (CONTD. SEE OTHER INFORMATION)

========== Fire Fighting Measures ==========

Flash Point Method:CC
Flash Point:<-10.C, 14.F
Autoignition Temp:=465.C, 869.F
Lower Limits:1.8
Upper Limits:9.6

Extinguishing Media:EXTINGUISH ISOBUTYLENE FIRES BY SHUTTING OFF THE SOURCE OF THE GAS. USE WATER SPRAY OR A FOAM AGENT TO COOL FIRE-EXPOSED CONTAINERS, STRUCTURES AND EQUIPMENT.

Fire Fighting Procedures:STRUCTURAL FIREFIGHTERS MUST WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE EQUIPMENT. THE BEST FIRE-FIGHTING TECHNIQUE MAY BE SIMPLY TO LET THE BURNING GAS ESCAPE FROM THE PRESSURIZED CY LINDER, TANK CAR, OR PIPELINE. STOP THE LEAK BEFORE EXTINGUISHING FIRE. LEAKING GAS COULD EXPLOSIVELY RE-IGNITE.

Unusual Fire/Explosion Hazard:WHEN INVOLVED IN A FIRE, THIS MATERIAL MAY IGNITE AND PRODUCE TOXIC GASES, INCLUDING CARBON MONOXIDE AND CARBON DIOXIDE.

========== Accidental Release Measures ==========

Spill Release Procedures:UNCONTROLLED RELEASES SHOULD BE COVERED BY TRAINED PERSONNEL USING PRE-PLANNED PROCEDURES. PROPER PROTECTIVE EQUIPMENT SHOULD BE USED. ADEQUATE FIRE PROTECTION MUST BE PROVIDED. MINIMUM PERSONAL PROTE CTIVE EQUIPMENT SHOULD BE LEVEL B: FIRE RETARDANT PROTECTIVE CLOTHING, GLOVES RESISTANT TO TEARS AND SELF CONTAINED BREATHING APPARATUS. USE NON-SPARKING TOOLS AND (CONTD. SEE "WASTE DISPOSAL")

========== Handling and Storage ==========

Handling and Storage Precautions:STORE IN COOL(,< 125F), DRY, WELL-VENTILATED AREA AWAY FROM SOURCES OF HEAT, IGNITION, DIRECT

SUNLIGHT. COMPRESSED GASES PRESENT SAFETY HAZARD. STORE AWAY FROM OXIDIZERS, OXIGEN, CHLORINE, FLUORINE, H EAVILY TRAFFICKED AREAS, EMERGENCY EXITS. POST "NO SMOKING OR NO OPEN FLAMES " SIGNS.
Other Precautions:ELECTRICAL EQUIPMENT SHOULD BE NON-SPARKING. MOVE CYLINDERS WITH HAND TRUCK. DO NOT DRAG, ROLL, DROP, STRIKE EACH OTHER. SECURE FIRMLY. DO NOT HEAT CYLINDER OR USE OILS OR GREASE ON GAS-HANDLING FITTI NGS OR EQUIPMENT. USE DESIGNATED CGA FITTINGS. DO NOT USE ADAPTERS. USE CHECK VALVE OR TRAP IN DISCH ARGE LINE.

========== Exposure Controls/Personal Protection ==========

Respiratory Protection:MAINTAIN OXYGEN LEVELS ABOVE 19.5% IN THE WORKPLACE. USE SUPPLIED AIR RESPIRATORY PROTECTION IF OXYGEN LEVELS ARE BELOW 19.5% OR DURING EMERGENCY RESPONSE TO A RELEASE OF ISOUTYLENE. IF RESPIRATORY PR OTECTION IS REQUIRED, FOLLOW THE REQUIREMENTS OF THE FEDERAL OSHA RESPIRATORY STANDARD (29 CFR 1910.134) OR EQUIVALENT STATE STANDARDS.
Ventilation:USE ADEQUATE VENTILATION. LOCAL EXHAUST VENTILATION IS PERFERRED, BECAUSE IT PREVENTS ISOBUTYLENE DISPERSION INTO THE WORKPLACE BY EMLIMINATING IT AT THE SOURCE
Protective Gloves:RESISTANT TO TEARS. USE LOW-TEMPERATURE PROTECTIVE GLOVED (E.G., KEVLAR)
Eye Protection:SPLASH GOGGLES OR SAFETY GLASSES.
Other Protective Equipment:USE BODY PROTECTION . TRANSFER OF LARGE QUANTITIES UNDER PRESSURE MAY REQUIRE PROTECTIVE EQUIPMET TO PROTECT FROM SPLASHES OF LIQUIDFIED PRODUCT AS WELL AS FIRE RETARANAT ITEMS.
Work Hygienic Practices:AS WITH ALL CHEMICALS, AVOID GETTING ISOBUTYLENE IN YOU. DO NOT EAT OR DIRNK WHILE HANDLING CHEMICALS. BEWARE OF ANY SIGNS OF DIZZINESS OR FATIGUE; EXPOSURES TO FATAL CONCENTRATIONS OF ISOBUTYLENE COULD
Supplemental Safety and Health
(CONTD. FROM FIRST AID) DO NOT USE HOT WATER. IF WARM WATER NOT AVAILABLE, OR IMPRACTICAL TO USE, WRAP AFFECTED PARTS GENTLY IN BLANKETS. (SEE OTHER INFORMATION)

========== Physical/Chemical Properties ==========

HCC:G2
Boiling Pt:=-6.9C, 19.6F
Melt/Freeze Pt:=-140.C, -220.F
Vapor Pres:39 PSIA
Vapor Density:0.15LB/FT3
Spec Gravity:1.997
pH:NA
Solubility in Water:INSOLUBLE
Appearance and Odor:COLORLESS LIQUID/ GAS WITH THE UNPLEASANT ODOR OF BURNING COAL.

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid:YES
STRONG OXIDIZERS (E.G., CHLORINE, BROMINE PENTAFLUORIDE, OXYGEN, OXYGEN DIFLUORIDE, AND NITROGEN TRIFLUORIDE).
Stability Condition to Avoid:CONTACT WITH INCOMPATIBLE MATERIALS AND EXPOSURE TO HEAT, SPARKS, AND OTHER SOURCES OF IGNITION. CYLINDERS EXPOSED TO HIGH TEMPERATURES OR DIRECT FLAME CAN RUPTURE OR BURST.
Hazardous Decomposition Products:WHEN IGNITED IN THE PRESENCE OF OXYGEN, THIS GAS WILL BURN TO PRODUCE CARBON MONOXIDE AND CARBON DIOXIDE.

Conditions to Avoid Polymerization:WILL NOT OCCUR.

========== Toxicological Information ==========

Toxicological Information:LC50 (RAT, INHALATION): 620 G/M3/ 4 HOURS; LC50 (MOUSE, INHALATION): 415 G/M3/ 2 HOUR. ISOBUTYLENE IS NOT FOUND ON FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA, AND THEREFORE IS NEITHER CONSIDERED TO BE N OR SUSPECTED TO BE A CANCER-CAUSING AGENT BY THESE AGENCIES. PRODUCT MAY BE MILDLY IRRITATING TO THE MUCOUS MEMBRANES. IN ADDITION, CONTACT WITH RAPIDLY EXPANDING GASES CAN CAUSE FROSTBITE TO EXPOSED TISSUE. ISOBUTYLENE IS NOT KNOWN TO CAUSE SENSITIZATION IN HUMANS. NO MUTAGENIC EFFECTS, NO EMBRYOTOXIC EFFECTS, NO TERATOGENIC EFFECTS, NO REPRODUCTIVE TOXICITY EFFECTS HAVE BEEN DESCRIBED FOR BUTYLE NE.

========== Ecological Information ==========

Ecological:ENVIRONMENTAL STABILITY: THIS GAS WILL BE DISSIPATED RAPIDLY IN WELL-VENTILATED AREAS. EFFECTS OF MATERIAL ON PLANTS OR ANIMALS: ANY ADVERSE EFFECT ON ANIMALS WOULD BE RELATED TO OXYGEN-DEFICIENT ENVI RONMENTS. NO ADVERSE EFFECT IS ANTICIPATED TO OCCUR TO PLANT LIFE, EXCEPT FOR FROST PRODUCED IN THE PRESENCE OF RAPIDLY EXPANDING GASES. EFFECT OF CHEMICAL ON AQUATIC LIFE: NO EVIDENCE IS CURRENTLY AV AILABLE ON THE EFFECTS OF ISOBUTYLENE ON AQUATIC LIFE.

========== Disposal Considerations ==========

Waste Disposal Methods:WASTE DISPOSAL MUST BE IN ACCORDANCE WITH APPROPRIATE FEDERAL, STATE, AND LOCAL REGULATIONS. RETURN CYLINDERS WITH ANY RESIDUAL PRODUCT TO AIRGAS INC. DO NOT DISPOSE OF LOCALLY. (CONTD. FROM "SPILL RE LEASE") EQUIPMENT. IF NOT ABLE TO STOP RELEASE, ALLOW GAS TO RELEASE IN PLACE OR REMOVE TO A SAFE AR EA AND ALLOW GAS TO RELEASE.

========== MSDS Transport Information ==========

Transport Information:THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION. PROPER SHIPPING NAME: ISOBUTYLENE; CLASS: 2.1 (FLAMMABLE GAS); UN 1055; PKG: N/A; DOT LABELS REQUIRED: FLAMMABLE GAS; NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 115. ALTERNATE DESCRIPTION: PSN: PETROLEUM GASES, LIQUIDFIED; CLASS: 2.1 (FLAMMABLE GAS); UN 1075; PKG N/A; DOT LABEL REQUIRE D: FLAMMABLE GAS; NORTH AMERICAN EMERGENCY GUIDEBOOK NUMBER: 115; MARINE POLLUTANT: ISOBUTYLENE IS NOT CLASSIFIED BY THE DOT AS A MARINE POLLUTANT (AS DEFINED BY 49 CFR 172.101, APPENDIX B). CANADA: SAME AS ABOVE.

========== Regulatory Information ==========

SARA Title III Information:ISOBUTYLENE IS NOT SUBJECT TO THE REPORTING REQUIREMENTS OF SECTION 302, 304, AND 313 OF TITLE I I I OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT. U.S. SARA THRESHOLD PLANNING QUANTITY: N/A. U. S. CERCLA REPORTABLE QUANTITY (RQ): NOT APPLICIABLE.

Federal Regulatory Information:ISOBUTYLENE IS LISTED ON THE U.S. TSCA INVENTORY. ISOBUTYLENE IS SUBJECT TO REPORTING REQUIREMENTS OF SECTION 112(R) OF THE CLEAN AIR ACT. THRESHOLD QUANTITY FOR THIS GAS IS 10,000 LB. DEPENDING ON SP ECIFIC OPERATIONS INVOLVING USE OF ISOBUTYLENE, REGULATIONS OF THE PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS MAY BE APPLICABLE (29 CFR 1910.119)

UNDER THIS REGULATION ISOBUTYLENE IS NOT LISTED IN APPENDIX A; HOWEVER, ANY PROCESS THAT INVOLVES A FLAMMABLE GAS ON-SITE, IN ONE LOCATION, I N QUANTITIES OF 10,000 LB (4,553 KG) OR GREATER IS COVERED UNDER THIS REGULATION UNLESS IT IS USED AS A FUEL.

State Regulatory Information:CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): ISOBUTYLENE IS NOT ON THE CALIFORNIA PROPOSITION 65 LISTS. PRODUCT COVERED UNDER FOLLOWING STATE REGULATIONS: AK: DESIGNATED TOXIC AND HAZARDOUS SUBSTANCES. CA: PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS; FL: SUBSTANCE LIST; MA: SUBSTANCE LIST; MN: LIST OF HAZARDOUS SUBSTANCES; NJ: RIGHT TO KNOW HAZARDOUS SUBSTAN CE LIST; PA: HAZARDOUS SUBSTANCE LIST; RI: HAZARDOUS SUBSTANCE LIST; TX: HAZARDOUS SUBSTANCE LIST: W V: HAZARDOUS SUBSTANCE LIST; WI: TOXIC AND HAZARDOUS SUBSTANCES.

========== Other Information ==========

Disclaimer (provided with this information by the compiling agencies): This information is formulated for use by elements of the Department of Defense. The United States of America in no manner whatsoever, expressly or implied, warrants this information to be accurate and disclaims all liability for its use. Any person utilizing this document should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation.

MATERIAL SAFETY DATA SHEET

Diesel Fuel (All Types) **MSDS No. 9909**

EMERGENCY OVERVIEW
CAUTION!
OSHA/NFPA COMBUSTIBLE LIQUID - SLIGHT TO MODERATE IRRITANT
EFFECTS CENTRAL NERVOUS SYSTEM
HARMFUL OR FATAL IF SWALLOWED
Moderate fire hazard. Avoid breathing vapors or mists. May cause dizziness and drowsiness. May cause moderate eye irritation and skin irritation (rash). Long-term, repeated exposure may cause skin cancer.
If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs).

NFPA 704 (Section 16)

1. CHEMICAL PRODUCT AND COMPANY INFORMATION

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

EMERGENCY TELEPHONE NUMBER (24 hrs): **CHEMTREC (800) 424-9300**
COMPANY CONTACT (business hours): Corporate Safety (732) 750-6000
MSDS INTERNET WEBSITE: www.hess.com (See Environment, Health, Safety & Social Responsibility)

SYNONYMS: Ultra Low Sulfur Diesel (ULSD); Low Sulfur Diesel; Motor Vehicle Diesel Fuel; Diesel Fuel #2; Dyed Diesel Fuel; Non-Road, Locomotive and Marine Diesel Fuel; Tax-exempt Diesel Fuel

See Section 16 for abbreviations and acronyms.

2. COMPOSITION and CHEMICAL INFORMATION ON INGREDIENTS

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Diesel Fuel (68476-34-6)	100
Naphthalene (91-20-3)	Typically < 0.01

A complex mixture of hydrocarbons with carbon numbers in the range C9 and higher. Diesel fuel may be dyed (red) for tax purposes. May contain a multifunctional additive.

3. HAZARDS IDENTIFICATION

EYES
Contact with liquid or vapor may cause mild irritation.

SKIN
May cause skin irritation with prolonged or repeated contact. Practically non-toxic if absorbed following acute (single) exposure. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

INGESTION
The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION
Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

CHRONIC EFFECTS and CARCINOGENICITY
Similar products produced skin cancer and systemic toxicity in laboratory animals following repeated applications. The significance of these results to human exposures has not been determined - see Section 11 Toxicological Information.

IARC classifies whole diesel fuel exhaust particulates as probably carcinogenic to humans (Group 2A). NIOSH regards whole diesel fuel exhaust particulates as a potential cause of occupational lung cancer based on animal studies and limited evidence in humans.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash).

