09-39-578957

Volk Field Rifle Ranges #2, #3, #4, and #6 (NAR)

Triggers and Tracking

Is investigation necessary? Consider:

Soil type and depth Sand

Depth to groundwater ~ 14-17'

Depth to bedrock Bedrock refusal @ 28' in nearby Mach. Gun/Pistol Range

Receptors BP978 FD660 SPLP sampling conducted; no exceedances below 8'

Environmental sensitivity

Type of Contamination Pb

Extent of Contamination

Adequacy of sampling data Good

Field screening results < LOD by XRF; lab anal's < 50 mg/kg

Odors or staining

Age of release Pre 1930s; extensive redevelopment, incl. other small ammo ranges, over portions

Also see criteria in NR 708.09(1)(a) through (n) [NR 720 standards are not relevant.]

Investigation not necessary if:

Spill less than reportable quantity (de minimus amounts)

Immediate response has been adequate

Data shows only low-level contamination without the appearance of exacerbating conditions (such as a sensitive environment or other reasons to believe the discharge may be significant)

Investigation ALWAYS necessary if:

Evidence that groundwater wells have been affected, incl. evidence found during release confirmation procedures in NR 706.

Free product removal required under NR 708.13.

Evidence that contaminated soils may be in contact with groundwater

---

May also consider EPA soil screening levels and environmental factors (in 708.09)

Scope of investigation should always be of a scope appropriate to the magnitude of the contamination.

RECEIVED

JAN 12 2015

DNR-WCR via email

State of Wisconsin
Department of Natural Resources
dnr.wi.gov

Notification For Hazardous Substance Discharge (Non-Emergency Only)

Form 4400-225 (09/13) Page 1 of 2

Emergency Discharges / Spills should be reported via the 24-Hour Hotline: 1-800-943-0003

Notice: Hazardous substance discharges must be reported immediately according to s. 292.11 Wis. Stats. Non-emergency hazardous substance discharges may be reported by telefaxing or e-mailing a completed report to the Department, or calling or visiting a Department office in person. If you choose to notify the Department by telefax or by email, you should use this form to be sure that all necessary information is included. However, use of this form is not mandatory. Under s. 292.99, Wis. Stats., the penalty for violating the reporting requirements of ch. 292 Wis. Stats., shall be no less than $10 nor more than $5000 for each violation. Each day of continued violation is a separate offense. It is not the Department's intention to use any personally identifiable information from this form for any purpose other than program administration. However, information submitted on this form may also be made available to requesters under Wisconsin's Open Records Law (ss. 19.31 – 19.39, Wis. Stats.).

Confirmatory laboratory data should be included with this form, to assist the DNR in processing this Hazardous Substance Release Notification.

Complete this form. **TYPE or PRINT LEGIBLY.** NOTIFY appropriate DNR region (see next page) **IMMEDIATELY** upon discovery of a potential release from **(check one)**:

- ☐ Underground Petroleum Storage Tank System (additional information may be required for Item 6 below)
- ☐ Aboveground Petroleum Storage Tank System
- ☐ Dry Cleaner Facility
- ☒ Other - Describe: Military Munitions Response Program - Munitions Response Site

ATTN DNR: **R & R Program Associate** Date DNR Notified:

1. Discharge Reported By

Name	Firm	Phone No. (include area code)
Dan Gonnering	Volk Field CRTC/CEVP	(608) 427-1397

Mailing Address	Email Address
100 Independence Drive, New Lisbon, WI 53950	Daniel.Gonnering@ang.af.mil

2. Site Information

Name of site at which discharge occurred. Include local name of site/business, not responsible party name, unless a residence/vacant property. Volk Field - Former Rifle/Small Arms Ranges - Multiple Sites (SR503) 1 of SR 503c

Location: Include street address, not PO Box. If no street address, describe as precisely as possible, i.e., 1/4 mile NW of CTHs 60 & 123 on E side of CTH 60. E to SE towards sandstone bluff located on the SE portion of base.

Municipality: (City, Village, Township) Specify municipality in which the site is located, not mailing address/city.
Township: 17N, Range: 2E

County:	Legal Description:	WTM:
Juneau	___ 1/4 ___ 1/4 Sec ___ Tn ___ Range ___ ○E ○W	X 928650 Y 262400

3. Responsible Party (RP) and/or RP Representative

Responsible Party Name: Business or owner name that is responsible for cleanup. If more than one, list all. Attach additional pages as necessary.

US ANG - Volk Field CRTC

☒ Reported in compliance with s. 292.11(2), Wis. Stats., by a local government exempt from liability under s. 292.11(9)(e), Wis. Stats. For more information see http://dnr.wi.gov/topic/Brownfields/Liability.html.

Contact Person Name (if different)	Phone Number	Email Address
SAA		

Mailing Address	City	State	ZIP Code

Property owner if Different From RP: Business or owner name that is responsible for cleanup. If more than one, list all. Attach additional pages as necessary. SAA

Contact Person Name (if different)	Phone Number	Email Address

Mailing Address	City	State	ZIP Code

(continued)

State of Wisconsin
Department of Natural Resources
dnr.wi.gov

Notification For Hazardous Substance Discharge (Non-Emergency Only)

Form 4400-225 (09/13) Page 2 of 2

4. Hazardous Substance Information

Identify hazardous substance discharged (check all that apply):

- ☐ VOC's
- ☐ PAH's
- ☒ Metals (specify): Antimony, Copper
- ☐ Arsenic
- ☐ Chromium
- ☐ Cyanide
- ☒ Lead
- ☐ PCB's
- ☐ Diesel
- ☐ Fuel Oil
- ☐ Gasoline
- ☐ Hydraulic Oil
- ☐ Jet Fuel
- ☐ Mineral Oil
- ☐ Waste Oil
- ☐ Petroleum-Unknown Type
- ☐ PERC (Dry Cleaners)
- ☐ RCRA Hazardous Waste
- ☐ Leachate
- ☐ Fertilizer
- ☐ Pesticide/Herbicide/Insecticide(s)
- ☒ Other (specify): Munitions of Explosive Concern
- ☐ Unknown

5. Impacts to the Environment Information

Enter "K" for known/confirmed or "P" for potential for all that apply.

- ___ Air Contamination
- ___ Co-Contamination (Petroleum & Non-Petroleum)
- ___ Contamination Within 1 Meter of Bedrock
- ___ Contaminated Private Well
- ___ Contaminated Public Well
- ___ Contamination in Fractured Bedrock
- ___ Sanitary Sewer Contamination
- ___ Contamination in Right of Way
- ___ Fire Explosion Threat
- ___ Free Product
- ___ Groundwater Contamination
- ___ Off-Site Contamination
- ___ Other (specify): _____
- P Soil Contamination
- ___ Storm Sewer
- ___ Surface Water Contamination
- ___ Within 100 ft of Private Well
- ___ Within 1000 ft of Public Well

Contamination was discovered as a result of:

- ☐ Tank closure assessment — Date _____
- ☐ Site assessment — Date _____
- ☒ Other - Describe: Remedial investigation of munitions response sites — Date _____

Lab results: ☐ Lab results will be faxed upon receipt ☐ Lab results are attached

Additional Comments: Include a brief description of immediate actions taken to halt the release and contain or cleanup hazardous substances that have been discharged.

Remedial investigation has been completed. Recommendation to complete non-time critical interim removal actions.

6. Federal Energy Act Requirements (Section 9002(d) of the Solid Waste Disposal Act (SWDA))

For all confirmed releases from UST's occurring after 9/30/2007 please provide the following information:

☒ Does not apply.

Source

- ☐ Tank
- ☐ Piping
- ☐ Dispenser
- ☐ Submersible Turbine Pump
- ☐ Delivery Problem
- ☐ Other (specify): _____

Cause

- ☐ Spill
- ☐ Overfill
- ☐ Corrosion
- ☐ Physical or Mechanical Damage
- ☐ Installation Problem
- ☐ Other (does not fit any of above)
- ☐ Unknown

Contact information to report non-emergency releases in DNR's five regions are as follows:

Northeast Region (FAX: 920-662-5197); Attention -- R&R Program Associate: DNRRRNER@wisconsin.gov

Brown, Calumet, Door, Fond du Lac **(except City of Waupun - see South Central Region)**, Green Lake, Kewaunee, Manitowoc, Marinette, Marquette, Menominee, Oconto, Outagamie, Shawano, Sheboygan, Waupaca, Waushara, Winnebago counties

Northern Region (FAX: 715-623-6773); Attention -- R&R Program Associate: DNRRRNOR@wisconsin.gov

Ashland, Barron, Bayfield, Burnett, Douglas, Forest, Florence, Iron, Langlade, Lincoln, Oneida, Polk, Price, Rusk, Sawyer, Taylor, Vilas, Washburn counties

South Central Region (FAX: 608-273-5610); Attention -- R&R Program Associate: DNRRRSCR@wisconsin.gov

Columbia, Dane, Dodge, Fond du Lac **(City of Waupun only)**, Grant, Green, Iowa, Jefferson, Lafayette, Richland, Rock, Sauk, Walworth counties

Southeast Region (FAX: 414-263-8550); Attention -- R&R Program Associate: DNRRRSER@wisconsin.gov

Kenosha, Milwaukee, Ozaukee, Racine, Washington, Waukesha counties

West Central Region (FAX: 715-839-6076); Attention -- R&R Program Associate: DNRRRWCR@wisconsin.gov

Adams, Buffalo, Chippewa, Clark, Crawford, Dunn, Eau Claire, Jackson, Juneau, LaCrosse, Marathon, Monroe, Pepin, Pierce, Portage, St. Croix, Trempealeau, Vernon, Wood counties

Final
Remedial Investigation Report
Volk Field CRTC, Wisconsin

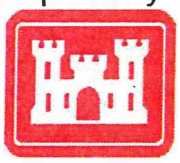
Revision 00
January 2015

Contract W9128F-10-D-0054 Task Order 0009

Prepared for

Air National Guard Bureau
Volk Field CRTC, Wisconsin

Prepared by:



United States Army
Corps of Engineers
Omaha District

and

5 Empire Drive
St. Paul, MN 55103

EXECUTIVE SUMMARY

Background

The U.S. Army Corps of Engineers, Omaha District (USACE), contracted with Bay West LLC (Bay West) under Contract W9128F-10-D-0054, Task Order (TO) 0009, to perform a remedial Investigation on 13 munitions response sites (MRS) at the Volk Field Combat Readiness Training Center (CRTC), Camp Douglas, Wisconsin.