4. FIRST AID MEASURES

EYES
In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN
Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION
DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION
Remove person to fresh air. If person is not breathing provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES:

FLASH POINT:	> 125 °F (> 52 °C) minimum PMCC
AUTOIGNITION POINT:	494 °F (257 °C)
OSHA/NFPA FLAMMABILITY CLASS:	2 (COMBUSTIBLE)
LOWER EXPLOSIVE LIMIT (%):	0.6
UPPER EXPLOSIVE LIMIT (%):	7.5

FIRE AND EXPLOSION HAZARDS
Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA
SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

FIRE FIGHTING INSTRUCTIONS
Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES

ACTIVATE FACILITY'S SPILL CONTINGENCY OR EMERGENCY RESPONSE PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal - caution, flammable vapors may accumulate in closed containers. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE

HANDLING PRECAUTIONS
Handle as a combustible liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Diesel fuel, and in particular low and ultra low sulfur diesel fuel, has the capability of accumulating a static electrical charge of sufficient energy to cause a fire/explosion in the presence of lower flashpoint products such as gasoline. The accumulation of such a static charge occurs as the diesel flows through pipelines, filters, nozzles and various work tasks such as tank/container filling, splash loading, tank cleaning; product sampling; tank gauging; cleaning, mixing, vacuum truck operations, switch loading, and product agitation. There is a greater potential for static charge accumulation in cold temperature, low humidity conditions.

Documents such as 29 CFR OSHA 1910.106 "Flammable and Combustible Liquids, NFPA 77 Recommended Practice on Static Electricity, API 2003 "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents and ASTM D4865 "Standard Guide for Generation and Dissipation of Static

Electricity in Petroleum Fuel Systems" address special precautions and design requirements involving loading rates, grounding, bonding, filter installation, conductivity additives and especially the hazards associated with "switch loading." ["Switch Loading" is when a higher flash point product (such as diesel) is loaded into tanks previously containing a low flash point product (such as gasoline) and the electrical charge generated during loading of the diesel results in a static ignition of the vapor from the previous cargo (gasoline).]

Note: When conductivity additives are used or are necessary the product should achieve 25 picosiemens/meter or greater at the handling temperature.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION

EXPOSURE LIMITS

Components (CAS No.)	Source	Exposure Limits TWA/STEL	Note
Diesel Fuel: (68476-34-6)	OSHA	5 mg/m, as mineral oil mist	
	ACGIH	100 mg/m^3 (as totally hydrocarbon vapor) TWA	A3, skin
Naphthalene (91-20-3)	OSHA	10 ppm TWA	
	ACGIH	10 ppm TWA / 15 ppm STEL	A4, Skin

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION

Gloves constructed of nitrile, neoprene, or PVC are recommended. Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION
A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

9. PHYSICAL and CHEMICAL PROPERTIES

APPEARANCE
Clear, straw-yellow liquid. Dyed fuel oil will be red or reddish-colored.

ODOR
Mild, petroleum distillate odor

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	320 to 690 oF (160 to 366 °C)
VAPOR PRESSURE:	0.009 psia @ 70 °F (21 °C)
VAPOR DENSITY (air = 1):	> 1.0
SPECIFIC GRAVITY (H_2O = 1):	0.83 to 0.88 @ 60 °F (16 °C)
PERCENT VOLATILES:	100 %
EVAPORATION RATE:	Slow; varies with conditions
SOLUBILITY (H_2O):	Negligible

10. STABILITY and REACTIVITY

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID and INCOMPATIBLE MATERIALS
Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources. Keep away from strong oxidizers; Viton ®; Fluorel ®

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

11. TOXICOLOGICAL PROPERTIES

ACUTE TOXICITY
Acute dermal LD50 (rabbits): > 5 ml/kg
Acute oral LD50 (rats): 9 ml/kg
Primary dermal irritation: extremely irritating (rabbits)
Draize eye irritation: non-irritating (rabbits)
Guinea pig sensitization: negative

CHRONIC EFFECTS AND CARCINOGENICITY
Carcinogenic: OSHA: NO IARC: NO NTP: NO ACGIH: A3

Studies have shown that similar products produce skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal's skin with soap and water between applications reduced tumor formation.

MUTAGENICITY (genetic effects)
This material has been positive in a mutagenicity study.

12. ECOLOGICAL INFORMATION

Keep out of sewers, drainage areas, and waterways. Report spills and releases, as applicable, under Federal and State regulations.

13. DISPOSAL CONSIDERATIONS

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION

PROPER SHIPPING NAME:	Diesel Fuel	Placard (International Only):
HAZARD CLASS and PACKING GROUP:	3, PG III	
DOT IDENTIFICATION NUMBER:	NA 1993 (Domestic) UN 1202 (International)	
DOT SHIPPING LABEL:	None	

Use Combustible Placard if shipping in bulk domestically

15. REGULATORY INFORMATION

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION

This product and its constituents listed herein are on the EPA TSCA Inventory. Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other regulations at the state and/or local level. Consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)

Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)

The CERCLA definition of hazardous substances contains a "petroleum exclusion" clause which exempts crude oil, refined, and unrefined petroleum products and any indigenous components of such. However, other federal reporting requirements (e.g., SARA Section 304 as well as the Clean Water Act if the spill occurs on navigable waters) may still apply.

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product may contain listed chemicals below the *de minimis* levels which therefore are not subject to the supplier notification requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372. If you may be required to report releases of chemicals listed in 40 CFR 372.28, you may contact Hess Corporate Safety if you require additional information regarding this product.

CALIFORNIA PROPOSITON 65 LIST OF CHEMICALS

This product contains the following chemicals that are included on the Proposition 65 "List of Chemicals" required by the California Safe Drinking Water and Toxic Enforcement Act of 1986:

INGREDIENT NAME (CAS NUMBER)	Date Listed
Diesel Engine Exhaust (no CAS Number listed)	10/01/1990

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B, Division 3 (Combustible Liquid) and Class D, Division 2, Subdivision B (Toxic by other means)

16. OTHER INFORMATION

NFPA® HAZARD RATING

HEALTH:	0
FIRE:	2
REACTIVITY:	0

Refer to NFPA 704 "Identification of the Fire Hazards of Materials" for further information

HMIS® HAZARD RATING

HEALTH:	1 *	* Chronic
FIRE:	2	
PHYSICAL:	0	

SUPERSEDES MSDS DATED: 02/28/2001

ABBREVIATIONS:

AP = Approximately < = Less than > = Greater than
N/A = Not Applicable N/D = Not Determined ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute (212) 642-4900
API	American Petroleum Institute (202) 682-8000
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation [General info: (800) 467-4922]
EPA	U.S. Environmental Protection Agency
HMIS	Hazardous Materials Information System
IARC	International Agency For Research On Cancer
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association (617)770-3000
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit (NIOSH)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
SCBA	Self-Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Canadian Workplace Hazardous Materials Information System

LIQUINOX MSDS

Section 1 : PRODUCT AND COMPANY IDENTIFICATION

Chemical family: Detergent.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800-255-3924.
813-248-0585 (outside of the United States).

Supplier: Same as manufacturer.

Product name: Liquinox

Section 2 : INGREDIENT INFORMATION

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE

Section 3 : HAZARD IDENTIFICATION

Route of entry: Skin contact, eye contact, inhalation and ingestion.

Effects of acute exposure

Eye contact: May cause irritation.

Skin contact: Prolonged and repeated contact may cause irritation.

Inhalation: May cause headache and nausea.

Ingestion: May cause vomiting and diarrhea.
May cause gastric distress.

Effects of chronic exposure: See effects of acute exposure.

Section 4 : FIRST AID MEASURES

Skin contact: Remove contaminated clothing.
Wash thoroughly with soap and water.
Seek medical attention if irritation persists.

Eye contact: Check for and remove contact lenses.
Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.

Inhalation: Remove victim to fresh air.
If irritation persists, seek medical attention.

Ingestion: Do not induce vomiting, seek medical attention.
Dilute with two glasses of water.
Never give anything by mouth to an unconscious person.

Section 5 : FIRE FIGHTING MEASURES

Flammability: Not flammable.

Conditions of flammability: Surrounding fire.

Extinguishing media: Carbon dioxide, dry chemical, foam.
Water
Water fog.

Special procedures: Self-contained breathing apparatus required.
Firefighters should wear the usual protective gear.
Use water spray to cool fire exposed containers.

Auto-ignition temperature: Not available.

Flash point (°C), method: None

Lower flammability limit (% vol): Not applicable.

Upper flammability limit (% vol): Not applicable.

Explosion Data

Sensitivity to static discharge: Not available.

Sensitivity to mechanical impact: Not available.

Hazardous combustion products: Oxides of carbon (COx).
Hydrocarbons.

Rate of burning: Not available.

Explosive power: Containers may rupture if exposed to heat or fire.

Section 6 : ACCIDENTAL RELEASE MEASURES

Leak/Spill: Contain the spill.
Prevent entry into drains, sewers, and other waterways.
Wear appropriate protective equipment.
Small amounts may be flushed to sewer with water.
Soak up with an absorbent material.
Place in appropriate container for disposal.
Notify the appropriate authorities as required.

Section 7 : HANDLING AND STORAGE

Handling procedures and equipment: Protect against physical damage.
Avoid breathing vapors/mists.
Wear personal protective equipment appropriate to task.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Avoid extreme temperatures.
Launder contaminated clothing prior to reuse.

Storage requirements: Store away from incompatible materials.
Keep containers closed when not in use.

Section 8 : EXPOSURE CONTROLS / PERSONAL PROTECTION

Precautionary Measures

Gloves/Type:

Wear appropriate gloves.

Respiratory/Type: None required under normal use.

Eye/Type:

Safety glasses recommended.

Footwear/Type: Safety shoes per local regulations.

Clothing/Type: As required to prevent skin contact.

Other/Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

Exposure limit of material: Not available.

Section 9 : PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Liquid.

Appearance & odor: Odourless.
Pale yellow.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): @ 20°C (68°F).
17

Vapour density (air=1): >1

Volatiles (%)

By volume: Not available.

Evaporation rate (butyl acetate = 1): < 1.

Boiling point (°C): 100 (212F)

Freezing point (°C): Not available.

pH: 8.5

Specific gravity @ 20 °C: (water = 1).
1.083

Solubility in water (%): Complete.

Coefficient of water\oil dist.: Not available.

VOC: None

Chemical family: Detergent.

Section 10 : STABILITY AND REACTIVITY

Chemical stability: Product is stable under normal handling and storage conditions.

Conditions of instability: Extreme temperatures.

Hazardous polymerization: Will not occur.

Incompatible substances: Strong acids.
Strong oxidizing agents.

Hazardous decomposition products: See hazardous combustion products.

Section 11 : TOXICOLOGICAL INFORMATION

LD50 of product, species & route: > 5000 mg/kg rat oral.

LC50 of product, species & route: Not available.

Sensitization to product: Not available.

Carcinogenic effects: Not listed as a carcinogen.

Reproductive effects: Not available.

Teratogenicity: Not available.

Mutagenicity: Not available.

Synergistic materials: Not available.

Section 12 : ECOLOGICAL INFORMATION

Environmental toxicity: No data at this time.

Environmental fate: No data at this time.

Section 13 : DISPOSAL CONSIDERATIONS

Waste disposal: In accordance with local and federal regulations.

Section 14 : TRANSPORT INFORMATION

D.O.T. CLASSIFICATION: Not regulated.

Special shipping information: Not regulated.

Section 15 : REGULATORY INFORMATION

Canadian Regulatory Information

WHMIS classification: Not controlled.

DSL status: Not available.

USA Regulatory Information

SARA hazard catagories sections 311/312: Immediate (Acute) Health Hazard: No.
Delayed (Chronic) Health Hazard: No.
Fire Hazard: No.
Sudden Release of Pressure: No.
Reactive: No.

SARA Section 313: None

TSCA inventory: All components of this product are listed on the TSCA inventory.

NFPA

Health Hazard: 1

Flammability: 0

Reactivity: 0

HMIS

Health Hazard: 1

Flammability: 0

Physical hazard: 0

PPE: A

Section 16 : OTHER INFORMATION

Supplier MSDS date: 2006/07/14

Data prepared by: Global Safety Management
3340 Peachtree Road, #1800
Atlanta, GA 30326

Phone: 877-683-7460
Fax: (877) 683-7462

Web: www.globalsafetynet.com
Email: info@globalsafetynet.com.

General note: This material safety data sheet was prepared from information obtained from various sources, including product suppliers and the Canadian Center for Occupational Health and Safety.

LUMINOX MSDS

Section 1 : PRODUCT AND COMPANY IDENTIFICATION

Chemical family: Detergent.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800-255-3924.
813-248-0585 (outside of the United States).

Supplier: Same as manufacturer.

Product name: Luminox

Section 2 : INGREDIENT INFORMATION

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
34590-94-8	15-40	DIPROPYLENE GLYCOL MONOMETHYL ETHER	100 PPM (SKIN)	5400 UL/KG RAT ORAL 5.5 ML/KG RAT ORAL 10 ML/KG RABBIT DERMAL	NOT AVAILABLE
5131-66-8	5-10	PROPYLENE GLYCOL N-BUTYL ETHER	NOT AVAILABLE	5660 UL/KG RAT ORAL 3100 MG/KG RABBIT	NOT AVAILABLE

Section 2A: ADDITIONAL INGREDIENT INFORMATION

Note*: (supplier).
CAS# 34590-94-8: LD50 5134 mg/kg - rat oral.

Section 3 : HAZARD IDENTIFICATION

Route of entry: Skin contact, eye contact, inhalation and ingestion.

Effects of acute exposure

Eye contact: May cause pain.
Severe irritation.
May cause swelling.

Skin contact: May cause redness, swelling.
May cause slight irritation.

Inhalation: May cause headache.
Possible irritation of the upper respiratory tract.
May cause discomfort.
May cause headache.

Ingestion: May cause diarrhea.
May cause weakness.
May cause dizziness.
May cause headache.
Large amounts may cause red blood cell damage.

Effects of chronic exposure: See effects of acute exposure.

Section 4 : FIRST AID MEASURES

Skin contact: Remove contaminated clothing.
Wash thoroughly with soap and water.
Seek medical attention if irritation persists.

Eye contact: Check for and remove contact lenses.
Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.

Inhalation: Remove victim to fresh air. If breathing is difficult administer oxygen. If not breathing, have qualified person give artificial respiration. Obtain medical attention.

Ingestion: Get medical attention immediately.
Never give anything by mouth to an unconscious person.
Drink a large amount of water.

Section 5 : FIRE FIGHTING MEASURES

Flammability: Not flammable.

Conditions of flammability: Product will support combustion.
At temperatures at or above flash point.

Extinguishing media: Carbon dioxide, dry chemical, foam.
Water fog.

Special procedures: Self-contained breathing apparatus required.
Firefighters should wear the usual protective gear.
Use water to cool exposed containers.

Auto-ignition temperature: Not available.

Flash point (°C), method: >93.3 (>200F)

Lower flammability limit (% vol): Not available.

Upper flammability limit (% vol): Not available.

Explosion Data

Sensitivity to static discharge: Not available.

Sensitivity to mechanical impact: Not available.

Hazardous combustion products: Oxides of carbon (COx).
Hydrocarbons.

Rate of burning: Not available.

Explosive power: Container explosion may occur when heated.