The RI was conducted under the Defense Environmental Restoration Program (DERP) Military Munitions Response Program (MMRP), the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

Activities that may present munitions and explosives of concern (MEC) hazards are required to be in compliance with the Department of Defense (DoD), U.S. Air Force (USAF), Air National Guard (ANG), Department of the Army, and USACE safety requirements and procedures for personnel and equipment.

The objective of the MMRP is to make MRSs safe for reuse and to protect human health and the environment. The MMRP addresses issues related to MEC and munitions constituents (MC) associated with historical operations. The MMRP does not address operational ranges, which are managed under other DoD programs.

The remedial investigation/feasibility study (RI/FS) process provides a means to move from limited historical site information to where sufficient information for assessment of potential hazard or risk is available. If the RI data indicate hazards or risks exists in excess of the screening criteria, the FS develops recommendations for munitions response remedial action objectives that are consistent with the current, determined or appropriate future land use (AFLU).

Field Operations

Field work performed during the Volk Field CRTC investigation is summarized on **Table ES-1**.

Table ES-1 RI Field Activity Summary

MRS	RI Activities
Firing-in Buttress #1 (FR501) 5.13 acres	• Performed a visual survey and surface clearance. • Performed Digital Geophysical Mapping (DGM) and identified 859 subsurface anomalies. Performed analog detector surveys in areas where DGM could not be performed and identified 118 additional anomalies. • Performed intrusive investigation of all anomalies. No MEC items were encountered. • Recovered 48 lbs of munitions debris (MD) and 412 lbs of non-munitions related other debris (OD). • Screened soil samples for Lead using ex-situ X-ray fluorescence (XRF). • Collected 20 soil samples and analyzed for munitions related metals. • Completed soil borings, collected samples and performed Synthetic Precipitation Leachate Procedure (SPLP) analysis to evaluate the potential for leachability of lead in soil. • Excavated 9 test pits in the impact berm soil and estimated the projectile density remaining in the berm. • Refined the MRS boundary and developed recommendation to split the MRS footprint into two separate MRSs based on differing risk parameters

Table ES-1 RI Field Activity Summary

MRS	RI Activities
Firing-in-Buttress #2 (SR502) 0.16 acres	• Performed a visual survey and surface clearance. • Performed DGM over the unpaved area where the Firing-in-Buttress (FIB) structure formerly stood and identified 82 subsurface anomalies. • Performed intrusive investigation of all anomalies. No MEC was identified. • Recovered 4 lbs of MD and 36 lbs of OD. • Collected two soil samples and analyzed for munitions related metals.
Former Rifle/Small Arms Ranges, Multiple Sites (SR503) - 8 sites total 110 acres	• Performed visual survey of the area between firing points and impact berms. • One MEC item was identified at Range 250. Additionally, MD from 40 millimeter (mm) grenades and extensive small arms debris across the entire Range 250 MRS obscured metal detection equipment resulting in a potential explosives safety issue and limiting collection of soil samples in this MRS. • Screened soil samples at impact areas of the remaining MRSs using ex-situ XRF. Collected soil samples to evaluate correlation between XRF screening values and laboratory results. • Completed soil borings to depth of 8 feet at sites where screening indicated elevated lead levels, collected samples and performed SPLP analysis to evaluate potential lead migration into the subgrade. • Refined the MRS boundaries and developed recommendation to split the MRS footprint into three separate MRSs based on differing risk parameters.
Former Small Arms Range #251 (SR504) 2.46 acres	• Performed a visual survey of area between firing point and impact berm. • Screened soil samples at impact area using ex-situ XRF. Collected soil samples to evaluate correlation between XRF screening values and laboratory results; • Completed soil borings, collected samples and performed SPLP analysis to evaluate potential lead migration into the subgrade.
Former Mortar/Artillery Range (MU505) 9.18 acres	• Performed analog detector assisted surface clearance and collected MD. • Performed analog detector survey (i.e., mag & flag) and flagged 10,667 subsurface anomalies to determine anomaly density. • Excavated 1,067 (10 percent [%]) of anomalies for explosives hazard characterization. • Recovered and destroyed three MEC items. • Recovered and removed 1,146 pounds (lbs) of MD and 98 lbs of OD. • Collected 18 soil samples at probable detonation craters and selected MD locations. Analyzed samples for residual explosives compounds. • Developed recommendation to extend the MRS boundary to assess areas adjacent to the MRS that were not identified during previous investigations.
Former Small Arms Debris Area (SR506) 0.48 acres	• Performed a visual survey of area. No small arms ammunition (SAA) debris was observed but extensive MD and detonation craters were evident. • Performed surface clearance over the portion of the MRS that could safely be accessed and collected 295 lbs of MD and 1 lb of OD. • Performed analog detector survey and flagged 684 subsurface anomalies to establish anomaly density. • Excavated 69 (10%) of anomalies for explosives hazard characterization. • Collected two soil samples for lead analysis and four samples for explosives analysis. • Developed recommendation to extend the MRS boundary to further assess the MRS as an extension of the Former Mortar/Artillery Range MRS.

2.3.3 Former Rifle/Small Arms Ranges – Multiple Sites (SR503)

The Former Rifle/Small Arms Ranges (SR503) area consists of multiple former rifle/small arms ranges that were carried forward from the CSE Phase II investigation as a single MRS. Six rifle ranges, numbered Rifle Range #1 – Rifle Range #6, and constructed by the authority of the Adjutant General beginning in 1894, were orientated with the firing lines towards the sandstone bluff on the southeastern portion of the installation (**Figure 2-3**). Former Rifle Ranges #1 through #5 were interconnected, while Former Rifle Range #6 remained a separate range.

The former rifle ranges were constructed in conjunction with training exercises performed by various infantry, artillery, and cavalry units. The area encompassed by all ranges originally included in this MRS, was approximately 1110 acres. However, after completion of the Phase I historical records review, approximately 1,000 acres were determined not to have been subject to activities directly related to munitions usage (i.e., impact berms, firing lines, munitions storage, etc.) and were administratively removed from the MMRP. After accounting of overlapping areas, approximately 110 acres were retained for further investigation. The majority of the former ranges footprint has been extensively redeveloped and no evidence of the original firing lines remains (Sky Research, 2011).

Other small arms ranges were developed over portions of the footprint of the original Ranges #1 through #6. For example, a Machine Gun/Pistol Range, identified on a historic figure titled "*The Location of the Rifle and Machine Guns Ranges at Camp Williams*" was constructed over the southeastern footprint of former Rifle Range #1 and eastern portion of former Rifle Range #2 sometime in the 1930s (Sky Research, 2011).

Small Arms Range #250 was constructed over portions of the former footprint of Rifle Ranges #4 and #5. Small Arms Range #250 first appears on a March 9, 1943, map entitled *Plat Camp Williams, Camp Douglas, Wisconsin* prepared for the Office of the Quartermaster. Small Arms Range #250 was reportedly used until the late 1980s. When Small Arms Range #250 was in use, Volk Field CRTC personnel barricaded Wisconsin Avenue where it cut through the Former Rifle Range #6 (Sky Research, 2011).

Range #250 use included small arms training by ANG personnel, law enforcement personnel, and at times, Civil War Era re-enactors. Documentation of the type or size of munitions used at these ranges was not identified in the CSE Phase II report. However, visual observations identified remnants of 40mm projectiles and extensive SAA debris ranging from Civil War Era lead slugs and minnie balls to modern day 9mm bullets (Sky Research, 2011).

2.3.4 Former Small Arms Range #251 (SR504)

Former Small Arms Range #251 (SR504) was identified in a 2007 Environmental Baseline Survey. The range was in use from 1954 until 1999 when the new, currently active small arms range (Facility #243) was constructed at the southeastern portion of former Small Arms Range #250 (**Figure 2-4**).

Range #251 (SR504) was located within the southeastern portion of the footprint of former Rifle Range #3. The sandstone bluff located to the east was used as the target impact area for range activities. The MRS encompasses approximately 2.46 acres. No documentation was identified discussing the specific types of munitions used at this range (Sky Research, 2011).