Section 6 : ACCIDENTAL RELEASE MEASURES

Leak/Spill: Contain the spill.
Prevent entry into drains, sewers, and other waterways.
Wear appropriate protective equipment.
Soak up with an absorbent material.
Small amounts may be flushed into sanitary sewer.
Place in appropriate container for disposal.

Section 7 : HANDLING AND STORAGE

Handling procedures and equipment: Protect against physical damage.
Avoid breathing vapors/mists.
Wear personal protective equipment appropriate to task.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Keep away from excessive heat and open flame.
Launder contaminated clothing prior to reuse.

Storage requirements: Store away from incompatible materials.
Keep containers closed when not in use.
Avoid extreme temperatures.

Section 8 : EXPOSURE CONTROLS / PERSONAL PROTECTION

Precautionary Measures

Gloves/Type:

Neoprene or rubber gloves.
(with cuffs).

Respiratory/Type:

If TLV is exceeded, wear an approved respirator.

Eye/Type:

Chemical safety goggles with side-shields.

Footwear/Type: Safety shoes per local regulations.

Clothing/Type: As required to prevent skin contact.

Other/Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.
Mechanical ventilation for confined areas.
Ventilation should be corrosion-proof.

Exposure limit of material: Not available for mixture, see the ingredients section.

Section 9 : PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Liquid.

Appearance & odor: Characteristic odour.
Colourless.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): @ 20°C (68°F).
17

Vapour density (air=1): >1

Volatiles (%)

By volume: Not available.

Evaporation rate (butyl acetate = 1): < 1.

Boiling point (°C): 100 (212F)

Freezing point (°C): Not available.

pH: 7

Specific gravity @ 20 °C: (water = 1).
1.03

Solubility in water (%): Complete.

Coefficient of water\oil dist.: Not available.

VOC: < 50 mg/l

Chemical family: Detergent.

Section 10 : STABILITY AND REACTIVITY

Chemical stability: Product is stable under normal handling and storage conditions.

Conditions of instability: Open flames.
Extreme temperatures.

Hazardous polymerization: Will not occur.

Incompatible substances: Strong acids.
Strong oxidizing agents.

Hazardous decomposition products: See hazardous combustion products.

Section 11 : TOXICOLOGICAL INFORMATION

LD50 of product, species & route: > 5000 mg/kg rat oral.

LC50 of product, species & route: Not available.

Sensitization to product: Not available.

Carcinogenic effects: Not listed as a carcinogen.

Reproductive effects: Not available.

Teratogenicity: Not available.

Mutagenicity: Not available.

Synergistic materials: Not available.

Section 12 : ECOLOGICAL INFORMATION

Environmental toxicity: No data at this time.

Environmental fate: No data at this time.

Section 13 : DISPOSAL CONSIDERATIONS

Waste disposal: In accordance with local and federal regulations.

Section 14 : TRANSPORT INFORMATION

ADR CLASSIFICATION: Not regulated.

Special shipping information: Not regulated.

Section 15 : REGULATORY INFORMATION

Canadian Regulatory Information

WHMIS classification: D2B

DSL status: Not available.

USA Regulatory Information

SARA hazard catagories sections 311/312: Immediate (Acute) Health Hazard: Yes.
Delayed (Chronic) Health Hazard: No.
Fire Hazard: No.
Sudden Release of Pressure: No.
Reactive: No.

SARA Section 313: None

TSCA inventory: All components of this product are listed on the TSCA inventory.

EU Regulatory Information

European Union (EU) Regulatory Information: EU labeling required.

EU Risks: R36: Irritating to eyes.
R38: Irritating to skin.

EU Safety: S2:Keep out of the reach of children.
S24/25: Avoid contact with skin and eyes.

EINECS#: CAS# 34590-94-8 - EINECS# 252-104-2.
CAS# 5131-66-8 - EINECS# 252-104-2.

EU Symbols: Irritant.

NFPA

Health Hazard: 1

Flammability: 1

Reactivity: 0

HMIS

Health Hazard: 1

Flammability: 1

Physical hazard: 0

PPE: B

Section 16 : OTHER INFORMATION

Supplier MSDS date: 2005/03/14

Data prepared by: Global Safety Management
3340 Peachtree Road, #1800
Atlanta, GA 30326

Phone: 877-683-7460
Fax: (877) 683-7462

Web: www.globalsafetynet.com
Email: info@globalsafetynet.com.

General note: This material safety data sheet was prepared from information obtained from various sources, including product suppliers and the Canadian Center for Occupational Health and Safety.

APPENDIX E

STANDARD OPERATING PROCEDURES

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SHE Volume VI: Accident Investigation

1.0 INTRODUCTION

Accident investigation is a useful tool for discovering the cause(s) of an accident and preventing future accidents. A thorough investigation of the contributing circumstances that might have caused an accident (including both injury accidents and noninjury accidents [incidents]) is crucial. The real or potential extent of injury or property damage dictates the thoroughness of the investigation. Causative factors are then evaluated to determine appropriate corrective action. Detailed corrective action information is provided in the *Injury and Illness Prevention Program, Volume I*, of this manual.

Accident investigation is not to be confused with injury or illness reporting (discussed in *SOP A-3, Injury or Illness Reporting*).

2.0 SCOPE

This procedure applies to accidents that occur in both office operations or on field jobsites. This procedure pertains to accidents involving AMEC Earth & Environmental, Inc. (AEE) personnel; personnel subcontracted to AEE; and visitors, including clients who may work on or visit AEE jobsites.

AEE reserves the right to investigate and document any accident involving a subcontractor.

3.0 RESPONSIBILITIES

3.1 Corporate Safety, Health, and Environment Director

The Corporate Safety, Health, and Environment Director (Corporate SHE Director) manages an accident investigation, either parallel to or in conjunction with the Unit Manager (UM), Project Manager (PM)/Field Manager (GM)/Supervisor, as the circumstances warrant. In instances of a severe injury or fatality, or a potentially catastrophic near miss, the Corporate SHE Director will investigate independently and report to the Executive Vice President of Operations. The Corporate SHE Director serves in an advisory capacity for all accident investigations. The Corporate SHE Director also periodically analyzes the accident investigation data to identify underlying causes and general patterns.

3.2 Unit Manager

The UM is responsible for initiation and oversight of accident investigations. Depending on the nature and breadth of the investigation, the UM may lead with the accident investigation.

3.3 Project Manager/Field Manager/Supervisor

The PM/FM/Supervisor is responsible for conducting accident investigations relating to projects or activities under his/her supervision. The PM/FM/Supervisor is also responsible for ensuring that corrective actions (identified through the accident investigation) are implemented within the targeted time frame and that the appropriate injury/illness or incident reports are made.

3.4 Safety, Health, and Environment Coordinator/Site Health and Safety Coordinator

The Safety, Health, and Environment Coordinator (SHE Coordinator)/Site Health and Safety Coordinator (SHSC) assists the PM/Supervisor during accident investigations and verifies the PM/Supervisor's findings.

3.5 Employees and Subcontractors

Employees and subcontractor employees are responsible for cooperating with accident investigators during an investigation and for being truthful and answering questions to the best of their recollection. Employees and subcontractor employees shall also comply with corrective action recommendations within the targeted time frame.

4.0 GOALS OF ACCIDENT INVESTIGATION

The PM/FM/Supervisor should make a personal investigation of all accidents because:

- An investigation is the best way to determine the true cause of an accident.
- The PM/FM/Supervisor should know what the employee was doing, the proper way to do it, and what the employee probably did or did not do to cause the accident.
- The PM/FM/Supervisor is best qualified to evaluate the information gathered and determine the cause of the accident.
- The PM/FM/Supervisor has the authority to investigate the accident and initiate corrective action.

5.0 SERIOUS INCIDENTS

In the event of a serious incident, an accident investigation must be documented and investigated by the PM/FM/Supervisor, and/or UM. A serious incident is defined as:

- A serious injury (hospitalization, loss of body part or any other injury that is life-threatening in nature) or death.
- An occurrence that requires reporting to a regulatory agency, e.g., OSHA or EPA.
- An occurrence that could lead to an enforcement action.
- Issuance of an enforcement action, e.g., citation and/or fine.
- An injury to a member of the public or a visitor.

Documentation of the serious incident is addressed in SOP A-3, Injury and Illness Reporting. Completion of the First Alert Report form (see SOP A-3) and submission to the AMEC Americas SHE Director, AMEC Americas Director of Communications, the AEE Corporate SHE Director, and Executive Vice President of operations constitutes the first step of documentation. Investigation procedures and tools are addressed in this SOP.

6.0 INVESTIGATIVE PROCEDURES

The PM/FM/Supervisor shall conduct an investigation of all incidents, injuries, and work-related illnesses; talk with the victim and/or coworkers who witnessed the accident or conditions; and review the medical findings report, if available. Each investigation shall be conducted as soon after the accident/incident as possible. Delays of even a few hours can allow for the destruction/alteration of evidence (whether intentional or unintentional).

Fairness and impartiality are essential during the investigation. The purpose of the investigation is to obtain information and prevent a recurrence of the incident/accident, not to place blame.

6.1 Reporting

The PM/FM/Supervisor shall report verbally and in writing any injury, illness, or incident on the appropriate forms and to the appropriate parties as defined in SOP A-3.

6.2 Investigating

The investigation phase of the accident investigation procedure is initiated in response to reports of an accident (either injury or noninjury). Important information that should be obtained through the investigation includes:

- project
- location of accident
- employee(s) involved
- narrative description of the accident
- equipment associated with the accident
- task being performed when accident happened
- time factors (e.g., time of day, hours into shift, type of shift)
- preventive measures
- characteristics of injury or property damage

6.2.1 Interviewing

After reviewing the Supervisor's Report of Injury or Illness, First Aid Incident Report, and/or Incident Report, (see SOP A-3), or after verbal report of an accident, the PM/FM/Supervisor and SHE Coordinator/SHSC shall interview individually witnesses to the accident. It is recommended to prepare a set of questions and ask each witness to answer the same questions. The details of the interview shall be recorded on the Accident Investigation Interview Report (Attachment 1). The completed form shall be forwarded to the UM and Corporate SHE Director.

6.2.2 Identifying Causal Factors and Corrective Actions

The PM/FM/Supervisor may identify contributing factors to the accident using the National Safety Council's *Guide for Identifying Causal Factors and Corrective Actions* (Attachment 2). Completed guides shall be forwarded to the appropriate UM, SHE Coordinator/SHSC, and Corporate SHE Director.

Possible corrective actions are suggested on the guide, but keep in mind that these are not the only possible corrective actions that may be implemented. The recommended (and mandatory) corrective action(s) will be determined by the PM/FM/Supervisor, with the assistance of the SHE Coordinator/SHSC and Corporate SHE Director (when necessary), and stated in the appropriate column of the guide.

Corrective actions will be selected based upon effectiveness, cost versus benefit, feasibility, reliability, acceptance, effect on productivity, time required to implement, and any other factor deemed significant. Corrective actions can be monitored for implementation and completion using the Corrective Action Program Schedule (Attachment 3).

6.3 Analysis

The Corporate SHE Director periodically analyzes the accident investigation data for the purpose of identifying underlying causes or general patterns. The analysis will also identify inadequate policies, procedures, or management systems that are not always readily evident when reviewing each individual accident.

6.4 Documentation

Accident investigations may be documented using interviews and photographs, and by sequestering faulty tools and equipment that were involved, as well as by completing the appropriate forms (see Section 6.0, Record Keeping).

7.0 RECORD KEEPING

An Accident Investigation Interview Report (Attachment 1), *Guide for Identifying Causal Factors and Corrective Actions* (Attachment 2), and Corrective Action Program Schedule (Attachment 3) will be completed for work-related incident, injury, or illness that occurs.

8.0 REFERENCES

- Fed-OSHA. 2000. 29 CFR 1904, *Recording and Reporting Occupational Injuries and Illnesses*.
- Cal-OSHA. 2000. 8 CCR 3203, *Injury and Illness Prevention Program*.
- National Safety Council. 1997. Accident Prevention Manual for Business and Industry: Administration and Programs. 10th ed.

Accident Investigation Interview Report

Name of Interviewer: _____ Name of Interviewee: _____

Department of Interviewer: _____ Department of Interviewee: _____

Project: _____ Time shift began: _____ a.m/p.m.

Project activity during this shift: _____

Accident date: _____ Time of accident: _____ a.m/p.m.

Date accident was reported: _____

Any injuries involved? Yes ❑ No ❑ _____

Location of accident (include address, city, county, zip code): _____

_____

Name of witnesses: _____

_____

_____

_____

What was/were employee(s) doing when accident occurred? Be specific (e.g., walking, lifting, operating machinery, etc.)?

_____

_____

_____

Please describe fully the events that resulted in the accident. Tell what happened and how it happened (do not describe the nature of the injury or property damage).

_____

_____

_____

What machine, tool, or object was most closely connected to the accident? (e.g, machine employee struck against or which struck him, vehicle employee was driving)?

_____

_____

_____

Nature of injury or property damage.

_____

_____

_____

Additional Information or drawings can be included on the reverse side of this form.

Forward completed form to the appropriate Unit Manager and Corporate SHE Director.

Guide for Identifying Causal Factors and Corrective Actions

Project/Department: _____ Investigators: _____

Accident Date/Time: _____ Date/Time of Investigation: _____

PART 1 - EQUIPMENT

Answer questions by placing an *x* in the appropriate box or circle (Y=Yes, N=No)

○ Y □ N **1.0 WAS A HAZARDOUS CONDITION(S) A CONTRIBUTING FACTOR?**

	CAUSAL FACTORS	COMMENTS	POSSIBLE CORRECTIVE ACTIONS	RECOMMENDED CORRECTIVE ACTIONS	TARGET COMPLETION DATE
○ Y □ N	1.1 Did any defect(s) in equipment/ tool(s)/material contribute to hazardous condition(s)?		Review procedure for inspecting, reporting, maintaining, repairing, replacing, or recalling defective equipment/tool(s)/material used.		
□ Y ○ N	1.2 Was the hazardous condition(s) recognized? If yes, answer A and B. If no, proceed to 1.3.		Perform job hazard analysis. Improve employee ability to recognize existing or potential hazardous conditions. Provide test equipment, as required, to detect hazard. Review any change or modification of equipment/tool(s)/ material.		
□ Y ○ N	A. Was the hazardous condition(s) reported?		Train employees in reporting procedures. Stress individual acceptance of responsibility.		
□ Y ○ N	B. Was employee(s) informed of the hazardous condition(s) and the job procedures for dealing with it as an interim measure?		Review job procedures for hazard avoidance. Review supervisory responsibility. Improve supervisor-employee communications. Take action to remove or minimize hazard.		
□ Y ○ N	1.3 Was there an equipment inspection procedure(s) to detect the hazardous condition(s)?		Develop and adopt procedures (for example, an inspection system) to detect hazardous conditions. Conduct test.		
□ Y ○ N	1.4 Did the existing equipment inspection procedure(s) detect the hazardous condition(s)?		Review procedures. Change frequency or comprehensiveness. Provide test equipment as required. Improve employee ability to detect defects and hazardous conditions. Change job procedures as required.		
□ Y ○ N	1.5 Was the correct equipment/ tool(s)/material used?		Specify correct equipment/tool(s)/ material in job procedures.		
□ Y ○ N	1.6 Was the correct equipment/tool(s)/ material readily available?		Provide correct equipment/tool(s)/ material. Review purchasing specifications and procedures. Anticipate future requirements.		
□ Y ○ N	1.7 Did employee(s) know where to obtain equipment/tool(s)/material required for the job?		Review procedures for storage, access, delivery, or distribution. Review job procedures for obtaining equipment/ tool(s)/material.		
○ Y □ N	1.8 Was substitute equipment/tool(s)/ material used in place of correct one?		Provide correct equipment/tool(s)/ material. Warn against use of substitutes in job procedures and in job instruction.		
○ Y □ N	1.9 Did the design of the equipment/ tool(s) create operator stress or encourage operator error?		Review human factors engineering principles. Alter equipment/tool(s) to make it more compatible with human capability and limitations. Review purchasing procedures and specifications. Check out new equipment and job procedures involving new equipment before putting into service. Encourage employees to report potential hazardous conditions created by equipment design.		
○ Y □ N	1.10 Did the general design or quality of the equipment/tool(s) contribute to a hazardous condition?		Review criteria in codes, standards, specifications, and regulations. Establish new criteria as required.		
○	1.11 List other causal factors in "Comments" column.				