4.0 SUMMARY OF DATA COLLECTION ACTIVITIES

This section presents discussion of tasks performed during the RI. This section is organized in two sections. In the first section, activities conducted to evaluate potential MEC impacts are discussed for each individual MRS where these activities were carried out. The second section discusses MC sampling activities, again broken out by activities within each individual MRS.

4.1 MEC Investigation Activities

MEC investigation activities conducted during the Volk Field RI included visual surveys and surface clearance, DGM mapping surveys, analog detector surveys, intrusive investigation, and MC sampling.

4.1.1 Visual Survey/Surface Clearance

Visual surveys and surface clearance were performed at the following sites to prepare the areas for subsequent DGM surveys:

- Former FIB #1 (FR501);
- Former FIB #1 (SR502);
- Building 324 Area – MEC Discovery (XU 511);
- POL Area – MEC Discovery (XU512); and
- FFTA/Suspected Munitions Burn/Burial Pit (OB513).

Visual surveys and surface clearance were also performed during the analog detector mag & flag surveys at the following sites:

- Former Mortar/Artillery Range (MU505);
- Potential Civil War Impact Area (MU507); and
- FFTA/Suspected Munitions Burial/Burn Area (OB513).

Historical firing points for the former rifle/small arms ranges (SARs) were identified by reviewing aerial photographs. The unexploded ordnance (UXO) team formed a sweep line and worked from the firing points to the impact berms searching for any SAA debris. Areas addressed by visual survey included:

- Former Rifle/Small Arms Ranges – Multiple Sites (SR503);
- Former Small Arms Range #251 (SR504); and
- Former Small Arms Debris Area (SR506).

Visual surveys were not performed at the following sites based on historical usage where no expectation of MEC or MD other than lead pellet size debris would be present:

- Former Skeet Range #1/Trap Range #1 & #2 (TS509); and
- Former Skeet Range #2 (TS510).

However, observations were made during the MC sampling (where nearly 100% of the MRS footprint was traversed) and if evidence of MEC items had been identified, formal visual surveys would have been performed.

4.1.2 Survey Control

Survey control was established by locating an existing monument from information supplied by Volk Field personnel and measuring a new base station point near the site trailer. Point numbers 2, 3, and 4 from the Volk Airfield Survey Control served as reference points for the new base station.

- Screening soil with XRF instruments, supplemented by soil sample collection to establish the correlation between the XRF and fixed laboratory samples;
- Discrete soil sample collection;
- Direct push technology (DPT) to complete soil borings to evaluate potential contaminant migration to deeper levels; and
- Installation of temporary monitoring wells for groundwater sample collection.

Pin flags or wooden sample stakes were initially used to mark ex-situ sample locations and then the locations were recorded with a GPS unit. Data from the XRF display was manually recorded on XRF field data forms and stored electronically in the XRF data logger.

4.2.1 XRF Screening

XRF screening was performed to focus the investigation on areas where lead values were highest, indicating SAA-related metals were potentially present, and to identify the areas where soil sampling and subsequent laboratory analysis was performed to obtain definitive analytical results. XRF results are not definitive data and therefore, the XRF results were not used in the risk assessment addressed in **Sections 8.0** and **9.0**.

A minimum of 10% of the XRF samples at each MRS were split for analysis for lead by USEPA Method SW-846 6010B at an off-site laboratory to establish a XRF reading correlation factor. The split samples were selected to represent the range of XRF readings (low, medium, high) observed across the MRSs. XRF Screening was performed at the following MRSs:

- FIB #1 (FR501);
- FIB #2 (SR502);
- Former Rifle/Small Arms Ranges - Multiple Sites (SR503);
- Former Small Arms Range #251 (SR504);
- Former Small Arms Debris Area (SR506);
- Former Skeet Range #1/Trap Range #1 & #2 (TS509); and
- Former Skeet Range #2 (TS510).

XRF sampling was completed in a grid layout using trowels and hand augers if needed at deeper depths. Ex-situ XRF samples were collected in the 0-to-6-inch interval and sampling continued downward in 6-inch increments until the XRF reading was less than the project-specific screening action level of one half of the USEPA human health screening value for lead (i.e., the XRF reading was less than 200 milligrams per kilogram [mg/kg]).

Visible slug fragments or metal debris were removed a sample by screening the soil through a #10 sieve. Fragments and debris was photographed, and noted in the sample log. The soil was mixed by hand to homogenize the sample and placed in a re-sealable Ziploc™ bag.

Three XRF readings were taken from each soil sample. The relative percent difference (RPD) was calculated from the three readings. If the RPD was greater than 20% the sample was re-mixed and re-sampled. If the RPD was less than 20% the results were averaged to provide a single lead value for the sample.

Numerous samples resulted in XRF Lead of non-detect. Bay West contacted the instrument manufacturer and determined that, based on the manufacturer's test data, the limit of detection (LOD) for the specific instrument in use varied from 10 mg/kg to 15 mg/kg depending on local soil conditions and variance in moisture content. To establish the lower end of the range, a value of 15 mg/kg was assigned to XRF values with non-detect (<LOD) readings.

A total of 231 XRF readings were compared to their corresponding laboratory sample values. The XRF correlation was performed site-wide rather than at each MRS due to the small number of XRF samples at some MRSs (i.e., 1-2 data points available per MRS in some cases).

Using linear regression for the combined XRF correlation dataset, a correlation factor of r = 0.9107 was achieved for the XRF screening (**Figure 4-8**). Values used to establish the correlation factor broken out by MRS are provided in **Table 4-5**.

The approach used during the RI produces a conservative result for the correlation factor as laboratory analysis readings with very low values (e.g., actual lead values as low as 1.0 mg/kg) are correlated against the instrument LOD of 15 mg/kg.

The manufacturer also indicated the upper limit for the instrument ranged from 1,000 mg/kg to 1,500 mg/kg. Samples falling outside these limits were submitted for laboratory analysis but were excluded from the split sampling since XRF results in these ranges were not anticipated to correlate well with laboratory results.

Table 4-5 XRF Correlation Factor Determination Data

Sample Name	Analyte	XRF Results (mg/kg)	Analytical Result (mg/kg)
Firing-in-Butt #1			
FR501-LS001-SB02-001-PS	Lead	15*	2.9
FR501-LS002-SB02-002-PS	Lead	15*	3.4
FR501-LS003-SB02-003-PS	Lead	15*	2.8
FR501-LS004-SB02-004-PS	Lead	15*	5.5
FR501-LS005-SB02-005-PS	Lead	15*	16
FR501-LS006-SB02-006-PS	Lead	15*	4.2
FR501-LS007-SB02-007-PS	Lead	15*	6.3
FR501-LS008-SB02-008-PS	Lead	15*	3.8
FR501-LS009-SB02-009-PS	Lead	15*	4.3
FR501-LS010-SB02-010-PS	Lead	15*	3.4
Firing-in-Butt #2			
FIB#2-LS001-SB02-001-PS	Lead	15*	3.1
FIB#2-LS002-SB02-002-PS	Lead	15*	3.5
Former Rifle Range #2			
FRR2-LS003-SB01-003-PS	Lead	15*	9.0
FRR2-LS008-SB01-008-PS	Lead	15*	1.7
Former Rifle Range #3			
FRR3-LS004-SB01-638-PS	Lead	31.92	42
FRR3-LS010-SB01-673-PS	Lead	32.76	43
Former Rifle Range #4			
FRR4-LS002-SB01-002-PS	Lead	15*	7.7
FRR4-LS007-SB01-007-PS	Lead	15*	13
Former Rifle Range #5/Former Range #250			
250-LS011-SB01-011-PS	Lead	629.16	540
250-LS017-SB01-017-PS	Lead	363.57	370
250-LS019-SB01-019-PS	Lead	413.92	230
250-LS026-SB02-026-PS	Lead	204.95	1100
250-LS030-SB02-030-PS	Lead	158.74	210
Former Rifle Range #6			
FRR6-LS001-SB01-677-PS	Lead	20.87	26
FRR6-LS008-SB01-705-PS	Lead	31.76	49