SOURCE: National Safety Council, Accident Prevention Manual for Business and Industry: Administration and Programs, 1988

PART 2 - ENVIRONMENTAL

2.0 WAS THE LOCATION/POSITION OF EQUIPMENT/MATERIALS/EMPLOYEE(S) A CONTRIBUTING FACTOR ? (Y ○ N ☐)

	CAUSAL FACTORS	COMMENTS	POSSIBLE CORRECTIVE ACTIONS	RECOMMENDED CORRECTIVE ACTIONS	TARGET COMPLETION DATE
Y ○ N ☐	2.1 Did the location/position of equipment/material/employee(s) contribute to a hazardous condition?		Perform job hazard analysis. Review job procedures. Change the location, position, or layout of the equipment. Change position of employee(s). Provide guardrails, barricades, barriers, warning lights, signs, or signals.		
Y ☐ N ○	2.2 Was the hazardous condition(s) recognized? If yes, answer A and B. If no, proceed to 2.3.		Perform job hazard analysis. Improve employee ability to recognize existing or potential hazardous conditions. Provide test equipment, as required, to detect hazard. Review any change or modification of equipment/tool(s)/ material.		
Y ☐ N ○	A. Was the hazardous condition(s) reported?		Train employees in reporting procedures. Stress individual acceptance of responsibility.		
Y ☐ N ○	B. Was employee(s) informed of the job procedure for dealing with the hazardous condition as an interim action?		Review job procedures for hazard avoidance. Review supervisory responsibility. Improve supervisor-employee communications. Take action to remove or minimize hazard.		
Y ☐ N ○	2.3 Was employee(s) supposed to be in the vicinity of the equipment/material?		Review job procedures and instruction. Provide guardrails, barricades, barriers, warning lights, signs, or signals.		
Y ☐ N ○	2.4 Was the hazardous condition created by the location/position of equipment/material visible to employee(s)?		Change lighting or layout to increase visibility of equipment. Provide guard-rails, barricades, barriers, warning lights, signs, or signals, floor stripes, etc.		
Y ☐ N ○	2.5 Was there sufficient workspace?		Review workspace requirements and modify as required.		
Y ○ N ☐	2.6 Were environmental conditions a contributing factor (for example, illumination, noise levels, air contaminant, temperature extremes, ventilation, vibration, radiation)?		Monitor, or periodically check environmental conditions as required. Check results against acceptable levels. Initiate action for those found unacceptable.		
○	2.7 List other causal factors in "Comment" column.				

PART 3 - PEOPLE

3.0 WAS THE JOB PROCEDURE(S) USED A CONTRIBUTING FACTOR? (Y ○ N ☐)

	CAUSAL FACTORS	COMMENTS	POSSIBLE CORRECTIVE ACTIONS	RECOMMENDED CORRECTIVE ACTIONS	TARGET COMPLETION DATE
Y ☐ N ○	3.1 Was there a written or known procedure (rules) for this job ?		Perform job hazard analysis and develop safe job procedures.		
Y ☐ N ○	If yes, answer A, B, and C. If no, proceed to 3.2.				
Y ☐ N ○	A. Did job procedures anticipate the factors that contributed to the accident?		Perform job hazard analysis and change job procedures.		
Y ☐ N ○	B. Did employee(s) know the job procedure?		Improve job instruction. Train employees in correct job procedures.		
Y ○ N ☐	C. Did employee(s) deviate from the known job procedure?		Determine why. Encourage all employees to report problems with an established procedure to supervision. Review job procedure and modify if necessary. Counsel or discipline employee. Provide closer supervision.		
Y ☐ N ○	3.2 Was employee(s) mentally and physically capable of performing the job?		Review employee requirements for the job. Improve employee selection. Remove or transfer employees who are temporarily, either mentally or physically, incapable of performing the job.		
Y ○ N ☐	3.3 Were any tasks in the job procedure too difficult to perform (for example, excessive concentration or physical demands)?		Change job design and procedures.		
Y ○ N ☐	3.4 Is the job structured to encourage or require deviation from job procedures (for example, incentive, piecework, work pace)?		Change job design and procedures.		
○	3.5 List other causal factors in “Comments” column.				

3.6 WAS LACK OF PERSONAL PROTECTIVE EQUIPMENT OR EMERGENCY EQUIPMENT A CONTRIBUTING FACTOR IN THE INJURY? (Y ○ N ☐)

SOURCE: National Safety Council, Accident Prevention Manual for Business and Industry: Administration and Programs, 1988

PART 3 - PEOPLE (Continued)

Answer questions by placing an *x* in the appropriate box or circle (Y=Yes, N=No)

CAUSAL FACTORS	COMMENTS	POSSIBLE CORRECTIVE ACTIONS	RECOMMENDED CORRECTIVE ACTIONS	TARGET COMPLETION DATE
NOTE: THE FOLLOWING CAUSAL FACTORS RELATE TO THE INJURY.				
☐ Y ◯ N 3.7 Was appropriate personal protective equipment (PPE) specified for the task or job? If yes, answer A, B, and C. If no, proceed to 3.8.		Review methods to specify PPE requirements.		
☐ Y ◯ N A. Was appropriate PPE available?		Provide appropriate PPE. Review purchasing and distribution procedures.		
☐ Y ◯ N B. Did employee(s) know that wearing specified PPE was required?		Review job procedures. Improve job instruction.		
☐ Y ◯ N C. Did employee(s) know how to use and maintain the PPE?		Improve job instruction.		
☐ Y ◯ N 3.8 Was the PPE used properly when the injury occurred?		Determine why and take appropriate action. Implement procedures to monitor and enforce use of PPE.		
☐ Y ◯ N 3.9 Was the PPE adequate?		Review PPE requirements. Check standards, specification, and certification of the PPE.		
☐ Y ◯ N 3.10 Was emergency equipment specified for this job (for example, emergency showers, eyewash fountains)? If yes, answer the following. If no, proceed to Part 4.		Provide emergency equipment as required.		
☐ Y ◯ N A. Was emergency equipment readily available?		Install emergency equipment at appropriate locations.		
☐ Y ◯ N B. Was emergency equipment properly used?		Incorporate use of emergency equipment in job procedures.		
☐ Y ◯ N C. Did emergency equipment function properly?		Establish inspection/monitoring system for emergency equipment. Provide for immediate repair of defects.		
◯ 3.11 List other causal factors in "Comment" column.				

PART 4 - MANAGEMENT

◯ Y ☐ N **4.0 WAS A MANAGEMENT SYSTEM DEFECT A CONTRIBUTING FACTOR?**

CAUSAL FACTORS	COMMENTS	POSSIBLE CORRECTIVE ACTIONS	RECOMMENDED CORRECTIVE ACTIONS	TARGET COMPLETION DATE
◯ Y ☐ N 4.1 Was there a failure by supervision to detect, anticipate, or report a hazardous condition?		Improve supervisor capability in hazard recognition and reporting procedures.		
◯ Y ☐ N 4.2 Was there a failure by supervision to detect or correct deviations from job procedure?		Review job hazard analysis and job procedures. Increase supervisor monitoring. Correct deviations.		
☐ Y ◯ N 4.3 Was there a supervisor/employee review of hazards and job procedures for tasks performed infrequently? (Not applicable to all accidents.)		Establish a procedure that requires a review of hazards and job procedures (preventive actions) for tasks performed infrequently.		
☐ Y ◯ N 4.4 Was supervisor responsibility and accountability defined and understood?		Define and communicate supervisor responsibility and accountability. Test for understandability and acceptance.		
☐ Y ◯ N 4.5 Was supervisor adequately trained to fulfill assigned responsibility in accident prevention?		Train supervisors in accident prevention fundamentals.		
◯ Y ☐ N 4.6 Was there a failure to initiate corrective action for a known hazardous condition that contributed to this accident?		Review management safety policy and level of risk acceptance. Establish priorities based on potential severity and probability of recurrence. Review procedure and responsibility to initiate and carry out corrective actions. Monitor progress.		
◯ 4.7 List other causal factors in "Comments" column.				

ⓧ **ITEM IS A CAUSAL FACTOR**

☒ **ITEM IS NOT A CAUSAL FACTOR**

SOURCE: National Safety Council, Accident Prevention Manual for Business and Industry: Administration and Programs, 1988

Corrective Action Program Schedule

Location _____ Attention _____ Date _____

Item No.	Description of Item	Assigned To	Date Assigned	Completion Target	Date Completed	Status

Cold Stress Control

1.0 PURPOSE

The purpose of this procedure is to provide information on the causes, detection, prevention, and treatment of cold stress.

2.0 SCOPE

This procedure should be utilized by all AMEC Earth & Environmental, Inc. (AEE) on-site personnel and subcontractors working on AEE field projects where cold stress poses a hazard.

3.0 RESPONSIBILITIES

3.1 Site Health and Safety Coordinator/Project Manager

The Site Health and Safety Coordinator (SHSC) and Project Manager (PM) are responsible for implementing these procedures.

3.2 Corporate Safety, Health, and Environment Director

The Corporate Safety, Health, and Environment Director (Corporate SHE Director) is responsible for auditing or evaluating on-site activities to ensure that these procedures are implemented.

4.0 PROCEDURES

4.1 Introduction

A cold environment can reduce the temperature of the body and cause shivering, reduced mental alertness, and sometimes even loss of consciousness. Cold can cause adverse effects before a problem is even realized.

When properly protected, a healthy worker can function efficiently and safely in both natural and man-made cold environments.

Cool conditions, especially with high winds, cold water, convection, conduction, and evaporation, are sources of cold that can affect workers.

The effects of cold on the body depend on how well the skin is insulated from the environment. This insulating barrier determines the rate of heat loss from the body by radiation, convection, conduction, and evaporation.

Any combination of low temperature and air movement will have a cooling effect on the body. The faster the air movement, the greater the effect. These environmental factors determine the rate at which the body cools by giving off or exchanging heat with the surrounding environment.

4.2 How the Body Loses Heat

Conduction, convection, evaporation, and radiation are means by which the body loses heat.

4.2.1 Conduction

Conduction is the transfer of heat between objects that are in contact with each other. For example, touching a piece of metal that is cooler than skin temperature will conduct heat away from the body.

4.2.2 Convection

Convection is the transfer of heat by movement of the thin layer of insulating air next to the skin. The air movement causes a cooling action. The stronger the wind, the more intense the cold effect will be. A strong current of air will blow the insulating air away and intensify the cold effect. A good example of how convection works is the familiar wind chill factor. A calm day with a temperature of 20 degrees Fahrenheit (°F) will feel cold. But if you add a 30-mile-per-hour wind to that same temperature, the day will feel bitterly cold (equivalent to about -18°F). For more specific information on the cooling power of wind, see the table in Attachment 1.

4.2.3 Evaporation

Evaporation is the absorption of moisture into the air. Evaporation of moisture from the skin cools the body. The rate of this evaporative cooling is significantly increased by convection or air movement across wet skin and/or wet clothing. The amount of evaporation is also increased by low humidity.

4.2.4 Radiation

Radiation is the transfer of heat to cooler objects in the surrounding environment. The heat is transferred through space between objects that are not in direct contact with each other. For example, the heat from a broiler will warm objects in its surrounding area. In the same way, the body's heat will transfer to a cooler environment.

When conduction, convection, evaporation, radiation, cold air temperatures, or fast air movement occur, the hazard of cold stress illness is present.

4.3 How the Body Handles Cold

The human body is designed to function best at a constant temperature of approximately 98.6^{o}F. The body does this by gaining heat from food and muscular work, or by losing it through radiation and sweating. The body's first physiological defense against cold is constriction of the blood vessels of the skin and/or shivering.

Cold first affects the skin. The chilled blood circulates and the body begins two processes - one to conserve heat already in the body, the other to generate new heat.

4.3.1 Constriction of Peripheral Blood Vessels

Heat conservation is accomplished by causing outer blood vessels to constrict, which reduces the heat loss from the surface of the skin and makes the outer area an insulator. This constriction also inhibits the function of the sweat glands, preventing heat loss by evaporation.

If someone becomes fatigued during physical activity, he or she will be more prone to heat loss. As exhaustion approaches, sudden enlargement of the blood vessels can occur, resulting in rapid loss of heat.

4.3.2 Blood Thickening

When it becomes necessary for the body to conserve heat, the kidneys are stimulated to produce about three times the normal amount of urine, which increases the oxygen level of the blood and reduces both the water and salt levels in the body. As a result, the blood becomes thicker and cannot reach the blood vessels near the skin, which makes more of the oxygen in the blood available as fuel for the muscles to generate heat and energy.

4.3.3 Increased Heart Rate and Glucose Production

The body produces glucose (blood sugar) to provide additional fuel. The heart also begins to beat faster, which sends oxygen- and glucose-rich blood to the muscles and organs where they are needed.

4.3.4 Involuntary Shivering

Involuntary shivering begins in an attempt to produce more heat by rapid contractions of the muscles, much as heat is generated by strenuous activity. Shivering raises the body's metabolic rate. As the metabolic rate increases, the appetite increases, usually followed by calorie intake (eating), which pours "fuel" into the body's "furnace."

4.4 The Safety Effects of Cold Stress

The frequency of accidents seems to be higher in cold environments. Nerve impulses are slowed and we react more sluggishly, fumble with our hands, and become clumsy. Additional clothing and gloves may hinder movement. There are also safety problems common to cold environments. They include ice or snow blindness, reflections from snow interfering with vision, and the possibility of burns from contact with cold metal surfaces.

4.5 Monitoring the Cold Environment

Common sense should dictate how much clothing to wear and when to get into a warm area in most cases. However, some work environments require more complex evaluation.

Evaluating a work environment to determine the degree of cold stress involves measuring:

- air temperature
- wind speed
- the amount of energy expended by the workers

Air temperature can be measured by an ordinary bulb thermometer. Wind speed is measured by a device called a thermoanemometer, which senses and measures air motion by the rate of cooling of a hot wire at the tip of a probe.