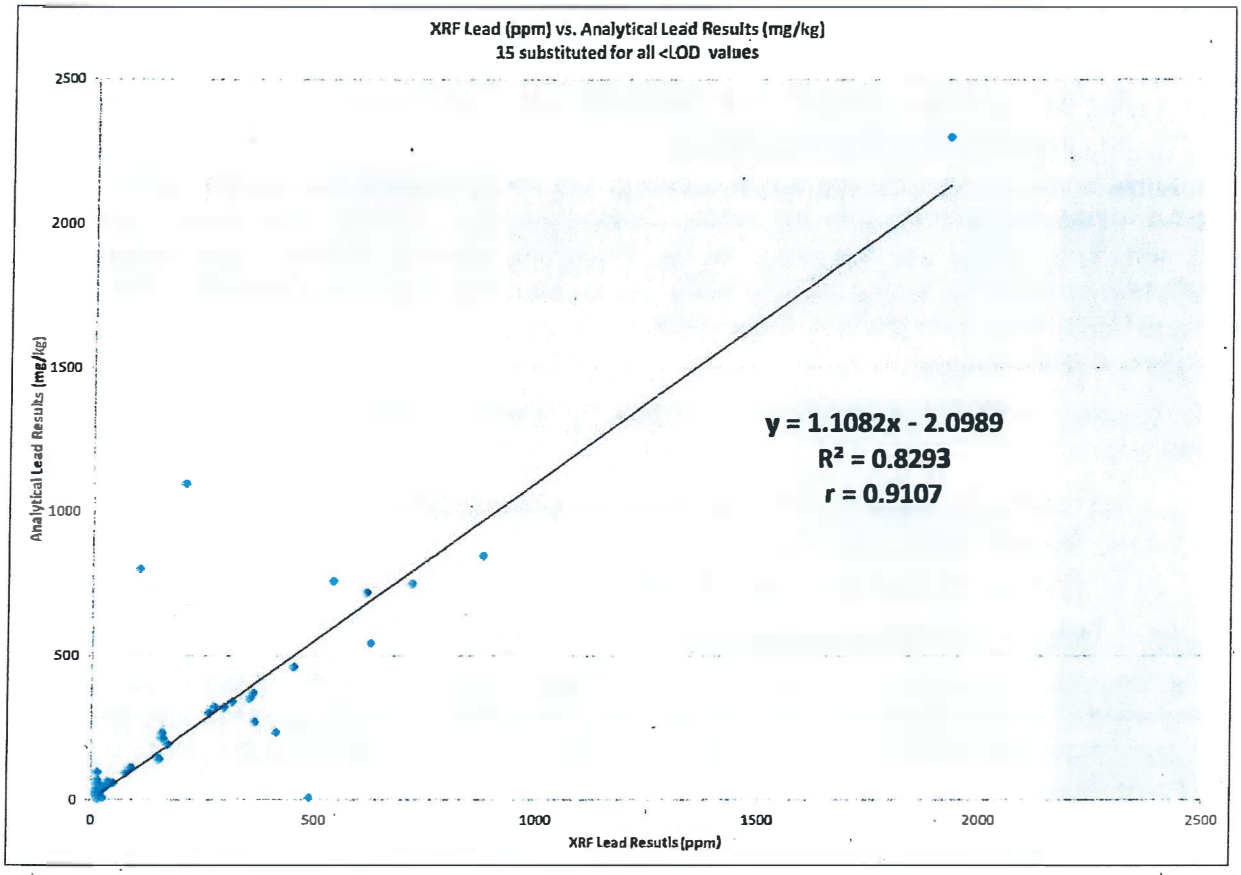
Sample Name	Analyte	XRF Results (mg/kg)	Analytical Result (mg/kg)
Former Rifle Range #1/Machine Gun Range			
FRRMG-LS002-SB01-111-PS	Lead	168.83	190
FRRMG-LS005-SB01-143-PS	Lead	1926.02	2300
FRRMG-LS015-SB01-214-PS	Lead	150.88	140
FRRMG-LS028-SB01-290-PS	Lead	89.53	110
FRRMG-LS030-SB01-302-PS	Lead	542.20	760
FRRMG-LS030-SB02-306-PS	Lead	454.26	460
FRRMG-LS032-SB01-322-PS	Lead	315.41	340
FRRMG-LS032-SB02-326-PS	Lead	490.09	4.9
FRRMG-LS032-SB03-330-PS	Lead	274.82	320
FRRMG-LS033-SB01-343-PS	Lead	38.04	62
FRRMG-LS035-SB01-351-PS	Lead	722.46	750
FRRMG-LS035-SB02-363-PS	Lead	104.27	800
Former Small Arms Debris Area			
FSADA-LS001-SB01-001-PS	Lead	19.61	24
Former Small Arms Range #251			
SAR251-LS001-SB01-430-PS	Lead	620.45	720
SAR251-LS002-SB01-438-PS	Lead	263.14	300
SAR251-LS003-SB01-447-PS	Lead	879.41	850
SAR251-LS004-SB01-455-PS	Lead	79.02	92
SAR251-LS010-SB01-502-PS	Lead	296.57	320
SAR251-LS013-SB01-523-PS	Lead	354.46	350
SAR251-LS015-SB01-599-PS	Lead	367.02	270
SAR251-LS023-SB01-583-PS	Lead	157.65	230

Note:

* = Value of 15 was substituted when XRF result was <LOD (less than the limit of detection)

mg/kg = milligam per kilogram

Figure 4-8 XRF Correlation Factor Determination



4.2.2 Soil Sampling

4.2.2.1 Explosives Analysis

Soil samples collected and analyzed for nitroaromatic/nitramine explosives by USEPA Method SW-846 8330A, modified to include PETN and nitroglycerine, at:

- Former Mortar/Artillery Impact Range (MU505);
- Former Small Arms Debris Area (SR506);
- Potential Civil War Impact Area (MU507);
- Kitchen Dump – C4 Discovery Area (XU508);
- POL Area (XU512); and
- Former Fire Training Area (OB513).

4.2.2.2 Discrete Soil Sample Analysis

Samples collected to establish the XRF correlation factor for Lead were also analyzed for other SAA related metals (i.e., antimony, copper, and zinc) to facilitate MC analysis. Soil samples were collected at the following MRSs:

- FIB #1 (FR501);
- FIB #2 (SR502);

- Former Rifle/Small Arms Ranges - Multiple Sites (SR503);
- Former Small Arms Range #251 (SR504);
- Former Small Arms Debris Area (SR506);
- Former Skeet Range #1/Trap Range #1 & #2 (TS509); and
- Former Skeet Range #2 (TS510).

In addition, two small wetlands areas (0.5 and 0.6 acres respectively) exist in MRS Former Skeet Range #2 (TS510) and POL Area – MEC Discovery (XU512). The wetland areas are ephemeral in nature and frequently dry up during the summer. Surface water samples and sediment samples were planned; however, as no standing water was observed, only surface soil samples were collected from these areas.

4.2.2.3 PAH Analysis

Soil samples collected and analyzed for PAHs by USEPA Method 8270SIM at the following sites:

- Former Skeet Range #1/Trap Range #1 & #2 (TS509);
- Former Skeet Range #2 (TS510); and
- Former Fire Training Area (OB513).

4.2.3 Test Pit Excavation and Sampling

Nine test pits were hand excavated from the impact berm at FIB #1 (FR501) and the soil screened to remove projectiles from the soil. The projectiles were inspected for potential MEC; none of the projectiles recovered were MEC but MD from 20 mm high explosive (HE) projectiles was identified.

Test pits were hand excavated from four areas at the Former Fire Training Area (OB513). Soil was removed and placed on plastic sheeting to allow visual inspection and sample collection. The field team collected a discrete soil sample from each pit/trench from staggered intervals (e.g., 0-1, 2-3, and 4-5 feet). Samples from each test pit were collected for analysis by USEPA Method SW-846 8330A (explosives), USEPA Method SW-846 6010B (metals) and USEPA Method 8270SIM (PAHs).

4.2.4 Direct Push Technology Sampling

A DPT rig was used to complete soil borings and collect samples to assess potential for vertical lead migration at 6 MRSs:

- FIB #1 (FR501);
- Former Rifle/Small Arms Ranges - Multiple Sites (SR503);
- Former Small Arms Range #251 (SR504);
- Kitchen Dump – C4 Discovery Area (XU508);
- Former Skeet Range #1/Trap Range #1 & #2 (TS509); and
- Former Skeet Range #2 (TS510).

At the Former Rifle/Small Arms Ranges - Multiple Sites (SR503), DPT samples were collected at the Rifle Range #1/Machine Gun Range and Range #5/Range #250 sub areas based on elevated XRF screening results.

Groundwater at Volk Field is relatively shallow, ranging from approximately 8 feet in the southeastern part of the base to approximately 15-18 feet across most of the rest of the

installation. However, MC metals tend to sorb tightly to soil and generally have low mobility. Previous investigations at numerous DoD installations reveals metals (predominately lead) frequently do not migrate more than 2-3 feet into the subsurface soils. Accordingly, migration to groundwater was not initially considered a potentially complete pathway, with the exception of the Kitchen Dump MRS where the anticipated depth to groundwater is shallower.

However, if lead was present above the USEPA's Regional Screening Level (RSL) default value for groundwater protection (i.e., 14 mg/kg for lead), Bay West collected soil samples and performed Synthetic Precipitation Leachate Procedure (SPLP) analysis. Similarly, SPLP analysis was performed for the skeet range locations where PAHs were above their individual chemical-specific screening levels to evaluate potential for lead/PAH leaching to groundwater at concentrations above the maximum contaminant level (MCL).

SPLP Samples were collected at intervals of 0-6, 6-24, 24-48, 48-72 and 72-96 inches except at Former Rifle Range #2 where refusal was encountered near the 72-inch level. At FIB #1 (FR501) the structure prevented direct access to soil under the impact berm. The DPT rig was positioned as close to the structure as possible and the boring was angled at approximately 45 degrees to collect samples from under the impact berm at 24-inch and 48-inch depths.

4.2.5 Groundwater Sampling

As discussed in **Section 4.2.4**, groundwater at the Kitchen Dump (XU508) was expected to be shallower than at the other MRS based on a lower surface elevation. Therefore; groundwater sampling at this MRS was warranted to confirm whether impacts to groundwater had occurred.