The Threshold Limit Value (TLV), published by the American Conference of Governmental Industrial Hygienists (ACGIH) states that the deep body core temperature should be prevented from falling below 98.6°F. For a single, occasional exposure to a cold environment, a drop in core temperature to no lower than 95°F should be permitted. The ACGIH Chill Temperature Chart relating dry bulb air temperature and wind velocity is presented in the table in Attachment 1. The recommended ACGIH TLVs for properly clothed workers for periods of work at temperatures below freezing are shown in the table in Attachment 2. TLVs are intended to protect workers from the severest effects of cold stress and to prevent injury to body extremities.

Workplace monitoring is required as follows:

- Suitable temperature measurements should be conducted at any workplace where the environment temperature is below 16 degrees Centigrade (°C) (60.8°F) so that overall compliance with the requirements of the TLV can be maintained.
- Whenever the air temperature at a workplace falls below -1°C (30.2°F), the dry bulb temperature should be measured and recorded at least every 4 hours.
- The wind speed should also be recorded at least every 4 hours whenever the rate of air movement exceeds 2 meters per second (5 miles per hour). Contact the local meteorological station (e.g., local airport) for wind speed and direction data.
- In outdoor work situations, the wind speed should be measured and recorded together with the air temperature whenever the air temperature is below -1°C (30.2°F).
- The equivalent chill temperature should be obtained from the table in Attachment 1 in all cases where air movement measurements are required; it should be recorded whenever the equivalent chill temperature is below -7°C (19.4°F).

Employees are excluded from work in cold at -1°C (30.2°F) or below if they are suffering from diseases or taking medication that interferes with normal body temperature regulation or reduces tolerance to work in cold environments. Workers who are routinely exposed to temperatures below -24°C (-11.2°F) with wind speeds less than 5 miles per hour, or air temperatures below -18°C (0°F) with wind speeds above 5 miles per hour, shall be medically certified as suitable for such exposures.

4.6 Cold Disorders

The main factors contributing to cold injury are exposure to humidity and high winds, contact with wetness or metal, inadequate clothing, age, and general health. Physical conditions that worsen the effects of cold are allergies, vascular disease, excessive smoking and drinking, and specific drugs and medicines. For a quick reference of cold illnesses, symptoms, possible underlying causes, and treatment, see Table 1.

4.7 First Aid Treatment

4.7.1 First Aid Procedures for Hypothermia

The main objective in treating hypothermia is rewarming the body core evenly and without delay. However, doing it too rapidly can further disrupt body functions, such as circulation. If medical help is not immediately available, the first thing to do is get the victim out of the wind, snow, or rain. Keep the victim's use of energy to a minimum, but keep him or her awake, if possible. Get the victim into dry clothes and wrap a blanket, sleeping bag, or newspapers around him or her. Avoid any unnecessary movement of the victim.

In a case of mild hypothermia, where the victim is conscious, the body may be packed with heat packs on wet towels - no warmer than 105°F - behind the neck, at the groin, and in the armpits. Give sweet, warm, caffeine-free, nonalcoholic drinks to conscious victims. Do not rewarm the extremities and the core at the same time. The sudden return of the cool blood pooled in the extremities to the heart can produce a drop in core temperature and cause shock.

As much as possible, try to avoid moving, because a hypothermia victim's exertion from walking could aggravate circulation problems.

All victims of hypothermia should receive professional medical treatment. Active rewarming without appropriate medical support could be hazardous to the victims.

Provide lifesaving actions as necessary - mouth-to-mouth resuscitation or cardiopulmonary resuscitation (CPR), if you are trained to do so. A hypothermia victim should never be given up for dead in the field. Many hypothermia victims unconscious for several minutes have been fully revived with minimal damage.

4.7.2 First Aid Procedures for Frostbite

First aid for frostbite is designed to prevent further tissue damage by warming the affected area rapidly and maintaining respiration. Accepted procedures are listed under Attachment 3, "Cold Illnesses."

Very minor frostbite of the outer layer of skin should be treated as soon as possible in the field. Deep frostbite should not be thawed in the field, or there is a possibility that the thawed tissue will refreeze. Thawed tissue will have impaired circulation and will be more susceptible to refreezing, infection, and tissue death. Freezing preserves tissues, so severe frostbite is best left in a frozen state until proper medical attention can be obtained. Protect the frozen area from additional injury.

Do not try to rewarm frostbitten areas by rubbing, exercise, exposure to open fires, cold water soaks, or rubbing with snow. This will only damage the tissue further.

Table 1
COLD ILLNESSES

Cold Illness	Symptoms	Possible Underlying Causes	Treatment
Hypothermia	• Pain in the extremities • Uncomfortable shivering and the sensation of cold • Reduction of body core temperature • Cool skin • Rigid muscles • Slowing of heart rate • Weakening of pulse • Low blood pressure • Irritability of heart muscle • Sometimes heart beating abnormally in respect to strength and rhythm • Slow irregular breathing • Memory lapses • Vague slow slurred speech • Drowsiness • Incoherence	• Exposure to low air temperatures, high wind, inadequate clothing or water immersion • Underlying disease, such as heart or blood vessel disease • Old age • Allergies • Alcoholism • Recent alcohol consumption • Smoking • Medications that affect the temperature-regulation mechanism • Exhaustion • Sedative drugs • Dehydration	• Get the victim out of the wind, snow, or rain • Keep use of energy to a minimum • Keep person awake • Victim should be handled on a stretcher if movement is necessary • Strip off all wet clothes • Get person into dry clothes • Wrap blanket around victim • In conscious victims, body should be packed with heat packs or wet towels no warmer than 105˚F, behind the neck, groin, and armpits • Do not rewarm

	• Diminished reaction time • Diminished coordination • Diminished dexterity		extremities and the core at the same time • Provide lifesaving actions as necessary - mouth-to-mouth resuscitation or cardiopulmonary resuscitation (CPR), if trained • If blankets, sleeping bag, newspapers, heat packs, or wet towels are not available, rewarm victim with body heat • Give sweet warm drinks to conscious victims • Do not immerse victim in a warm water bath • Take victim to the hospital by calling an ambulance and telling them that a cold illness emergency exists
Raynaud's Syndrome	• Fingers turn white and stiff • Intermittent blanching and reddening of the fingers and toes • Affected area tingles and becomes very red or reddish purple	• Exposure to low air temperature, high winds • Inadequate clothing • Underlying disease such as blood vessel disease	• Remove to warmer area • Consult physician
Acrocyanosis	• Hands and feet are cold, blue, and sweaty	• Exposure to cold • Inadequate clothing • Underlying disease such as blood vessel	• Remove to warmer area • Loosen tight clothing • Consult

		disease	physician
Frostnip	• Skin turns white	• Exposure to cold	• Remove to warmer area • Refer to treatment for frostbite
Chilblain	• Recurrent localized itching, swelling, and painful inflammation of the fingers, toes, or ears • Severe spasms	• Inadequate clothing • Exposure to cold and moisture • Underlying disease such as blood vessel disease	• Remove to warmer area • Consult physician
Trench Foot	• Edema • Tingling, itching • Severe pain • Blistering	• Exposure to cold and dampness	• Remove to warmer area • Consult physician • Refer to frostbite treatment
Frostbite	• Skin changes color to white or grayish yellow, progresses to reddish violet, and ultimately turns black • Burns at first • Blisters • Affected part cold, numb, and tingling	• Exposure to cold • Lack of acclimatization • Age (very young or old) • Physically disabled or mentally impaired • Underlying diseases, such as heart and blood vessel disease	• Cover the frozen part • Provide extra clothing and blankets • Bring victim indoors as soon as possible • Place the frozen part in warm water at a temperature of 102°F to 105°F or rewarm with warm packs • If affected part has been thawed and refrozen, do not use water, rewarm at room temperature • If no water is available, wrap gently in a sheet and blanket • Discontinue

			warming the victim as soon as the affected part becomes flushed and swelling develops after thawing • Exercise part after rewarming, but do not allow victim to walk after the affected part thaws • Place dry sterile gauze between affected fingers and toes, do not apply other dressings unless victim is to be transported for medical aid • If travel is necessary, warm affected parts with sterile or clean cloths during transportation • Elevate the frostbitten parts and protect them from contact with bedclothes • Give sweet, warm fluid if victim is conscious and not vomiting; no alcoholic or caffeine beverages • In absence of warm water, frostbitten fingers should be placed uncovered under the armpits next to skin • If the toes or

			heels are affected, footwear should be covered with dry socks • If above measures for feet are not possible, place bare frostbitten feet against the belly of a companion or under clothing • If the cheeks are frostbitten, cover the affected areas with warm hands until the pain returns • Following rewarming, wounds should be treated in open and sterile manner; bandages hamper the circulation • Deep frostbite should not be thawed in the field • Do not rub the part with anything (including snow and ice), apply heat lamp or hot water bottles, place injured part near a hot stove, or break blisters • Obtain medical assistance as soon as possible

4.8 Preventing Cold Stress

In preventing cold stress, factors relating both to the individual and the environment must be taken into account. For the individual, that means acclimatization, adherence to work practices, water and salt replacement, medical screening, continuing medical supervision, proper work clothing, training, and

education. Controlling the environment involves engineering controls, work practices, work-rest schedules, environmental monitoring, and monitoring the wind chill temperature.

4.8.1 Cold Stress Work Practices

- Older workers, or workers with circulatory problems, need to be extra careful in the cold. Additional insulating clothing and reduced exposure time should be considered for these workers.
- Obese and chronically ill people need to make a special effort to follow preventive measures.
- Sufficient sleep and good nutrition are important for maintaining a high level of tolerance to cold.
- If possible, the most stressful tasks should be done during the warmer parts of the day. Double shifts and overtime should be avoided. Rest periods should be extended to cope with increases in cold stress.
- A worker should go immediately to a warm shelter if any of the following symptoms are spotted: the onset of heavy shivering, frostnip, the feeling of excessive fatigue, drowsiness, irritability, and euphoria.
- The outer layer of clothing should be removed when entering a heated shelter. If possible, a change of dry work clothing should be provided to prevent people from returning to work with wet clothing. If this is not feasible, the remaining clothing should be loosened to permit sweat to evaporate.
- Alcohol should not be consumed while in the warmer environment.
- Anyone on medications such as blood pressure control or water pills should consult a physician about possible side effects from cold stress.
- It is strongly recommended that workers suffering from diseases or taking medication that interferes with normal body temperature regulation, or that reduces tolerance of cold, not be permitted to work in temperatures of 30°F or below.
- It is a good idea for people to weigh themselves at the beginning and end of the workday to check for weight loss that might occur from progressive dehydration.

4.8.2 Acclimatization

Some degree of acclimatization may be reached in cold environments, but it is usually not significant.

With sufficient persistent exposure to cold, the body undergoes some changes that increase comfort and reduce the risk of cold injury slightly. However, these physiological changes are usually small and require repeated, uncomfortably cold exposures to induce them.

Some people do not acclimatize readily, such as those who are physically unfit, older, obese, taking medications, or using alcohol or drugs.

4.8.3 Fluid Replacement

Working in cold areas causes high water losses through the skin and lungs due to the dryness of the air. Increased fluid intake is essential to prevent dehydration, which affects the flow of blood to the extremities and increases the risk of cold injury.

Warm, sweet, caffeine-free, nonalcoholic drinks and soup should be available at the work site for fluid replacement and caloric energy.

4.8.4 Salt Requirements

The body needs a certain amount of salt and other electrolytes to function properly. However, using salt tablets is not recommended. Salt tablets cause stomach irritation, which may include nausea and vomiting. A normal, balanced diet should take care of salt needs. In the event that salt intake needs to be increased, utilize electrolyte replacement fluids like Gatorade™. Anyone with high blood pressure or on a restricted sodium diet should consult a physician for advice regarding salt intake.

4.8.5 Diet

It is important for people who work in cold environments to eat a well-balanced diet. Restricted diets can deprive the body of elements needed to withstand cold stress.

4.8.6 Control Measures

Continuous exposure of skin should not be permitted when the wind chill factor results in an equivalent temperature of -25°F.

Workers exposed to air temperatures of 35.6°F or lower who become immersed in water or whose clothing gets wet should be given dry clothing immediately and treated for hypothermia.

Cold stress can be controlled by engineering, administrative work practices, and use of personal protective equipment (PPE).

Engineering Controls

Here are some of the ways engineering controls can be used to reduce the stress of a cold environment:

- General or spot space heating should be used to increase temperature at the workplace.
- If fine work is to be performed with bare hands for more than 10 or 20 minutes, special provisions should be made to keep the worker's hands warm. Warm air jets, chemical hot packs, radiant heaters, or contact warm plates can be used.
- At temperatures below 30°F, metal handles of tools and control bars should be covered with thermal insulating material.
- Unprotected metal chair seats should not be used.
- When necessary, equipment and processes should be substituted, isolated, relocated, or redesigned to reduce cold stress at the work site.
- Power tools, hoists, cranes, or lifting aids should be used to reduce the work load.
- Heated warming shelters such as tents and cabins should be made available if work is performed continuously in an equivalent chill temperature of 20°F or below. Workers should be encouraged to use the shelters regularly.

Engineering control of cold stress can be very complex and often depends more on ingenuity than on standard methods.

Administrative Work Practice Controls

These controls include any work practices or rules designed to reduce the total cold-stress burden. Some of them are:

- work-rest schedule (see Attachment 2) to reduce the peak of cold stress
- enforcing scheduled rest breaks
- enforcing the buddy system (pairing up)
- enforcing frequent intake of warm, sweet, caffeine-free, nonalcoholic drinks or soup
- moving work to warmer areas whenever possible
- assigning extra workers to highly demanding tasks
- allowing workers to pace themselves and take extra work breaks when needed
- making relief workers available for workers who need a break
- teaching workers the basic principles of preventing cold stress and emergency response to cold stress
- maintaining protective supervision or a buddy system for those who work at 10°F or below
- allowing new employees time to adjust to conditions before they work full-time in cold environments
- arranging work to minimize sitting still or standing for long periods of time
- reorganizing work procedures so as much of a job as possible is done in a warm environment, which will reduce the amount of work that must be done in a cold environment
- including the weight and bulkiness of clothing when estimating work performance requirements and weights to be lifted

Personal Protective Equipment and Clothing

PPE takes in a wide range of garments and equipment, from ordinary work clothing to special bodysuits. The correct clothing depends on the specific cold stress situation.

Workers should wear several layers of clothing instead of a single, heavy, outer garment. In addition to offering better insulation, the layers can be removed as needed to keep the worker from overheating.

The outer layer should be windproof and waterproof. Body heat is lost quickly if the protective layer is not windproof.

Attachment 3 lists recommended fabrics for the various layers of clothing.

It is essential to preserve the air space between the body and the outer layer of clothing to retain body heat. The more air pockets each layer of clothing has, the better the insulation. However, the insulation effect is negated if the clothing interferes with the evaporation of sweat, or the skin or clothing is wet.

The most important parts of the body to protect are the feet, hands, head, and face. Hands and feet are the farthest from the heart and become cooled most easily. Keeping the head covered with a hat or hood is important, because as much as 40 percent of body heat can be lost when the head is exposed. Gloves and adequately insulated foot protection are essential to maintain and conserve body heat.

Dirty or greasy clothing loses much of its insulation value. Air pockets in dirty clothes are crushed or filled up, and heat can escape more easily.

Any interference with the circulation of the blood reduces the amount of heat delivered to the extremities. All clothing and equipment must be properly fitted and worn to avoid interfering with the circulation.

Remember to think C-O-L-D to keep warm in a cold environment: keep clothing clean, avoid overheating, wear clothing loose and in layers, and keep clothing dry.

Recommended clothing includes:

Light Activity

Inner Clothing

A cotton t-shirt and shorts or underpants under cotton and wool thermal underwear for light activity. Two-piece long underwear is preferred, because the top can be removed and put back on as needed.

Socks with high wool content are best. When two pairs of socks are worn, the inside pair should be smaller and made of cotton. In a pinch, wool socks can also double as mittens.

Outer Clothing

Wool or thermal trousers (either quilted or specially lined) are preferred. Belts can constrict and reduce circulation, so use suspenders if necessary. You will need extra room for trousers to fit over long underwear. Trousers should be lapped over boot tops to keep out snow or water. A synthetic, windproof, and preferably waterproof, shell layer can provide the final layer of protection.

Heavy Activity

Foot Protection

For heavy work, a felt-lined, rubber-bottomed, leather-topped boot with a removable felt insole works well. The boots should be waterproofed and socks changed when they become sweat-soaked. Air insole cushions and felt liners should be used with chemical and/or water-resistant boots. The best foot protection is provided by insulated boots sealed inside and outside by vapor barriers.

Protective Garments

Either a wool shirt, wool sweater, or a down jacket over a synthetic shirt (such as polypropylene or capilene) should be worn. Size-graduated shirts and sweaters can be worn in layers. Wool pants are a better choice than jeans or corduroy. Synthetic materials used in jackets or pants, such as Thinsulate, Qualofil, and pile, are ideal.

An anorak or snorkel coat or arctic parka should fit loosely, with a drawstring at the waist. Sleeves should fit snugly. The hood, which prevents the escape of warm air from around the neck, should be capable of extending past the face to create a frost tunnel, which warms the air for breathing.

Finish with a windproof, and preferably waterproof, shell layer. Check the shell for wind seals at the waist, neck, wrists, and ankles.

Head, Eye, Face, and Respiratory Protection

A wool knit or synthetic cap provides the best protection. When a hard hat is worn, a liner should be used.

Wool or synthetic mittens are more efficient insulators than gloves; they can be worn over gloves for extra warmth.

A face mask or scarf is vital when working in a cold wind. A ski mask with eye openings gives better visibility than a snorkel hood. Face protectors must be removed periodically, so the worker can be checked for signs of frostbite.

Thermal-type masks and respirators are available for those bothered by breathing very cold air. Full-face respirators must have separate respirator channels to prevent fogging and frosting of the facepiece. Medical clearance is required prior to issuing any respiratory protective equipment.

Double-layered goggles with foam padding around the edges have proved to be effective in extremely cold conditions.

Hand Protection

Liquids conduct heat better than air and have a greater capacity for heat than air. For example, a spill of cold gasoline on skin can freeze the tissue quickly. It is a good idea to wear chemical-resistant gloves—such as neoprene gloves with cotton inserts—for chemical handling operations. If you are handling chemicals with permeable-type gloves, always keep extra gloves available in case the ones you are using become contaminated.

Gloves should be used by workers if manual dexterity is not required, or if the air temperature falls below 60°F for sedentary work, 40°F for light work, and 20°F for moderate work. Mittens should be used instead of gloves if the air temperature is 0°F or less.

Emergency Actions

When stranded during a storm in a vehicle, it is better to stay with the vehicle. The engine can furnish heat, and the vehicle can act as a shelter. However, care should be taken to prevent carbon monoxide gas from building up in a closed vehicle. In an emergency situation, insulating material can be taken from the vehicle seats and stuffed into clothing for additional warmth.

If you are in the water, try to reach something that will keep you afloat, but do not do any unnecessary swimming—it increases the rate of body heat loss. Air between layers of clothing provides buoyancy. Personal flotation devices (PFDs) offer your best chance of survival in cold water. Type III PFDs include cold weather jackets and coats that contain flotation material and thermal protection.

It is especially important to keep your head dry. Avoid thrashing about if wearing a PFD, and assume the H.E.L.P. position (Heat Escape Lessening Posture), Attachment 4, by crossing your wrists over your chest and keeping your legs close together to avoid using excess body heat. By using the H.E.L.P position, you can protect your head, neck and groin area—all of which are high heat loss areas.

If others are in the water with you, huddle together. This will reduce heat loss, aid in rescue, and may even boost morale.

Keep in mind that survival floating techniques may not work in extremely cold water.

4.9 Control Program Summary for Cold Stress

A control program summary for cold stress at AEE includes the following elements:

- medical supervision of workers, including preplacement physicals that evaluate fitness, weight, and cardiovascular system, and other conditions that might make a worker susceptible to cold stress
- required medical evaluation during and after cold illnesses and required medical release for returning to work
- employee orientation and training on cold stress, cold-induced illnesses and their symptoms, water and salt replacement, proper clothing, work practices and emergency first aid procedures

- work-rest regimens, with heated rest areas and enforced rest breaks
- scheduled drink breaks for recommended fluids
- environmental monitoring, using the air temperature and wind speed indices to determine wind chill and adjust work-rest schedules accordingly
- reduction of cold stress through engineering and administrative controls, and the use of PPE

5.0 REFERENCES

1. National Safety Council. 1986. *Pocket Guide to Cold Stress*.
2. American Conference of Governmental Industrial Hygienists (ACGIH). 2001 Threshold Limit Values (TLVs™) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs™).
3. American Red Cross. 1993. Standard First Aid. St. Louis: Mosby Lifeline.

CHILL TEMPERATURE CHART
COOLING POWER OF WIND ON EXPOSED FLESH EXPRESSED
AS AN EQUIVALENT TEMPERATURE (UNDER CALM CONDITIONS)

Estimated	Actual Temperature Reading (˚F)											
Wind Speed	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
(in mph)	Equivalent Chill Temperature (˚F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect)	LITTLE DANGER In < hr with dry skin. Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within 1 minute.				GREAT DANGER Flesh may freeze within 30 seconds.			
	Trenchfoot and immersion foot may occur at any point on this chart.											

From American Conference of Governmental Industrial Hygienists, Inc., *2001 Threshold Limit Values (TLVs®) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs®)*. Reprinted with permission.

THRESHOLD LIMIT VALUES
WORK/WARM-UP SCHEDULE FOR 4-HOUR SHIFT

Air temperature — Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. work period	No. of breaks	Max. work period	No. of breaks	Max. work period	No. of breaks	Max. work period	No. of breaks	Max. work period	No. of breaks
-26° to -28°	-15° to -19°	(Norm. Breaks) 1		(Norm. Breaks) 1		75 min	2	55 min	3	40 min	4
-29° to -31°	-20° to -24°	(Norm. Breaks) 1		75 min	2	55 min	3	40 min	4	30 min	5
-32° to -34°	-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-emergency work should cease					
-40° to -42°	-40° to -44°	30 min	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

1. Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-up periods of ten (10) minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For Light-to-Moderate Work (limited physical movement): apply the schedule one step lower. For example, at -35°C (-30°F) with no noticeable wind, a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period.

2. The following is suggested as a guide for estimating wind velocity if accurate information is not available: 5 mph: light flag moves; 10 mph: light flag fully extended; 15 mph: raises newspaper sheet; 20 mph: blowing and drifting snow.

3. If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be: (1) special warm-up breaks should be initiated at a wind chill cooling rate of about 1750 W/m^2; 2) all non-emergency work should have ceased at or before a wind chill of 2250 W/m^2. In general, the warmup schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges because windy conditions rarely prevail at extremely low temperatures.

4. TLVs apply only for workers in dry clothing.

Source: American Conference of Governmental Industrial Hygienists, Inc., 2001. Threshold Limit Values (TLVs®) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs®). Reprinted with permission.

WINTER CLOTHING

	ADVANTAGES	DISADVANTAGES	WEAR IN
Wool	Stretches without damage. Insulates well even when wet.	Heavy weight. Absorbs moisture. May irritate skin.	Layer 1, 2, or 3
Cotton	Comfortable and lightweight.	Absorbs moisture.	Layer 1 (for inactive people) or 2
Silk	Extremely lightweight and durable. Very good insulator. Washes well.	More expensive. Does not transfer moisture quickly.	Layer 1
Down	Durable, lightweight. Most effective insulator by weight.	Expensive. Loses insulative quality when wet. Difficult to dry.	Layer 2 or 3 (especially in dry, extreme cold)
Nylon	Lightweight, wind- and water-resistant, durable.	May not allow perspiration to evaporate. Low melting point. Flammable.	Layer 3
Synthetic Polyester Insulation	Does not absorb moisture; therefore, insulates even when wet.	Heavier than down. Does not compress as well.	Layer 2 or 3 (especially in wet weather)

Note: Layer 1 is the innermost layer.
Source: National Safety Council. Pocket Guide to Cold Stress. 1986.

Heat Stress Control

1.0 PURPOSE

The purpose of this procedure is to provide information on the causes, detection, prevention, and treatment of heat stress.

2.0 SCOPE

This procedure should be utilized by AMEC Earth & Environmental, Inc. (AEE) on-site personnel and subcontractors working on AEE field projects.

3.0 RESPONSIBILITIES

3.1 Site Health and Safety Coordinator/Project Manager/Field Manager

The Site Health and Safety Coordinator (SHSC) and Project Manager (PM) and/or Field Manager (FM) are responsible for implementing these procedures. Specific duties/responsibilities include:

- having knowledge about the signs and symptoms of heat stress
- ensuring appropriate time is allowed for acclimatization
- ensuring that employees practice appropriate heat stress prevention techniques
- completion of Heat Stress Monitoring form (Attachment 1) when conditions necessitate its use

3.2 Corporate Safety, Health, and Environment Director

The Corporate Safety, Health, and Environment Director (Corporate SHE Director) is responsible for auditing or evaluating on-site activities to ensure that these procedures are implemented.

4.0 PROCEDURES

4.1 Introduction

Heat is a physical stress on the human body. Exposure to excessive heat can develop into a serious health condition known as heat stress. If the proper measures are not taken to prevent or treat heat stress, the condition can become debilitating and perhaps fatal.

The two most likely sources of heat stress that could be encountered by AEE field personnel are (1) external heat produced by high air temperatures and humidity, and (2) heat generated from the human body that cannot dissipate. Protective garments can greatly hinder the body's mechanism of evaporative cooling, causing the body temperature to rise.

4.2 How the Body Handles Heat

Under moderate conditions of work and environmental heat, the brain regulates the body's temperature by monitoring the temperature of the blood. When the blood temperature rises above 98.6 degrees Fahrenheit (°F), the body initiates heat control mechanisms. The two major mechanisms of thermoregulation are increased blood flow and sweating.

4.2.1 Increased Blood Flow

As the heart begins to pump more blood towards the skin, excess body heat is lost to the air through convection, radiation, evaporation, and conduction depending on air temperature, humidity, and air movement.

Convection

Convection is the transfer of heat by movement of the thin layer of insulating air next to the skin. Air movement causes a cooling action. The absence of wind will cause a more intense heat effect.

Radiation

Radiation is the transfer of heat to cooler objects in the surrounding environment. The heat is transferred through space between objects that are not in direct contact with each other. For example, the heat from a broiler will warm objects in its surrounding area. In the same way, the body's heat will transfer to a cooler environment or will warm in the presence of a hotter environment.

Evaporation

Evaporation is the absorption of moisture into the air. Evaporation of moisture from the skin cools the body. The rate of this evaporative cooling is significantly increased by convection or air movement across wet skin and/or wet clothing. The amount of evaporation is also increased by low humidity. When humidity is high, evaporation is hindered and the heat hazard increases.

Conduction

Conduction is the transfer of heat between objects that are in contact with each other. For example, touching a piece of metal that is hotter than skin temperature will conduct heat toward the body.

4.2.2 Sweating

When heat loss by increased blood flow is not enough to keep the body core temperature normal, the brain signals the sweat glands in the skin to begin producing sweat (mixture of water and salts). The sweat evaporates on the skin and cools the skin surface. Sweating does nothing to cool the body unless the sweat can evaporate from the skin. When humidity is high, evaporation of perspiration slows down or stops. As the heart labors to pump more and more blood to the surface and the sweat glands continue to pour liquids onto the skin surface, the production of internal body heat continues. If this condition is not dealt with at this stage, heat stress disorders can arise rapidly.

As more blood flows to the skin, less blood remains to supply the active muscles. Strength declines and fatigue may come sooner than it would otherwise. Behavioral changes can arise in the forms of reduced accuracy, comprehension, and retention. In addition to these physiological changes, certain safety problems commonly arise in hot environments:

- sweaty palms resulting in impaired functional ability
- dizziness
- fogging of safety eyewear
- possible burns from accidental contact with hot surfaces

4.3 Monitoring the Hot Work Environment

There are two commonly recognized methods to measure the working conditions for heat hazard. One method employs measuring the actual environment for important physical parameters. The other monitoring technique, often used in tandem with environmental monitoring, is personal monitoring.

4.3.1 Environmental Monitoring

Evaluating the work environment to determine the degree of heat stress involves measuring and recording four different physical factors:

- air temperature
- humidity
- radiant temperature
- air speed

Many different ways have been devised to evaluate the above-mentioned parameters. The method recognized by the American Conference of Governmental Industrial Hygienists (ACGIH) is commonly known as Wet Bulb Globe Temperature (WBGT). WBGT values are calculated based on the following equations:

(1) Outdoors with solar load

$$WBGT = 0.7\ (WB) + 0.2\ (GT) + 0.1\ (DB)$$

(2) Indoors or Outdoors with no solar load

$$WBGT = 0.7\ (WB) + 0.3\ (GT)$$

WBGT = Wet Bulb Globe Temperature Index
WB = Natural Wet-Bulb Temperature
DB = Dry-Bulb Temperature
GT = Globe Temperature

NOTE: Temperatures can be recorded in either °F or °C (degrees Centigrade), but must be used consistently throughout the equation.

These measurements are made using specialized heat stress measuring equipment that measures each of the temperature parameters of the equation above. Instruments that measure the various temperature parameters, as well as calculate the WBGT for the user, are also available. To obtain the equipment, contact a manufacturer (e.g., Metrosonics, Inc.) or a local instrument rental company. The monitoring should be made by an industrial hygienist or an appropriately trained SHSC who is familiar with the instruments and work being performed. Measurements are recorded on the Heat Stress Monitoring Form (Attachment 1).

The recommended ACGIH Screening Criteria for Heat Stress Exposure are presented in Attachment 2.