Soil borings were completed at the Kitchen Dump (XU508) MRS using a DPT rig and dual tube equipment. The soils were described by a geologist and logged in the field log book and bore log form. Soil samples were collected at two foot intervals and analyzed for explosives by USEPA Method SW-846 8330A.

The actual depth to groundwater measured in the field ranged from 14.9 ft. to 16.4 ft., deeper than anticipated based on groundwater depths identified in previous, nearby IRP investigations. The soil borings were converted into temporary 1-inch diameter wells with a 5-foot slotted screen. As the wells were temporary, no filter pack or bentonite seal was placed in the annular space.

Once a temporary well was installed, the well was developed to remove sediment. Well development included purging the well and collecting turbidity readings to document silt minimization to less than 10 nephelometric turbidity units (NTU). Groundwater stabilization parameters (temperature, pH, conductivity, dissolved oxygen and redox potential) were collected during purging.

Once the turbidity stabilized a photograph of the water was collected and final turbidity readings were recorded. A groundwater sample was then collected using a peristaltic pump and Teflon-lined tubing. Groundwater samples analyzed for explosives by USEPA Method SW-846 8330A.

4.2.6 IDW Management

Liquid investigation-derived waste (IDW) was generated as purge water from groundwater wells, equipment decontamination and rinsate blanks used to validate equipment decontamination. Liquid IDW was collected and stored in polyethylene drums staged at a location coordinated with the Volk Field Environmental Management Office. Equipment decontamination water and groundwater well purge water was combined. To ensure drums were readily movable, the field team only filled drums half full.

One sample was collected from each IDW drum generated. IDW samples were analyzed for PAHs by USEPA Method SW-846 8270-SIM and munitions related metals by USEPA Method

5.3 Former Rifle/Small Arms Ranges – Multiple Sites (SR503)

Beginning in 1888, a number of rifle and small arms ranges were constructed and used at Volk Field. Consequently, a number of these ranges overlapped one another. Therefore, former Rifle Ranges #1 through #6, former Small Arms Range #250, and the former Machine Gun/Pistol Range were carried forward in the CSE Phase II process as one MRS totaling approximately 110 acres.

The various ranges were orientated east by southeast towards the sandstone bluff located on the southeastern portion of the base. The former firing lines and target impact areas for these ranges were not specified during the review of documents provided; however, as a result of the Modified CSE Phase II field investigation, the impact areas were towards the bluff.

The location and size of Rifle Ranges #1 through #6 were georeferenced from the historical map that appears in the 2007 EBS (ANG, 2007). The location and size of the Former Small Arms Range #250 was georeferenced from a 1943 historical site map. The location and size of the Machine Gun/Pistol Range was georeferenced from the 1934 historical map entitled *The Location of the Rifle and Machine Gun Ranges at Camp Williams.*

Former Rifle Ranges #1 through #5 were interconnected. The MRS measures approximately 5,030 ft. by 3,663 ft. with a perimeter of 25,303 ft. The coordinates of the area are 43.92865 degrees latitude, -90.2624 degrees longitude.

Former Rifle Range #6 remained a separate range and measures approximately 867 ft. by 183 ft., with a perimeter of 2,111 ft. The coordinates of this area are 43.92499 degrees latitude, -90.2622 degrees longitude.

The total acreage for former Rifle Ranges numbers 1 through 5 and Small Arms Range #250 was calculated as 106.5 acres. The calculated area for former Rifle Range #6 is 3.5 acres.

This calculation excludes the active Small Arms Range #243, which lies within a portion of former Small Arms Range 250; former Small Arms Range #251, which lies within a portion of former Rifle Range #3; and a portion of the Potential Civil War Impact Area (MU507), which lies within a portion of former Rifle Range #2. Therefore, total acreage of the Former Rifle/Small Arms Range – Multiple Sites MRS is approximately 110 acres.

5.3.1 Site Description

5.3.1.1 Former Rifle Range #1

Former Rifle Range #1 was orientated northwest/southeast. The northwest portion of the former footprint of Range #1 appears to start between Sioux Falls Drive and St. Louis Drive. The range continues southeast over developed property towards the sandstone bluff, located in the southeastern portion of the installation.

The range exhibits gently to moderately sloping topography where soils consist of Plainfield sand, and Plainbo sand. Depth-to-groundwater is expected at approximately 16.0 ft. bgs based upon water levels from a base production well (W2) located near the impact area (ES, 1993).

5.3.1.2 Former Rifle Range #2

Former Rifle Range #2 was orientated southwest/northeast. The southwest end of Rifle Range #2 appears to start in an open manicured lawn south of St. Louis Drive, and the range ends at the sandstone bluff to the northeast.

The former range exhibits gently to moderately sloping topography where soils consist of the Friendship sand, Meehan sand, Plainfield sand, and Plainbo sand. Depth-to-groundwater is

expected at approximately 16.0 ft bgs based upon water levels from a base production well (W2) located near the impact area (ES, 1993).

5.3.1.3 Former Rifle Range #3

Former Rifle Range #3 was located partially within Rifle Range #2, but was orientated northwest/southeast. The majority of the former footprint of Rifle Range #3 is located in an open manicured field, known as the Parade Grounds, between W. Wisconsin Avenue to the south and St Louis Drive to the north, and the range continues southeast towards the sandstone bluff. A portion of the northwest corner of the range is now located within Camp Williams ARNG.

The former Rifle Range #3 exhibits gently sloping topography where soils consist of the Friendship sand, Meehan sand, and Plainfield sand. Depth-to-groundwater is expected at approximately 17 ft. bgs based on location of range between base production wells W2 and W6 (ES, 1993).

5.3.1.4 Former Rifle Range #4

Former Rifle Range #4 was orientated northwest/southeast. The northwest portion of Rifle Range #4 intersected Rifle Range #3 at the open manicured field (Parade Grounds) between W. Wisconsin Avenue and St. Louis Drive, and continued and ended southeast towards the sandstone bluff.

The former Rifle Range #4 exhibits gently sloping topography where soils consist of the Friendship sand, Meehan sand, Plainfield sand, and Udorthents. Depth-to-groundwater is expected at approximately 16 ft. bgs based upon water levels from a base production well (W6) located near the impact area of (ES, 1993).

5.3.1.5 Rifle Range # 5

Former Rifle Range #5 was orientated west/east. The west portion of Rifle Range #5 is bounded by Peoria Drive to the west, W. Wisconsin Avenue to the north, and Williams Street to the South. The range continues east, crossing over Wisconsin Ave and ending at the sandstone bluff. The range intersected Rifle Range #4 west of the intersections of Wisconsin Avenue and Independence Drive.

The former Rifle Range #5 exhibits gently to moderately sloping topography where soils consist of the Plainfield sand and Udorthents. Depth-to groundwater is expected at approximately 16 ft. bgs based upon water levels from a base production well (W6) located near the impact area (ES, 1993).

5.3.1.6 Former Rifle Range # 6

Former Rifle Range #6 was orientated west/east. The west portion of Rifle Range #6 is now located within the Camp Williams ARNG facility while the remaining range continues east in an open manicured field, then crossing Wisconsin Ave and the main entrance to the installation, and ending at the sandstone bluff.

The former range exhibits gently to moderately sloping topography where soils consist of the Plainfield sand. Depth-to-groundwater is expected as approximately 16 ft. bgs based upon water levels from a base production well (W6) located near the impact area of (ES, 1993).

5.3.1.7 Former Machine/Gun Pistol Range

The former Machine Gun/Pistol Range was located on the southeastern footprint of former Rifle Range #1 and a portion of former Rifle Range #2. The range is bounded to the north by Wisconsin Avenue and was oriented to northwest/southeast. The target impact area was located towards the sandstone bluff.

The former Machine Gun/Pistol Range area exhibits gently to moderately sloping topography where soils consist of the Plainfield sand. Depth-to-groundwater is expected as approximately 16.0 ft. bgs based upon water levels from a base production well (W2) located near the impact area (ES, 1993).

5.3.1.8 Former Small Arms Range #250

Former Small Arms Range #250 was orientated west/east. The majority of former Small Arms Range #250 was constructed over the footprint of former Rifle Range #5, and part of Former Rifle Range #4. The northwest portion of the former footprint of Small Arms Range #250 is bounded by Peoria Drive to the west, and the southwest portion of the former footprint is located within the Camp Williams ARNG facility. The remaining portion of the range continues east, crossing over Wisconsin Avenue and ending into the sandstone bluff.

The former Small Arms Range #250 area exhibits gently to moderately sloping topography where soils consist of the Plainfield sand and Udorthents. Depth-to-groundwater is expected to be approximately 16 ft. bgs based upon water levels from a base production well (W6) located near the impact area of Rifle Range #6 (ES, 1993).

5.3.2 History of MEC Activities

5.3.2.1 Former Rifle Ranges #1-6

Former Rifle Ranges #1 through #6 were in operation by 1894 in conjunction with training exercises performed by infantry, artillery, and cavalry units. The date of closure for these ranges has not been identified but appears to be prior to 1934, based on a drawing titled *The Location of the Rifle and Machine Guns Ranges at Camp Williams,* dated 1934, that shows only Rifle Range #5 and the Machine Gun Range in use at the time.

Aerial photographs dated 1938 show the northwest portion of Rifle Range #1 redeveloped into installation buildings and partial woodlands, and part of Rifle Range #2 developed into woodlands. Rifle Range #3 was an open manicured field, and Rifle Range #4 was partially redeveloped with installation buildings and sparse woodlands.

The west end of Rifle Range #6 was redeveloped by Camp Williams ARNG, and the east end at the impact area had unkempt vegetation, an indication that this range was no longer in use.

The 2007 EBS (WANG, 2007) addressed these rifle ranges and indicated no environmental investigation or assessment was performed for the former rifle ranges. Munitions dating back to 1888 until at least the 1930s would have been used in this area but the type, or size of munitions used at these ranges has not been clearly identified. No further documentation has been provided regarding the history of MEC activities at these ranges.

5.3.2.2 Former Machine Gun/Pistol Range

The former Machine Gun Range was identified on a historic figure titled *The Location of the Rifle and Machine Guns Ranges at Camp Williams;* dated 1934. The range was also identified in a 1944 historic site plan titled *Camp Williams, WI, Site Plan dated 9 Sept 1944.* The range, however, was then referred to as a "Pistol" Range. The former firing lines have not been clearly identified; however, they would have been oriented to the southeast towards the sandstone bluff, which was used as the backstop for the range.

The Former Machine Gun/Pistol Range also had an earthen berm. The berm is still present and located just in front of the tree line. Based upon available documentation, the range was used from the 1930s until late 1940s.

No further discussion regarding MEC-related activities, munitions used, or specific dates of operation has been identified.

5.3.2.3 Former Small Arms Range #250

Former Small Arms Range #250 was identified in the 2007 EBS (WANG, 2007). The majority of former Small Arms Range #250 was constructed over portions of the former footprint of Rifle Ranges #4 and #5 in 1954. The Small Arms Range used the sandstone bluff as the impact area. This range was equipped with a mechanical target structure used to raise and lower targets from a trench protected by a stone wall. The stone trench is in front of the sandstone bluff used as the backstop for the range.

According to the 2007 EBS (WANG, 2007), the Small Arms Range was in use until 1999, when a new, currently active small arms range (Facility #243) was constructed at the southeastern end of Small Arms Range #250. No documentation has been identified revealing the types of munitions used at the range; however, according to Volk Field CRTC personnel, the Former Small Arms Range #250 contained 100-, 200-, and 600-yard firing positions.

The range was used by Security Forces personnel for firing 40-mm practice grenade rounds but no time period for this activity was determined.

Based upon available information, the former Small Arms Range #250 was in use from 1954-1999. No further documentation has been provided regarding the history of MEC activities at the former Small Arms Range #250.

5.3.3 Current and Future Land Use

The former Rifle Range #1-#6 areas are extensively redeveloped with buildings and roads constructed over much of the areas; however, some portions of the ranges are maintained as open fields. The western portion of Rifle Range #6 was redeveloped by Camp Williams ARNG, and the east end of Rifle Range #6 towards the impact area was developed into the main entrance into Volk Field.

The area of the former Machine Gun/Pistol Range is mostly woodlands bordered by an open, manicured field. Governor's Drive intersects part of the range. Just to the north of the former range is a building, referred to as the Governor's Cottage, used to house Volk Field visitors.

The Former Small Arms Range #250 area also has been redeveloped. The majority of the area is open field with dissecting roads. The southeastern portion of the range is now occupied by the currently active Small Arms Range #243, constructed in 1999.

According to interviews, the Former Small Arms Range #250 received heavy use. The range had multiple firing positions, some of which extended beyond Wisconsin Avenue. When firing positions west of Wisconsin Avenue were in use the road was barricaded off. Interviewees also reported that the range was used for 40-mm target practice rounds during more recent years. The sandstone bluff face used as the impact area remains inactive and practically devoid of vegetation.

5.3.4 Access Controls

There is no fencing or other controls associated with any of the former Rifle/Small Arms Range (SR503) areas; however, access to Volk Field CRTC requires admittance through the security gate and there is a fence around the installation. Therefore, access to the various former Rifle/Small Arms Range areas is restricted to the general public, but is accessible to base personnel and contractors. No changes to the current land uses are anticipated.

5.3.5 Restrictions

There are no restrictions specific to the former Rifle/Small Arms Range (SR503) areas. Due to their location on Volk Field CRTC, access is limited to authorized base personnel and contractors; however, trespassers can access the area.

5.3.6 Field Investigation Results

5.3.6.1 MEC Investigation Results

The SR503 MRS consists of multiple former rifle/small arms ranges that were carried forward as a single MRS. Former Rifle Ranges #1 through #5 were interconnected, while Former Rifle Range #6 was a separate range. Other small arms ranges (e.g., Former Pistol/Machine Gun Range and Range #250) were later developed over portions of the original rifle ranges.

A visual survey of the small arms ranges in the MRS was conducted using aerial photographs to determine the location of the former firing points. The UXO Team lined up and walked from the firing points to the impact berms, scanning the surface to search for potential MEC items or MD. No MEC, MD or SAA debris was identified during the visual survey, except at Range #250, primarily due to heavy redevelopment of the entire area.

An intact 40mm grenade was identified at Range #250 during a site tour in conjunction with the RI Kickoff Meeting. Since Bay West had not mobilized field personnel at this time, the grenade was identified to the Volk Field CRTC Safety Office. In turn, the Safety Office requested assistance from the EOD unit at Ft. McCoy, Wisconsin.

The EOD unit responded and determined the grenade was a M407A1 training grenade. The EOD team performed an explosive demolition procedure. A copy of the EOD report is provided in **Appendix D.8**.

After mobilization, the UXO Team conducted a visual sweep of the Range #250 area between the firing points and the impact berm. No additional MEC was identified on the surface, but approximately 80 lbs of expended 40mm grenade debris was recovered.

The Range #250 impact area is so littered with SAA projectiles the analog detectors emitted a continuous signal across most of the impact area and identifying individual anomalies that could represent potential subsurface 40mm targets was not possible. The SUXOS and UXOSO/QCS jointly determined subsurface clearance within the body of the area presented an unnecessary safety risk. As no subsurface investigation of discrete targets was performed, the potential for additional subsurface 40mm grenades exists.

5.3.6.2 MC Investigation

XRF screening was performed to focus the investigation on areas where lead values, indicating SAA-related metals were potentially present, and to identify the areas where soil sampling and subsequent laboratory analysis was performed to obtain definitive analytical results.

5.3.6.2.1 Rifle Range #1/Machine Gun Range

The Range #1 sampling area was determined by locating the firing line from aerial photos and projecting the range orientation to the sandstone bluff that served as the backstop for the range. Beginning at the target placement area identified from aerial photographs, and confirmed by the existing soil berm, sample locations followed an approximate 50-by-50-foot grid moving up the sloping area behind the target placement area.

Forty-eight locations were sampled. At each location, a sample was extracted using a hand auger and screened with the XRF. Twelve soil samples representing a range of XRF readings were sent to an off-site laboratory for correlation of field XRF lead values with fixed laboratory analysis (**Table 5-6**). The XRF lead correlation samples were also analyzed for MC-related metals (e.g., antimony, copper and zinc) to evaluate the presence of MC-related metals.

Ten samples had lead values exceeding the USEPA and WDNR residential screening criteria of 400 mg/kg, of which seven also exceeded the USEPA and WDNR industrial screening criteria of 800 mg/kg. The extent of samples that exceeded screening criteria are indicated on **Figure 5-6**.

5.3.6.2.3 Former Rifle Range #3

The Range #3 sampling area was determined by locating the firing line from aerial photos and projecting the range orientation to the sandstone bluff that served as the backstop for the range. The MRS sampling area was then extended to include multiple small berm-like features present beyond the range boundary identified in the CSE Phase II report (**Figure 5-8**).

Thirteen samples were collected using a hand auger at the interval 0-6 inches. All samples were screened with the XRF; all XRF results were below the instrument LOD limit (**Table 5-11**).

Two DPT borings were completed to 8-foot depth to evaluate potential migration of lead to lower levels. Samples were collected from 0-6, 6-24, 24-48, 48-72, and 72-96 inch intervals. Samples from one XRF location and both DPT locations were submitted for fixed laboratory analysis for MC-related metals. All analytical results were below the project action limits at all sample locations and at all depth intervals. The analytical results are provided in **Table 5-12**.

5.3.6.2.4 Former Rifle Range #4

The Range #4 sampling area was determined by locating the firing line from aerial photos and projecting the range orientation to the sandstone bluff that served as the backstop for the range (**Figure 5-9**).

Samples were collected at 11 locations with the locations spread across the potential impact zone from east to west with approximately 50 feet between each location. Samples were taken near the base of the hill where the most probable impact area was located. All samples were collected using a hand auger at a depth of 0-6 inches. Each sample was screened with the XRF; all results were all below the XRF's LOD (**Table 5-13**).

Two locations were sampled with the DPT to evaluate potential migration of lead to lower levels; one location hit bedrock refusal at a depth of 4 feet and the other location hit refusal at depth of 6 feet. The two DPT locations were sampled in increments of 0-6, 6-24, and 24-48 inches, and at one location at 48-72 inches.

Samples from two XRF locations and both DPT locations were submitted for fixed laboratory analysis for MC-related metals. All analytical results were below the project action limits at all sample locations and at all depth intervals. The analytical results are provided in **Table 5-14.**

5.3.6.2.5 Former Rifle Range #5/Former Range #250

The sample locations at Range #5 fit on a roughly 50-by-50-foot grid, and reach from a small berm where the targets were placed and run to the east to the top of the hill that served as the impact area. However, due to rocky and unstable portions of the hillside, the 50-by-50-foot grid could not be followed precisely in some locations.

Samples in the 0-to-0.5-foot interval that exceeded the project screening level for lead were sampled 0.5 ft. deeper until lead values were below 200 mg/kg on the XRF. When contamination above the screening level was observed with XRF, samples were taken from the highest XRF reading and submitted for laboratory analysis (**Table 5-15**).

One location at Range #5, (SAR250-LS011-SB01-011-PS) the lead value exceeded the USEPA screening level with a result of 540 mg/kg. At two locations (SAR250-LS017-SB01-017-PS and SAR250-LS019-SB01-019-PS) lead levels did not exceed the USEPA criteria but did exceed the State of Wisconsin screening level at 370 mg/kg and 230 mg/kg respectively. The extent of the samples that exceeded screening levels is indicated on **Figure 5-10**.

However, the ground at Range #250 is so littered with SAA and 40mm MD, only one location (SAR250-LS026-SB01-026-PS) in the primary impact area was considered safe to collect samples from. At this location, lead was detected at 1,100 mg/kg in the 0.5-to-1 ft. interval. The

0-0.5 ft. interval was not analyzed for total lead; however, lead was detected at 1,900 micrograms per liter (µg/L) in the SPLP sample from this location.

XRF samples were collected along the perimeter of the Range #250 impact area to determine if lead was migrating away from the impact area. One location (SAR250-LS030-SB02-030-PS) exceeded the XRF screening limit and a sample was submitted for laboratory analysis with a resultant value of 210 mg/kg. All other XRF samples were below the 200 mg/kg screening limit. The extent of the sample locations is indicated on **Figure 5-11**.

The samples were also analyzed for explosives based on the presence of the 40mm MD. However, no explosives were detected in any sample. The consolidated analytical results for the Range #5 and Range #250 areas are provided in **Table 5-16**.

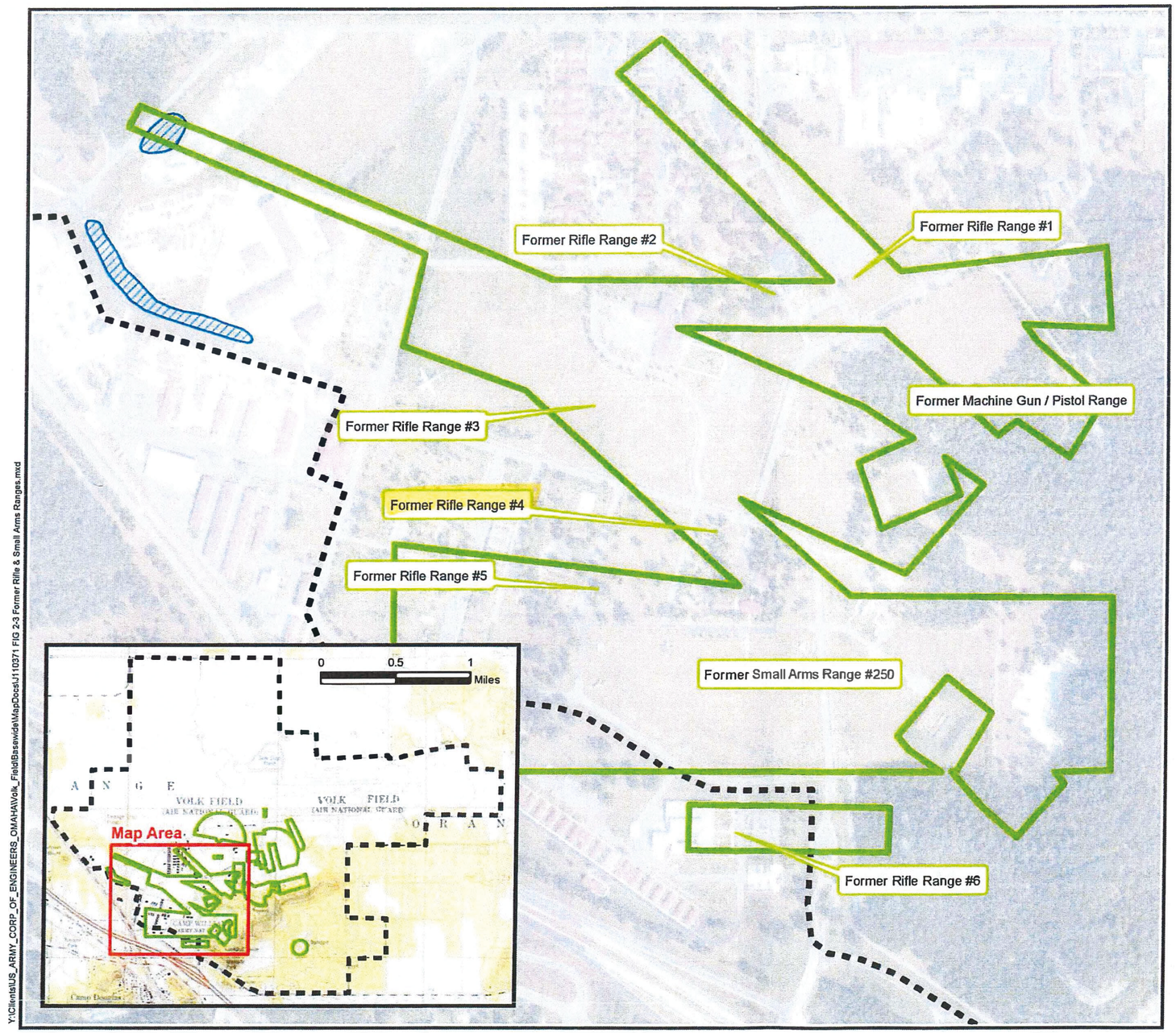
Samples were collected at three locations to a depth of 4 feet with sample intervals of 0-0.5, 0.5-2, and 2-4 feet. The samples were analyzed for total lead and SPLP lead. The SPLP results are compared to USEPA MCL criteria in **Table 5-17** to evaluate the potential for leaching to local groundwater. At one location (SAR250-LS017-SB01-017-PS), the SPLP Lead values exceed the USEPA MCL down to the 2-foot depth. At location SAR250-LS026-SB01-026-PS (where SPLP lead was detected at 1,900 µg/L in the 0-0.5 ft. interval), the SPLP Lead levels exceed the USEPA MCL down to the 4-foot depth, suggesting that lead has migrated vertically beneath the lead impacted soil. Deeper data (**>** 4 ft bgs) is typically considered when evaluating the migration to groundwater pathway (WDNR, 2014). Samples below 4 foot were not collected due to the rocky terrain of the impact area and the presence of MD in the impact area. The Former Small Arms Range #250 was in use until 1999. Depth-to-groundwater is expected as approximately 16.0 ft. bgs. Therefore, potential for leaching of lead is possible, though leaching would be limited by the generally low mobility of MC, the age of the release and the depth to groundwater.

5.3.6.2.6 Former Rifle Range #6 (FFR6)

The Range #6 sampling area was determined by locating the firing line from aerial photos and projecting the range orientation to the sandstone bluff that served as the backstop for the range. Due to restrictions (i.e. the active roadway), it was difficult to follow a 50X50' grid, but the entire site was covered from north to south in the potential impact zone. Eight locations were sampled in 0-to-6-inch intervals using a hand auger and screened with the XRF (**Table 5-18**). All XRF screening results were below half the human health standard for lead. Four soil samples were sent to an off-site laboratory and analyzed for SAA-related metals (**Figure 5-12**).

Samples were collected with the DPT at two locations to depth of 96 inches bgs and sampled for SAA-related metals to evaluate potential migration of lead to lower levels. All analytical results were below the project action limits at all sample locations and at all depth intervals. The analytical results are provided in **Table 5-19**.

Figure 2-3 Former Rifle/Small Arms Ranges (SR503)



N
W E
S

0 500 1,000 Feet

0 150 300 Meters

Map Projection: NAD 1983 StatePlane Wisconsin South Feet

Esri World Imagery Basemap

Volk Field CRTC, Wisconsin

Former Rifle / Small Arms Ranges Multiple Sites

Contract Number: W9128F-10-D-0054

Task Order: 0009

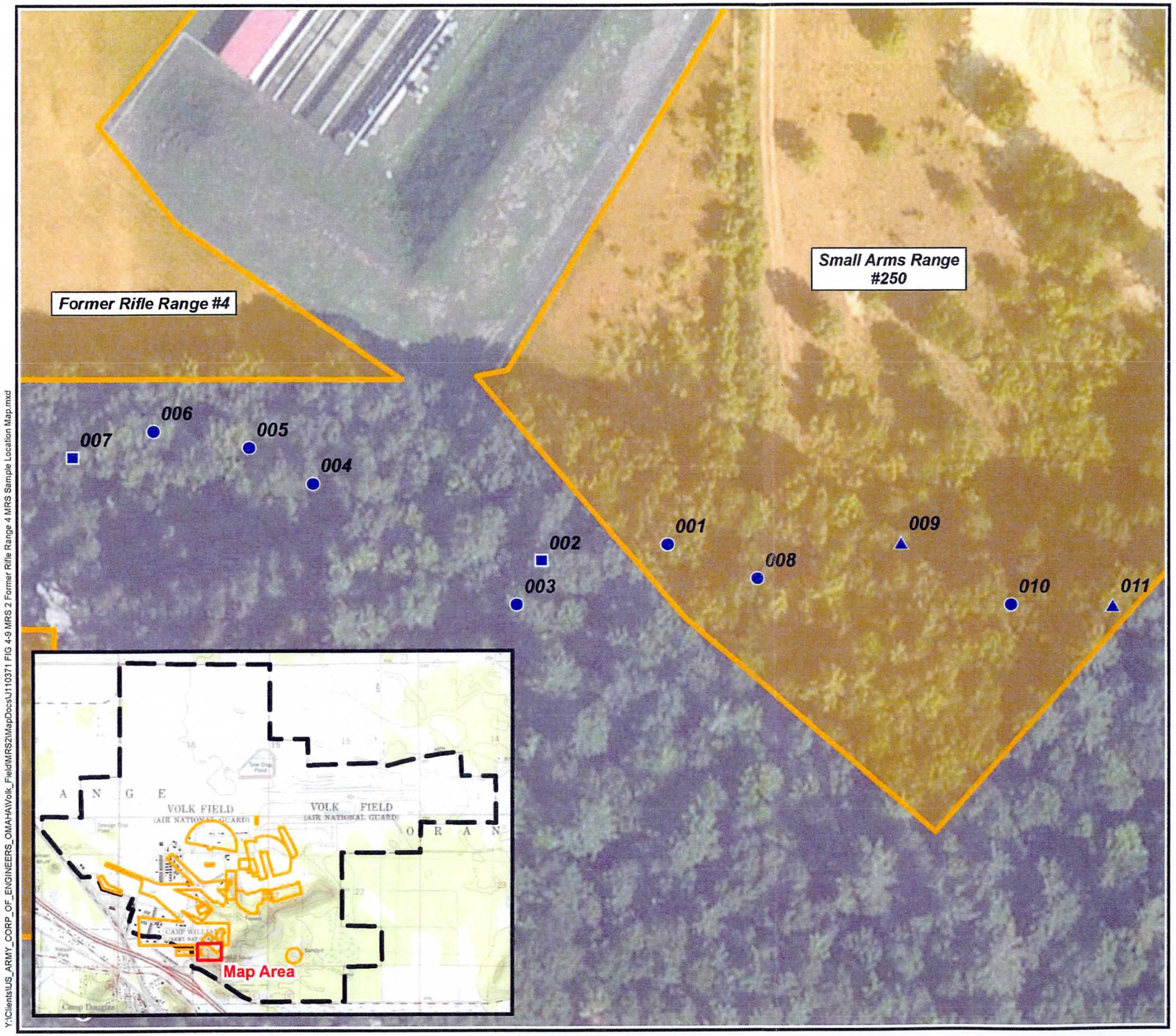
Legend

- Installation boundary
- MRS boundary
- Wetlands

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.B.	Scale: 1:5,000	Rev:
Checked By: M.L.	DateDrawn: 11/18/2013	
Submitted By: M.L.	Revision Date:	

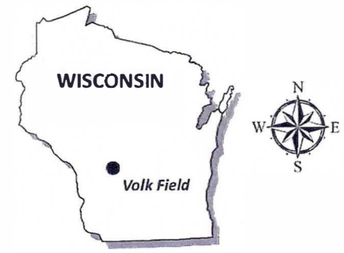
Figure 5-9 Former Rifle Range #4 Analog Investigation Area



Former Rifle Range #4

Analog Investigation Area

Volk Field CRTC, Wisconsin



Map Projection: NAD 1983 StatePlane Wisconsin South Feet

Bing World Imagery Basemap

0 50 100 Feet

0 15 30 Meters

- XRF Sample
- Direct Push Technology Sample
- Analytical Lab Result
- MRS Boundary
- Installation Boundary

XRF / Analytical Results

Lead Concentrations in mg/Kg

- <LOD - 200
- 201 - 400
- 401 - 600
- 600 +

Contract Number: W9128F-10-D-0054

Task Order: 0009

US Army Corps of Engineers
Omaha District
Drawn By: SG
Date Drawn: 11/18/2013

Table 5-13 XRF Sample Results - Former Rifle Range #4

Former Rifle Range #4			
Sample ID	**Depth (Inches)**	**XRF Lead Concentration (mg/kg)**	**Laboratory Lead Concentration (mg/kg)**
FRR4-LS001-SB01-001	0-6	< LOD	NT
FRR4-LS002-SB01-002	0-6	< LOD	7.7
FRR4-LS003-SB01-003	0-6	< LOD	NT
FRR4-LS004-SB01-004	0-6	< LOD	NT
FRR4-LS005-SB01-005	0-6	< LOD	NT
FRR4-LS006-SB01-006	0-6	< LOD	NT
FRR4-LS007-SB01-007	0-6	< LOD	13
FRR4-LS008-SB01-008	0-6	< LOD	NT
FRR4-LS009-SB01-009	0-6	< LOD	NT
FRR4-LS010-SB01-010	0-6	< LOD	NT
FRR4-LS011-SB01-011	0-6	< LOD	NT

Notes:

< LOD - less than limit of detection

NT - Not Tested

Table 5-14 Sample Data - Former Rifle Range #4

Analyte	Sample ID		FRR4-LS002-SB01-002-PS					FRR4-LS002-SB01-002-FD					FRR4-LS007-SB01-007-PS					FRR4-LS009-SB01-009-PS				
	Sample Date		11/7/12					11/7/12					11/7/12					12/4/12				
	Sample Depth (ft)		0-0.5					0-0.5					0-0.5					0-0.5				
	i-SL	r-SL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)																						
Antimony	41	3.1	0.62	U		0.4	2.1	0.6	U		0.38	2	0.6	U		0.38	2	0.57	U		0.36	1.9
Copper	4100	310	1.7	J Q	J	0.23	52	1.6	J Q	J	0.22	5	1.5	J Q	J	0.22	5	0.76	J Q	J	0.21	4.7
Lead	800	400	7.7		J	0.28	0.94	6.2		J	0.27	0.9	13			0.27	0.9	5.7			0.26	0.85
Zinc	31000	2300	21			0.41	8.3	19			0.4	8	9.3			0.4	8	7.2	J	J	0.38	7.6

Analyte	Sample ID		FRR4-LS009-SB04-009-PS					FRR4-LS009-SB08-009-PS					FRR4-LS011-SB01-011-PS					FRR4-LS011-SB04-011-PS				
	Sample Date		12/4/12					12/4/12					12/4/12					12/4/12				
	Sample Depth (ft)		0.5-2					2-4					0-0.5					0.5-1				
	i-SL	r-SL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)																						
Antimony	41	3.1	0.56	U		0.36	1.9	0.57	U		0.36	1.9	0.58	U		0.37	1.9	0.57	U		0.36	1.9
Copper	4100	310	0.39	J Q	J	0.2	4.7	0.32	J Q	J	0.2	4.7	0.98	J Q	J	0.21	4.8	1.1	J Q	J	0.21	4.7
Lead	800	400	1.9			0.25	0.84	0.75	U		0.25	0.85	3.1			0.26	0.86	0.81	J	J	0.26	0.85
Zinc	31000	2300	1.7	J	J	0.37	7.5	0.74	J	J	0.38	7.5	5.3	J	J	0.38	7.7	2.7	J	J	0.38	7.6

Analyte	Sample ID		FRR4-LS011-SB08-011-PS					FRR4-LS011-SB12-011-PS				
	Sample Date		12/4/12					12/4/12				
	Sample Depth (ft)		2-4					4-6				
	i-SL	r-SL	Result	Lab Q	Val Q	MDL	MRL	Result	Lab Q	Val Q	MDL	MRL
Metals (mg/kg)												
Antimony	41	3.1	0.58	U		0.36	1.9	0.55	U		0.35	1.8
Copper	4100	310	0.96	J Q	J	0.21	4.8	1.2	J Q	J	0.2	4.6
Lead	800	400	0.38	J	J	0.26	0.86	0.54	J	J	0.25	0.82
Zinc	31000	2300	1.8	J	J	0.38	7.7	1.5	J	J	0.36	7.3

All analyte concentrations are reported in milligram per kilogram (mg/kg).
PS=Primary Sample, FD=Field Duplicate, ft=feet/foot

12	J
12	J
12	12

Shading indicates an United State Environmental Protection Agency (USEPA) Industrial Screening Level (i-SL) exceedance. USEPA, May 2014.
Bold outline indicates a USEPA Residential Screening Level (r-SL) exceedance. USEPA, May 2014
Shading in the Method Detection Limit (MDL)/Method Reporing Limit (MRL) columns indicates the MDL exceeds a screening level.

Laboratory (Lab Q) and Validation Qualifiers (Val Q):

J = The reported positive result is considered estimated because the result is less than the level of quantitation (LOQ) or because certain quality control criteria were not met.
U = The analyte was not detected and is reported as less than the limit of detection (LOD)
Q = One or more quality control criteria failed [e.g., Laboratory control sample (LCS) recovery, surrogate spike recovery or continuing calibration verification (CCV)]