4.3.2 Personal Monitoring

Individuals vary in their susceptibility to heat stress. Factors that may predispose an individual to heat stress include:

- lack of physical fitness
- alcohol and drug use

- lack of acclimatization
- infection
- age
- sunburn
- dehydration
- diarrhea
- obesity
- chronic disease

When workers must wear semipermeable or impermeable encapsulating personal protective garments the ACGIH recommended Threshold Limit Values (TLVs) cannot be used. For these situations, employees should be monitored when the temperature in the work area is above 70°F (21°C). When impermeable clothing will be worn, exposure limits will be established by applying adjustment factors to the values in Attachment 2. Adjustment factors are as follows:

WBGT Correction Factor* (˚C)

Summer work uniform[1] 0
Coveralls 2
Kleenguard coveralls 4
Standard Tyvek 6
Tyvek, PE 7
Encapsulating suit 11

* Subtract correction factor (°C) from the WBGT in Attachment 2.
[1] Summer work uniform is cotton long pants and cotton tee shirt.

To monitor an employee for heat stress, one can measure any of the following parameters:

• Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period.

If the heart rate exceeds 110 beats per minute (bpm) at 1 minute into the rest period, shorten the next work cycle by one-third and keep the rest period the same duration.

If the heart rate still exceeds 110 bpm at 1 minute into the next rest period, shorten the following work cycle by one-third.

If the heart rate exceeds 120 bpm at 1 minute into the rest period, the worker is under a significant strain and risk and the worker should be removed from the shift until his/her heart rate returns to normal.

• Oral temperature. Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the start and end of the work period. To obtain accurate results, workers shall not eat or drink for 15 minutes prior to oral temperature monitoring. There shall be no talking or mouth breathing when the thermometer is measuring the temperature.

If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period duration.

If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following work cycle by one-third.

Do *not* permit a worker to wear a semipermeable or impermeable garment when his/her oral temperature exceeds 100.6°F (38.1°C).

• Body water loss, if possible. Measure weight on a scale accurate to ± 0.25 pound (lb) at the beginning and end of each workday to see if enough fluids are being taken to prevent dehydration. Weights should be taken while the employee wears similar work clothing. If the change in body weight divided by the body weight, when multiplied by 100, exceeds 1.5 then there is likely dehydration. *The body water loss should not exceed 1.5 percent total body weight in a workday.*

• Behavior. Other indications of heat stress may be recognized from worker behaviors that include:

- adjusting clothing
- slowing down
- increased number of mini-breaks
- irritability
- low morale
- absenteeism
- increased number of errors
- shortcuts in maintenance

The SHSC should monitor personnel for these changes in worker behavior.

4.4 Heat Illnesses

Table 1 provides a description of the common heat stress illnesses, symptoms, underlying causes, and treatment.

4.5 Preventing Heat Stress

Heat stress can be prevented by taking personal protective measures, such as allowing for acclimatization, ensuring fluid replacement, satisfying the body's salt requirements, modifying work practices, and other control measures.

4.5.1 Acclimatization

The human body has a dramatic adaptation mechanism for working in the heat called acclimatization. Any unprepared employee when exposed for the first time to a hot work environment will develop signs of significant strain such as elevated body temperature, pounding heart, high pulse rate, and sweating. But the body will, over a series of days spent working in the heat, make a series of adjustments. These adjustments, which include the decreasing of body temperature and pulse rate, will occur after the individual has worked in the heat for a week for at least 2 hours per day.

After acclimatization has taken place, work in the heat can be performed with a major reduction in strain. This allows the employee to work more effectively under conditions that may have been intolerable before acclimatization.

An important point to emphasize - acclimatization will not take place if workers do not drink enough water to replace body fluids lost to sweating. Also, acclimatization is gradually lost if work in heat stops. Some degree of acclimatization is lost over a weekend and a large degree would be lost over a full week. It is significant to remember that when employees are first exposed to the heat, or when they are returning from time off such as vacation, the workload should be reduced until acclimatization can occur.

4.5.2 Fluid Replacement

Employees must be encouraged to drink enough fluid to replace the fluid that is lost through sweating. Employees should be told to drink often throughout the day. Fluid replacement should occur at 20-minute

intervals and coincide with cool-down breaks. Workers should begin the day with 16 ounces (2 cups) of water or electrolyte replacement fluids and then about 8 ounces (1 cup) every break. Cool water (about 10 to 15°C) is the ideal replacement fluid. Employees who are sweating heavily must be encouraged to drink large amounts of water every 20 to 30 minutes whether they are thirsty or not. Thirst is a poor indicator under these conditions because by the time thirst is felt, heat stress already exists. Intermediate decon (as defined in the Decontamination Procedures section of the hazardous waste site-specific Health and Safety Plan [HSP]) may be performed for short heat stress mitigation breaks on hazardous waste sites.

Table 1
Heat Stress Illnesses

Heat Illness	Description	Symptoms	Possible Underlying Causes	Treatment
Heat Cramps	Spasms in voluntary muscles due to reduction in the concentration of sodium chloride with continued loss of salt in sweat and copious intake of water without appropriate salt replacement. Other electrolytes, such as magnesium, calcium, and potassium may also be involved.	Painful spasms of muscles used during work. May occur during or after work hours.	Drinking large quantities of water without replacing salt loss Excessive perspiration during hot work	Administer lightly salted water by mouth unless on medical restriction. Consult physician. Adequate salt intake with meals. Those on salt-restricted diets should consult their physician for guidance. Do not follow fad or restrictive diets while working in heat conditions except under physician's advice.
Heat Syncope	Pooling of blood in dilated vessels of skin and lower parts of body	Fainting while standing erect and immobile in the heat	Lack of acclimatization	Remove to cooler area Recovery should be prompt and complete Consult physician
Dehydration	Excessive loss of body water	No early symptoms Fatigue/weakness Dry mouth	Excessive fluid loss due to sweating Excessive fluid loss due to illness (such as vomiting or diarrhea)	Remove to cool area Fluid replacement

		Loss of work capacity Increased response time	Excessive fluid loss due to alcohol consumption	
Heat Rash (Prickly Heat)	Keratinous layers of skin absorb water, swell, and mechanically obstruct the sweat ducts	Profuse, tiny, raised, red vesicles (blister-like), usually in areas where clothing is restrictive Prickling sensation during heat exposure, particularly as sweating increases	Occurs on skin that is persistently wetted by unevaporated sweat Plugging of sweat gland ducts with retention of sweat and inflammatory reaction	Clean, cotton garments against the skin Mild drying lotions Skin cleanliness to prevent infection
Heat Exhaustion	Low arterial blood pressure caused partly from inadequate cardiac output and partly from widespread vasodilation	Skin clammy and moist, profuse sweating, coloring pale or muddy Extreme fatigue, weakness, blurred vision, dizziness, nausea, headache or light-headedness Insecure gait, may faint while standing Exhibits rapid pulse and low blood pressure Oral temperature normal or low, rectal temperature may be elevated to 99^{o}F to 101^{o}F	Lack of acclimatization/fitness Continuous exertion in heat Failure to replace water/salt lost in sweat, or from gastrointestinal maladies (dehydration) Distribution of blood to the periphery	Remove to cooler area Administer fluids by mouth (if victim is conscious) or give intravenous infusions of normal saline (should be done under care of a physician, especially for those on medically restricted diets)
Heat Stroke	Failure of the thermoregulating system	Chills; hot, dry skin; red, mottled or bluish High, rising deep body (core)	Continuous exertion in heat by unacclimatized employees Lack of	Call emergency medical services for assistance. Inform ambulance on telephone that heat illness

		temperature: 104°F and over Mental confusion, restlessness, irritability, belligerence, loss of consciousness, convulsions or coma as temperature rises	acclimatization Obesity Recent alcohol consumption Dehydration Individual workers' susceptibility Chronic cardiovascular disease	emergency exists. Danger - Fatal if treatment is delayed. Cool body while awaiting ambulance. Immediate cooling of victim by immersion in chilled water Wrapping victim in wet sheet while fanning with cool, dry air Sponging with cool liquid and fanning Treat shock, if necessary

4.5.3 Salt Requirements

Sweat contains water, salt, and other electrolytes. The body needs a certain amount of salts to function properly, but using salt tablets is not recommended. Salt tablets cause stomach irritation that may result in nausea and vomiting.

Presently, it is recommended that drinking water for employees not be salted, because the normal diet should provide adequate salt intake. However, if heat cramps are observed, slightly salted water (0.1% or 1 teaspoon of salt/15 quarts water) or an electrolyte replacement fluid (e.g., Gatorade™) should be provided. Caution should be taken by individuals with high blood pressure or on a sodium-restricted diet.

4.5.4 Work Practices

Preventive work practices can be used as either an alternative or complementary approach to engineering controls for preventing heat stress. Preventive practices may include:

- limiting or modifying the duration of exposure time
- building the heat tolerance of the worker by heat acclimatization and physical conditioning
- establishing a work-rest regimen that provides adequate rest periods for cool down
- training workers in safety and health procedures for work in hot environments

The following are ways to control the daily length of time and temperature to which a worker is exposed in heat stress conditions:

- schedule hot jobs for cooler parts of the day
- schedule routine maintenance, repair work, and field projects in hot areas for the cooler seasons of the year
- alter the work-rest regimen to permit more rest time (the initial work period for an acclimatized worker should not exceed 1 to 1.5 hours, followed by a cool down of at least 15 minutes)
- • provide cool, shaded areas for rest and recovery during the work shift
- • add extra personnel to reduce exposure time for each member of the work crew
- • permit freedom to interrupt work when a worker feels extreme heat discomfort

The heat tolerance of workers can be enhanced in the following ways:

- establish an appropriate heat-acclimatization program
- instruct employees to gradually increase the thermostat in sleeping quarters for off-duty hours so that daily adjustment to the temperature at the project site is made easier
- encourage workers to achieve and maintain physical fitness
- ensure that an adequate supply of water is taken (roughly 8 ounces every 20 minutes)
- maintain the electrolyte balance in the body fluids

A work-rest regimen that provides adequate periods for cool down should be established. Work-rest periods will be adjusted based on the condition of the heat-exposed worker. When impermeable protective garments are worn, they will be removed during the cool-down period to allow for adequate recovery. Breaks shall be taken in a shaded, cool rest area (77°F or lower is best).

4.5.5 Training

Workers will be trained in accordance with Volume IV, Training Program, of this manual in health and safety procedures for work in hot environments. Such workers will be familiar with the preventive measures outlined in Volume II, Comprehensive Field Project Health and Safety Program, of this manual and in the site-specific HSP (when applicable), as well as early recognition of the signs and symptoms of heat illnesses and initiation of first aid and corrective procedures. Training topics will include:

- signs and symptoms of heat-induced illnesses
- causes and recognition of heat illnesses
- work practices to minimize heat illnesses
- proper care and use of heat protective clothing and equipment
- effects of nonoccupational factors (such as drugs, alcohol, and obesity) on tolerance to occupational heat stress
- buddy system designed to recognize the early signs and symptoms of heat illnesses

4.5.6 Additional Control Measures

<u>Engineering Controls</u>

Engineering controls are measures that may be used to reduce the stress of a hot environment. They include, but are not limited to:

- use of increased general ventilation or spot cooling to reduce temperatures in the work location
- use of local exhaust ventilation at points of high heat production to remove large quantities of generated and/or latent heat from the work area
- use of large fans to increase the air velocity over the workers and thereby increase the evaporative heat loss (Caution: if air temperature is greater than 95˚F, the use of fans will increase the heat stress. Cool the air instead being careful to avoid causing drafts that will disturb any existing exhaust ventilation controls)
- Application of radiant heat shielding may be helpful by such methods as:

    - insulating heat-producing equipment
    - covering exposed body parts with clothing
    - using reflective screens (made up of material such as polished aluminum, tin, or zinc) placed between the worker and the radiant heat source to reflect the heat back to the source
    - wearing reflective aprons or reflective clothing (especially useful when the workers face the heat source)

- elimination of steam leaks, by hooding or covering of steaming tanks, hot water drains, etc., to reduce the water vapor pressure at the work site
- isolation, relocation, redesign, or substitution of equipment and/or processes to reduce the thermal stress at the work site
- a wider use of work-saving devices (such as power tools, hoists, cranes, or other lifting aids) to reduce the metabolic workload
- as feasible, provisions for field "showers" or hose-down areas to cool the body down

Administrative Controls

Administrative work practice controls are most easily implemented and include any and all work practices or rules that may reduce the total heat stress burden. Included are:

- acclimatization to the heat
- work-rest schedule designed to reduce peaks of heat stress
- enforcing scheduled rest breaks
- if possible, providing air-conditioned rest areas to give rapid recovery (this practice decreases the cumulative effects of heat exposure)
- enforcing a schedule of frequent water ingestion breaks and provision of abundant, cool drinking water or electrolyte replacement fluids
- scheduling the hottest work for the coolest parts of the day
- where possible, moving work indoors or to air-conditioned or cooler areas
- assigning extra workers to highly demanding tasks to reduce the individuals' metabolic loads
- allowing employees to pace themselves and take frequent rest breaks
- rotating duties for hot jobs
- enforcing the buddy system
- educating workers on the basic principles of preventing heat stress illnesses and on emergency response to heat illness
- cooling sleeping quarters to allow skin to dry between heat exposures

Personal Protective Equipment

Personal protective equipment (PPE) includes a wide range of items such as ordinary work clothing, liquid cooling systems, ice-cooled body suits, and reflective clothing for radiant heat. The correct clothing depends upon the specific heat stress situation. The HSP will identify appropriate garments for heat stress management.

Where air temperature is higher than the skin temperature or there is radiant heat (e.g., from a furnace or the sun), then clothing will protect the body. The advantage of wearing clothing, however, is negated if the clothes interfere too much with the evaporation of sweat, which is a vital cooling function.

Clothes made of thin cotton fabric help evaporate sweat by picking it up and bringing it to the surface. Nonbinding clothes are also good for sweat evaporation. In contrast, tightly fitting clothes made of synthetic fabrics interfere with evaporation.

4.6 Control Measures for Heat Stress

A summary of heat stress control measures includes the following:

- Medical supervision of workers including preplacement physicals that evaluate fitness, weight, cardiovascular system and other conditions that may make an individual susceptible to heat illnesses. Medical evaluation during and after heat illnesses and medical release for returning to work should also be included.
- Employee training and education on heat stress, heat-induced illnesses and their symptoms, water and salt replacement, clothing, work practices, and emergency first aid procedures.
- Acclimatization of employees for work in the heat.
- Work-rest regimens with air-conditioned rest areas and enforced rest breaks.
- Provision of cool, plentiful water supplies or electrolyte replacement fluids and scheduled rehydration breaks. Employees should be encouraged to weigh themselves daily to avoid dehydration.
- Environmental monitoring using one of the heat stress indices to determine the heat load and adjust work-rest regiments accordingly.
- Forecast of episodes of extreme heat or heat spells whereupon a number of preventive practices would be initiated.
- Reduction of heat stress by the proper use of engineering controls, administrative controls, or PPE.

5.0 RECORDS

Ambient temperature records and heat stress mitigation methods shall be recorded on the Heat Stress Monitoring Form (Attachment 1) by the SHSC or designee.

6.0 References

1. National Safety Council. 1985. *Pocket Guide to Heat Stress*.
2. American Conference of Governmental Industrial Hygienists. *Threshold Limit Values and Biological Exposure Indices for 2001*.
3. National Safety Council. 1988. *Fundamentals of Industrial Hygiene*. 3rd Edition.
4. Patty, F.A. 1991. *Patty's Industrial Hygiene and Toxicology, General Principles*. Edited by George D. Clayton and Florence E. Clayton. Vol. I, Part A. 4th Edition. New York: Wiley and Sons, Inc.

7.0 ATTACHMENTS

1. Heat Stress Monitoring Form *(PDF)*
2. Screening Criteria for Heat Stress Exposure *(Word)*

Heat Stress Monitoring Form

Site Information _____ Page _____ of _____

Project _____ Field Manager _____

Date _____ Site Health and Safety Coordinator _____

Site Location _____

Site Personnel _____

Reading No.	Time	Reading Description	Location or Job Task	Instrument Type	Reading	Comments

SCREENING CRITERIA FOR HEAT STRESS EXPOSURE
(Values are given in °C and °F WBGT)

	Acclimatized				Unacclimatized			
Work Demands	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
100% Work	29.5 (85.1)	27.5 (81.5)	26 (78.8)		27.5 (81.5)	25 (77)	22.5 (72.5)	
75% Work 25% Rest	30.5 (86.9)	28.5 (83.3)	27.5 (81.5)		29 (84.2)	26.5 (79.7)	24.5 (76.1)	
50% Work 50% Rest	31.5 (88.7)	29.5 (85.1)	28.5 (83.3)	27.5 (81.5)	30 (86)	28 (82.4)	26.5 (79.7)	25 (77)
25% Work 75% Rest	32.5 (90.5)	31 (87.8)	30 (86)	29.5 (85.1)	31 (87.8)	29 (84.2)	28 (82.4)	26.5 (79.7)

Notes:

- WBGT values are expressed in °C and °F and represent thresholds near the upper limit of the metabolic rate category.
- If work and rest environments are different, hourly time-weighted averages (TWAs) should be calculated and used. TWAs for work rates should also be used when the work demands vary within the hour.
- Values in the table are applied by reference to the “Work-Rest Regimen” section of the Documentation* and assume 8-hour workdays in a 5-day workweek with conventional breaks, as discussed in the Documentation. When workdays are extended, consult the “Application of the TLV” section of the Documentation.
- Because of the physiological strain associated with Very Heavy work among less fit workers regardless of WBGT, criteria values are not provided for continuous work and for up to 25% rest in an hour. The screening criteria are not recommended, and a detailed analysis and/or physiological monitoring should be used.

*Documentation = Documentation of the Threshold Limit Values and Biological Exposure Indices, latest edition.

Control of Hazardous Energy Sources (Lockout/Tagout)

1.0 PURPOSE

This procedure establishes the minimum requirements for the protection of employees working on systems, machines, or equipment, where the unexpected energization, start-up, or release of stored energy could cause injury. It shall be used to ensure that the system, machine, or equipment is isolated from all potentially hazardous energy sources and locked and/or tagged out prior to employees or subcontractors beginning work in the affected areas. This procedure also applies to work performed at or near deenergized electrical equipment and circuits.

2.0 SCOPE

This procedure applies to AMEC Earth & Environmental, Inc. (AEE) personnel, personnel subcontracted to AEE, and visitors (including clients) who may work on or visit AEE job sites where personnel work on or near systems, machines, or equipment. It is to be used in conjunction with any existing facility procedures where work is to be performed.

3.0 DEFINITIONS

Affected Employee - Employees (including subcontractors) whose jobs require them to operate or use systems, machinery, or equipment that is being serviced or maintained or whose jobs require them to work in areas where service or maintenance is being performed.

Authorized Employee - A person who locks out and/or tags out systems, machinery, or equipment in order to perform service or maintenance on that system, machine, or equipment and has been properly trained in the control of hazardous energy sources.

Energy Isolating Device - A device that physically prevents the transmission or release of energy.

Energy Source - Any source of electrical, pneumatic, chemical, thermal, or other energy.

Lockout - The placement of a lockout device on an energy isolating device, ensuring that the equipment being controlled cannot be operated until the lockout device is removed.

Lockout Device - A device that utilizes a positive means (e.g., lock, either key or combination type) to hold an energy isolating device in a safe position and prevent the energizing of a machine or equipment.

Primary Control - The Field Manager (FM) lock or tag (the first lock/tag to be applied and the last lock/tag to be removed from all isolation points).

Qualified Person (Qualified Employee) - A person who can demonstrate by experience or training the ability to recognize potentially hazardous energy and its potential impact on workplace conditions and who has the knowledge to implement adequate methods and means for control and isolation of such energy; a qualified person shall also be trained and certified competent in:

- skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment
- skills and techniques necessary to determine the nominal voltage of exposed live parts

- minimum approach distances specified in Occupational Safety and Health Administration (OSHA) 29 CFR 1910.269, *Electrical Power Generation, Transmission, and Distribution*, corresponding to the voltages to which the qualified employee will be exposed
- proper use of special precautionary techniques, personal protective equipment (PPE), insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electric equipment

Tagout - The placement of a tagout device to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Tagout Device - A prominent warning device capable of being securely attached to an energy isolating device that identifies the applier or authority who has control of the energy control procedure and contains information, instructions, or both to prevent the operation of an energy isolating device.

4.0 RESPONSIBILITIES

4.1 Project Manager

The Project Manager will ensure that employees and subcontractors hired to perform work on a system, machine, or equipment capable of releasing stored energy are knowledgeable in safe lockout/tagout procedures.

4.2 Field Manager

The FM is responsible for:

- ensuring all authorized employees are trained in accordance with 29 CFR 1910.147, *The Control of Hazardous Energy (Lockout/Tagout)*, and Section 5.0 of this procedure
- identifying all work activities requiring the isolation and lockout/tagout of hazardous energy sources
- coordination with the facility point-of-contact to ensure notification of all affected employees
- issuing the locks and tags to authorized employees and documenting on the Lockout/Tagout Log (Attachment 1)

4.3 Corporate Safety, Health, and Environment Director

The Corporate Safety, Health, and Environment Director (Corporate SHE Director) is responsible for conducting a periodic inspection at least annually to ensure that the procedure and the requirements of 29 CFR 1910.147 are being followed.

4.4 Site Health and Safety Coordinator

The Site Health and Safety Coordinator (SHSC) is responsible for implementing and enforcing this procedure, under the guidance of the Corporate SHE Director or local technically-knowledgeable designee during project operations and activities. The SHSC is also responsible for documenting implemented procedures. Copies of Lockout/Tagout Logs will be maintained on file by the SHSC.

4.5 Subcontractors

Subcontractor employees involved with installation, repair, or demolition of a system, machine, or equipment that can store hazardous energy will either accept and abide by this SOP or their employer will provide an established written lockout/tagout procedure to AEE for review.

The subcontractor will provide employees trained in the hazards of uncontrolled energy sources and the measures that must be taken to control the hazards (lockout/tagout). Subcontractors will provide their own tags and/or locks for usage for tasks under their control.

5.0 PROCEDURE

5.1 Control Devices

The authorized employee will obtain a lock and tag from the SHSC or subcontractor supervisor. This issuance will be documented by the SHSC by making an entry on the Lockout/Tagout Log, Attachment 1, or the subcontractor on a similar log.

A lock and tag shall be placed on each energy-isolating device used to deenergize an energy source (e.g., circuit and equipment), except as provided in Section 5.1.3 and/or Section 5.1.4 below.

5.1.1 Locks

All locks used for lockout devices shall be substantial enough to prevent removal without the use of excessive force and shall be distinctive in color. The locks shall not be used for any other purpose.

5.1.2 Tags

Tags shall be constructed and printed so that exposure to weather conditions will not cause the tag to deteriorate or the message to become illegible. All tags shall have a standard message as illustrated in Attachment 2. The tag attachment means shall be nonreusable, attachable by hand, self-locking, and nonreleasable with a minimum unlocking strength of not less than 50 pounds. Tag attachments shall be at least equivalent to a one-piece, all-environmental tolerant nylon cable tie.

5.1.3 Locks without Tags

A lock may be placed without a tag only under all of the following conditions:

- only one circuit or piece of equipment is deenergized
- the lockout period does not extend beyond the work shift
- employees or subcontractors exposed to the hazards associated with reenergizing the circuit or equipment are familiar with this procedure

5.1.4 Tags without Locks

If a tag is used on an energy-isolating device that is capable of being locked out, the tagout device will be placed where the lock would have been attached, or as close as possible, with at least one additional safety measure employed that provides a level of safety equivalent to that obtained by the use of a lock. Examples of additional safety measures include:

- removal of an isolating circuit element
- blocking of a controlling switch
- opening of an extra disconnecting device

- removal of a valve handle to reduce the likelihood of inadvertent energization

In instances where tags are used without a lock, the tag must be thought of as an equivalent to a lock and not be removed unless the authorized employee removes his/her tag in accordance with Section 5.2.7 (employee's tag) or Section 5.2.8 (another employee's tag).

5.2 Lockout-Tagout Procedure

5.2.1 Preparation for Deactivation

Prior to the start of a project, the SHSC and the FM (or designee, or subcontractor supervisor) shall survey the work areas to identify activities that require the isolation of a system, machine, or equipment.

Prior to the deactivation of a system, machine, or equipment, the FM shall notify the facility point-of-contact and all affected employees.

5.2.2 Deactivation of Equipment or Machines

The machine or equipment shall be turned off or deactivated using the procedures established for the machine or equipment. An orderly deactivation must be utilized to avoid any additional or increased hazard(s) to employees as a result of the machine or equipment stoppage.

See also related standard operating procedure (SOP) S-5, *Electrical Safety Requirements for Work at Transformers* for specific procedures regarding deactivation of transformers.

5.2.3 Isolation

All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated so as to effectively isolate the machine or equipment from the energy source(s).

5.2.4 Application of Locks and Tags

Upon deactivation, the employee or subcontractor shall place a lock on all isolation points capable of being locked. Lockout devices shall hold the energy isolating device in a "safe" or "off" position. All isolation points that are not capable of being locked shall be tagged (see Section 5.1.4).

The employee's or subcontractor's lock or tag shall be considered the primary control. The primary control shall be the first lock/tag applied and the last removed.

When multiple isolation points are involved, a central lock box may be utilized. When used, the FM, SHSC, or subcontractor supervisor shall place the keys of all primary control locks into the lock box and then lock the box. Each authorized employee will then apply their lock to the lock box, thus controlling all isolation points.

When necessary, an adapter or multilocking device may be used to attach one or more locks to a single control mechanism.

5.2.5 Stored Energy (Electric and Nonelectric)

Following the application of lockout/tagout devices to energy isolating devices, all potentially hazardous, stored, or residual energy shall be relieved, disconnected, restrained, or otherwise rendered safe by a qualified person.

5.2.6 Verification of Isolation

A qualified person shall use test equipment to test the circuit elements and electrical parts of equipment and shall verify that the circuit elements and equipment parts are deenergized. The test shall also determine if any energized condition exists as a result of inadvertently induced voltage or unrelated voltage backfeed. If the circuit to be tested is over 600 volts nominal, the test equipment shall be checked for proper operation immediately before and after this test.

Prior to starting work, each authorized employee shall verify that isolation and deenergization of the system, machine, or equipment has been accomplished.

See also related SOP S-5, *Electrical Safety Requirements for Work at Transformers*, for specific information on applying protective grounds (as part of a transformer deenergizing program).

5.2.7 Removal of Isolation and Reactivation

A qualified person shall conduct tests and visual inspections to verify that all tools, electrical jumpers, shorts, grounds, and other such devices have been removed so that the circuits and equipment can be safely energized.

Before removal of the primary controls the following shall be checked:

- all necessary guards have been replaced
- the affected area has been cleaned and all tools removed
- all affected personnel have been notified to "stay clear" of circuits and equipment

After these items are complete the FM, SHSC, or subcontractor supervisor shall make a visual determination that affected employees are cleared and then remove all primary controls. The system, machine, or equipment may now be reactivated.

When work is complete, each authorized employee shall remove only his or her own lock or tag.

5.2.8 Removal of Another Employee's or Subcontractor's Lock (or Tag without a Lock)

Authorized employees or subcontractors should be instructed to remove their locks (or tag without a lock) after completing their portion of the work or when leaving the affected area for extended periods of time.

When it becomes necessary to remove the lock (or tag without a lock) of an employee or subcontractor who is absent from the job site, the following shall be followed:

1. The employee's or subcontractor's supervisor shall verify that indeed the lock (or tag without a lock) owner is absent from the site.
2. All reasonable attempts shall be made to notify the employee or subcontractor.
3. The FM or SHSC may now direct the removal of the lock (or tag without a lock).

4. The employee's or subcontractor's supervisor shall be responsible for making immediate notification to the employee upon return to the site.
5. All actions shall be documented by the FM or SHSC in the project log book.

5.3 Training

In accordance with Volume IV, Training Program, of this manual, each authorized employee or subcontractor shall receive training in this procedure, recognition of hazardous energy sources, the type and magnitude of the energy in the workplace, and methods and means necessary for energy isolation and control.

When isolation points cannot be locked and tags are used, employees shall also be trained in the following, as listed in 29 CFR 1910.147.

- Tags are essentially warning devices affixed to energy isolating devices and do not provide the physical restraint on those devices that is provided by a lock.
- When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.
- Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective.
- Tags and their means of attachment must be made of materials that will withstand the environmental conditions encountered in the workplace.
- Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.
- Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

Retraining shall be provided for employees whenever there is a change in the job assignments or when there is a change in the energy control procedure.

6.0 RECORDS

Lockout/Tagout Logs (Attachment 1) will be maintained by the SHSC or subcontractor supervisor. Records of training and annual program inspections will be maintained in the project, office, or contract files.

7.0 REFERENCES

1. Fed-OSHA. 2000. 29 CFR 1910.147, *The Control of Hazardous Energy (Lockout/Tagout)*.
2. Fed-OSHA. 2000. 29 CFR 1910.269, *Electric Power Generation, Transmission, and Distribution*.
3. Fed-OSHA. 2000. 29 CFR 1910.333, *Selection and Use of Work Practices*.
4. DOE/ID-1044 "Construction Safety Reference Guide."
5. U.S. Army Corps of Engineers. 1996. *Safety and Health Requirements Manual*, EM 385-1-1.

Lockout/Tagout Log

LOCK NO.	ISSUED TO	ISSUED BY	DATE/ TIME ISSUED	EQUIPMENT DESCRIPTION AND DATE EMPLOYEE RETURNED LOCK	LOCATION FOR USE	NAME OF EMPLOYEE WHO RETURNED LOCK	COMMENTS

DANGER
DO NOT OPERATE **PERSONNEL PROTECTION** **Lockout/Tagout**

DANGER
Tag No.: Device Position: Applied By Name: Company: Date: