ENTERED

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON WHITE SANDS
100 Headquarters Avenue
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5000

February 12, 2010

REPLY TO
ATTENTION OF
Directorate of Public Works

Mr. James Bearzi
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Subject: Revised RCRA Facility Investigation Work Plan for the Main Post POL Storage Site White Sands Missile Range

Dear Mr. Bearzi,

Enclosed for your review is the report submittal titled: *Revised RCRA Facility Investigation Work Plan for the Main Post POL Storage Site White Sands Missile Range, February 2010.*

The revised work plan was prepared in response to the New Mexico Environment Department (NMED) Notice of Disapproval dated November 6, 2009 (HWB-WSMR-09-004) and addresses NMED's comments contained in that letter.

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

Copies furnished with enclosure (1 print copy w/CD) to Mr. Dave Cobrain, NMED-HWB; and without enclosure to Mr. John Kieling, NMED-HWB.

Should you have any questions regarding this matter, please contact Mr. Benito Avalos of our Environmental Compliance office at (505) 678-2225/1007.

Sincerely,

Thomas A. Ladd

THOMAS A. LADD
Director, Public Work

Enclosure

Table ES-1 – White Sands Missile Range Response to New Mexico Environment Department Comments

Comment No.	NMED Comments	WSMR Response	Section/Page Reference
1	Appendix A (Human Health Risk Assessment Work Plan) and Appendix B (Ecological Risk Assessment Work Plan) contain work plans for human health and ecological risk assessments proposed to be performed as part of the Work Plan. According to the Work Plan, historical data has not been collected at this site; therefore, it is not known if contamination is present at the site or if such contamination would exceed applicable screening levels. The need for risk assessment will not be known until site characterization is completed. The scope of field activities in this Work Plan does not propose the collection of sufficient analytical data to perform statistically valid risk calculations; therefore, inclusion of risk assessment work plans in Appendix A (Human Health Risk Assessment Work Plan) and Appendix B (Ecological Risk Assessment Work Plan) are inappropriate at this time. The Permittee must remove Appendices A and B from the revised Work Plan.	WSMR concurs that the need for risk assessment will not be known until site characterization is complete. However, the likelihood of impacts is high due to the nature of the release. As discussed in Section 5.1 of the RFI Work Plan, a total of 6 borings are proposed to be advanced at the site, with four soil samples collected from each boring (at 4 to 5 ft bgs, 9 to 10 ft bgs, 14 to 15 ft bgs, and 19 to 20 ft bgs). This plan will result in the collection and analysis of a total of 24 soil samples (four samples/boring for six borings), of which 12 samples will be collected from the depth interval in which direct contact exposure to soil could potentially occur for both human and ecological receptors (i.e., the top 10 ft of the soil column). Based on these considerations, WSMR believes that this sampling plan will provide sufficient and valid data for use in the risk screening process, as well as in a future human health and ecological risk assessment (if necessary based on the results of the risk screening). The text of the RFI Work Plan has been revised to reflect that risk assessment will be performed only if necessary and the risk assessment work plans have been removed from the revised RFI Work Plan.	Section 7, pages 16-17 of Revised RFI Work Plan Appendix A (Human Health Risk Assessment Work Plan) and Appendix B (Ecological Risk Assessment Work Plan) of RFI removed from Revised RFI Work Plan

Table ES-1 – White Sands Missile Range Response to New Mexico Environment Department Comments			
Comment No.	**NMED Comments**	**WSMR Response**	**Section/Page Reference**
2	In Section 1 (Introduction), page 1, the Permittee states "[t]he Site map is shown on Figure 1 (Main Post Site Map) shows an aerial photo of the Main Post POL Storage Site in relation to the Main Post at White Sands Missile Range. The scale of Figure 1 is not appropriate to provide adequate information regarding the location of Main Post POL Storage Site. The Permittee must include an additional figure depicting the subject site at a smaller scale that contains relevant features at, and in the vicinity of, the site in the revised Work Plan.	The intent of Figure 1 is to show the location of the Site in relation to the remainder of the Main Post. Figure 1 has been revised to include street names to more easily identify the location of the Site within the Main Post. Figure 2 shows the Site at a scale that allows specific features of the Site to be identified.	Figures 1 and 2
3	Figure 2 (Main Post POL Storage Site Proposed Soil Borings) does not clearly illustrate the boundaries, structures, or features of the Main Post POL Storage Site. Several features discussed in the Work Plan are not shown on Figure 2 (e.g., location of the filling station, locations of all above ground storage tanks (ASTs)). The Permittee must revise Figure 2 to clearly mark the boundaries of the Main Post Storage POL on a site map which includes all ASTs and secondary containment areas associated with the Main POL Storage Site. The Permittee must also identify the capacity and contents of all ASTs, locations of the dispensers at the filling station and a schematic of all associated piping in the revised Figure.	Figure 2 has been revised to include information available at this time. The text of the Work Plan has also been revised to provide information regarding the sizes and contents of ASTs and a description of the dispensers. During the field effort, various methods will be used to locate underground utilities in the vicinity of the borings. Any additional underground utilities or changes in the locations of the known underground utilities will be reflected in the investigation report.	Figure 2 Section 2, pages 1-2 of Revised RFI Work Plan
4	Section 2 (Background Information) provides no information on the types of fuel stored in the aboveground storage tanks (ASTs). The Permittee must include information on the types of fuel currently stored and historically stored in the aboveground storage tanks (ASTs) at the site in the revised Work Plan.	Section 2 of the Revised Work Plan has been modified to include a discussion of the current ASTs located at the POL site.	Section 2, pages 1-2 of Revised RFI Work Plan

Table ES-1 – White Sands Missile Range Response to New Mexico Environment Department Comments			
Comment No.	**NMED Comments**	**WSMR Response**	**Section/Page Reference**
5	In Section 2 (Background Information), page 1, last paragraph, the Permittee states "a release of approximately 1,370 gallons of gasoline occurred while transferring fuel between a 25,000 gallon AST and a 6,000 gallon AST." Section 2 provides no information on the type of fuel released. The Permittee must include the type(s) of fuel involved in the release and any other known historical fuel releases that occurred at the site in the revised Work Plan.	Section 2 of the Revised Work Plan has been modified to clarify that gasoline was being transferred from a 25,000 gallon gasoline AST to a 6,000 gallon gasoline AST. As previously stated in Section 2, this is the only documented release of fuel from the POL station. While the potential for non-documented releases does exist due to the age of the facility, the scope of this investigation focuses on the December 2005 release of gasoline.	Section 2, page 2 of Revised RFI Work Plan
6	In Section 2 (Background Information), page 2, first paragraph, the Permittee states "...fuel was captured by the concrete secondary containment; however, cracks in the concrete allowed the majority of the fuel to escape and be released in the subsurface below." The Permittee must provide information on the amount of fuel recovered, if any, in the revised Work Plan.	No written documentation of a release report could be located, as stated in Section 2. It is assumed that no gasoline was recovered from December 2005 release.	Section 2, page 2 of Revised RFI Work Plan
7	On page 13, second paragraph, the Permittee states "[d]isposal of IDW will adhere to the most current versions of applicable State of New Mexico ARARs and EPA laws and regulations." The acronym ARARs is not defined in the Work Plan. The Permittee must define ARARs, and list each ARAR to be used for this Workplan. The Permittee must include a list of all acronyms used in the revised Work Plan and the Permittee must describe the procedures for IDW management and disposal in the revised Work Plan. See Comment 15.	A list of acronyms has been added to the Revised Work Plan. The term ARAR has been removed from the Revised Work Plan. Detailed procedures for management and characterization of IDW and potential disposal options are included in Section 5.7 of the Work Plan.	List of Acronyms, page iii of Revised RFI Work Plan Section 5.7, pages 12 to 15 of Revised RFI Work Plan

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Comment No.	**NMED Comments**	**WSMR Response**	**Section/Page Reference**
8	In Section 3.4.1 (Flora), page 5, second paragraph, the Permittee states "WSMR lists Sheer's pincushion cactus (*Corypantha sheeri*) as a species of concern that infrequently occurs in this habitat type." The spelling for this species is incorrect, the correct reference should be Scheer's pincushion cactus (*Coryphantha scheeri var. scheeri*). The Permittee must correct the spelling error in the revised Work Plan.	The spelling of the cactus species has been corrected in the Revised Work Plan.	Section 3.4.1, page 6 of Revised RFI Work Plan
9	In Section 5.1 (Soil Sampling), page 8, second paragraph, the Permittee states "[t]he borings will be installed to 20 ft bgs using Hollow Stem Auger (HSA) drilling methodology and split spoon sampling methodology. During the drilling, soil cores will be collected continuously to the total depth drilled at each location." In the fourth paragraph of the same section the Permittee further states "[s]oil samples will be collected from each boring at depths of 4 to 5 feet, 9 to 10 feet, 14 to 15 feet and 19 to 20 feet..." The Permittee does not indicate the characteristics of the split spoon to be used to collect the soil samples (e.g., length of sampler, lined or unlined). The Permittee must fully describe the split spoon sampling method in the revised Work Plan.	The Revised Work Plan provides a description of the various types of sampling tools that may be used to collect soil samples. The use of a split spoon or a split core barrel will be determined based on the soil type encountered during the drilling process. Actual sample collection methods will be recorded in the field records and described fully in the investigation report.	Section 5.1, pages 8 and 9 of Revised RFI Work Plan

Table ES-1 – White Sands Missile Range Response to New Mexico Environment Department Comments			
Comment No.	**NMED Comments**	**WSMR Response**	**Section/Page Reference**
10	In Section 5.1 (Soil Sampling), page 8, third paragraph, the Permittee states "[a]liquots of the soil cores will be placed into re-sealable plastic bags and allowed to equilibrate for approximately 10 minutes. After equilibration, a photoionization detector (PID) will be used to measure the total volatile organic concentration in the headspace samples." The Permittee does not provide detailed information describing the process of collecting headspace measurements. At a minimum, both the maximum value recorded on the PID and the ambient air temperature must be recorded on the soil boring logs for each sample. The Permittee must provide a detailed description of the headspace measurement procedure, including the procedure for recording ambient air temperature in the revised Work Plan.	The Work Plan has been revised to provide additional detail regarding the process of collecting headspace measurements. The Work Plan has been revised to include a requirement that the ambient air temperature be recorded on the lithologic log.	Section 5.1, pages 8 and 9 of Revised RFI Work Plan
11	In Section 5.1 (Soil Sampling), page 8, last paragraph, the Permittee states " .. .if ARCADIS determines through field observation and PID readings that 20 ft bgs is not the bottom of the vertical extent of contamination, the boring will continue until clean soil is encountered (to approximately 50 ft.)." The Permittee provides no further discussion on the procedure should investigation activities reveal soil contamination at depths greater than 50 ft bgs. In the revised Work Plan the Permittee must provide a discussion of further drilling explorations should the investigation reveal soil contamination at depths greater than 50 ft bgs.	The anticipated depth that the drill rig to be used for this investigation can reach is approximately 50 ft bgs. If the investigation indicates impacts extend to a depth greater than 50 ft bgs, the PID readings will be recorded, soil samples will be collected, the boring will be plugged, and recommendations for future investigation activities will be made.	Section 5.1, page 8 and 9 of Revised RFI Work Plan

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Comment No.	**NMED Comments**	**WSMR Response**	**Section/Page Reference**
12	In Section 5.2 (Groundwater Sampling), page 9, the Permittee states "[h]owever, if saturated soils are observed during drilling activities, temporary monitoring wells will be installed and groundwater sampled." The Permittee does not specify the groundwater analytical suite, if groundwater samples are analyzed. The Permittee must identify the specific field and laboratory analyses that will be performed on groundwater samples collected during the investigation in the revised Work Plan. The Permittee must note that if the installation of monitoring wells is required, the requirements of the New Mexico State Engineer Office regulations for Well Driller Licensing; Construction, Repair and Plugging of Wells, 19.27.4 NMAC, must be met.	The Work Plan has been revised to specify the analytical methods that will be requested in the event that temporary monitoring wells are installed. The drilling company selected to perform the soil sampling will be required to provide a licensed well driller in the event that saturated soil is encountered and temporary monitoring wells are installed. In the unlikely event that temporary monitoring wells are installed, the requirements of 19.27.4 NMAC will be met.	Section 5.2, page 10 of Revised RFI Work Plan
13	In Section 5.3 (Field Quality Assurance/Quality Control Samples), page 9, first paragraph, the Permittee states "[d]uplicate samples will not be collected from the soil samples because contaminants are not homogeneously dispersed in these media. As a result, it is difficult, if not impossible, to collect representative duplicate samples." The Permittee must collect field duplicate samples at a minimum frequency often percent of the total number of samples submitted for analysis. Field duplicates shall consist of two samples either split from the same sample device or collected sequentially. The Permittee must revise the Work Plan to include a description of field duplicate sampling, which includes a minimum frequency of ten percent of the total number of samples submitted for analysis.	The Revised Work Plan includes collection of field duplicate samples at a frequency of ten percent of the normal field samples. Due to the non-homogeneous nature of the soil and the dispersion of contaminants through the media, variation of reported concentrations in a field duplicate sample from the concentrations in a primary sample will not negate the validity of the primary sample results.	Section 5.3, page 10 of Revised RFI Work Plan

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Comment No.	**NMED Comments**	**WSMR Response**	**Section/Page Reference**
14	The Permittee does not discuss how the soil borings will be plugged following drilling and sampling activities. The Permittee must describe the procedures for plugging the soil borings after drilling and sampling activities in the revised Work Plan.	Each boring will be filled with grout or cement following completion of soil sample collection. Section 5.1 has been revised to include a paragraph describing plugging and abandonment requirements.	Section 5.2, page 10 of Revised RFI Work Plan
15	In Section 5.7 (Management of Investigation Derived Wastes), page II, second paragraph, the Permittee states "[a]fter characterization, all containers of [investigation derived wastes] IDW will be staged at WSMR's Waste Management Center (WMC) until the waste is transported for off-site disposal." The Permittee does not discuss what constitutes characterization of IDW. The Permittee must state the details of the characterization of IDW in the revised Work Plan. See Comment 7.	Primary soil samples will be tested for benzene, toluene, ethylbenzene, and xylenes (BTEX) using United States Environmental Protection Agency (USEPA) Method 8021B; Gasoline Range Organics (GRO) using USEPA Method 8015; and lead using USEPA Method 6010A. It is most likely that the soil data will be sufficient for appropriate characterization of the investigation derived waste and that no additional characterization will be required. We cannot anticipate at this time what additional characterization, if any, may be required by the landfill company.	Section 5.7, page 12 of Revised RFI Work Plan
16	In Section 8 (Reporting), page 16, second bullet, the Permittee states "[l]ithologic logs for the new soil borings" will be included in the report submittal, however, the Permittee did not discuss what would be included on the lithologic logs. The Permittee must discuss the contents of the lithologic logs in the revised Work Plan. (see comment 17)	The Work Plan has been revised to include a sample lithologic log, which will be used to summarize the field observations. Information to be recorded on the form includes the location, boring id, drilling method, start and finish time of drilling, personnel involved in drilling and observation, sampling device used, depth of sample, percent recovery, soil classification and description, moisture, PID reading, air temp, lab sample depth, and other general comments.	Appendix A of Revised RFI Work Plan

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Comment No.	**NMED Comments**	**WSMR Response**	**Section/Page Reference**
17	In Section 5.1 (Soil Sampling), page 8, second paragraph, the Permittee states "[t]he soil cores will be examined visually and described according to the Unified Soil Classification System, ASTM Standard D 2487-83 (ASTM, 1985). Observations will be recorded on a lithologic log." The Permittee does not describe which observations will be recorded on the lithologic log. The Permittee must also include depth of split spoon interval, PID sample depth, PID results, ambient air temperature, laboratory sample depth, blow counts, depth of moisture or groundwater, as well as the depth of visual or olfactory evidence of petroleum contamination on the lithologic logs. (see comments 10 and 16)	The Work Plan has been revised to include a field boring log form, which will be used to summarize the field observations and to prepare the lithologic logs. All of the information described in NMED's comment will be recorded on the logs.	Appendix A of Revised RFI Work Plan
18	The project schedule outlined on Figure 4 (Implementation Schedule) indicates that soil investigation activities were completed between August 31 and September 4, 2009. In Section 9 (Project Schedule), page 17, the Permittee states "[b]ecause the POL Storage site is in active use, access will have to be organized with WSMR Facilities Department. Once the access is approved and scheduled, drilling activities will begin immediately." NMED was not notified of field activities; therefore, it is not clear if soil investigation activities have already been completed at the site. If investigation activities were completed without NMED's prior approval of the Work Plan, the investigation was conducted at risk. In its approval NMED may require a scope of work that differs from the Work Plan. NMED reminds the Permittee additional field activities may be required as a result of our review of the Work Plan.	A revised general schedule is provided as Figure 4.	Section 9, page 18 of Revised RFI Work Plan Figure 4 of Revised RFI Work Plan

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Comment No.	**NMED Comments**	**WSMR Response**	**Section/Page Reference**
General Comments	The Permittee must address all comments in this NOD and submit a revised Work Plan. The revised Work Plan must be accompanied with a response letter that details where all revisions have been made, cross-referencing NMED's numbered comments. In addition, an electronic version of the revised Work Plan must be submitted identifying where all changes were made to the Work Plan in red-line strikeout format. The revised Work Plan must be submitted to NMED no later than February 4, 2010. If the investigation has already been completed, the Permittee must submit a report summarizing the implementation of the Work Plan and the results by the date specified for submittal of the revised Work Plan.	The comments have been addressed as summarized in this table, which provides a reference to the locations of revisions. An electronic version of the Revised Work Plan has been submitted identifying changes to the work plan in redline/strikeout.	This table and CD included with Revised RFI Work Plan

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Revised RCRA Facility Investigation Work Plan for the Main Post POL Storage Site SWMU 219

White Sands Missile Range

White Sands, New Mexico

February 2010

ARCADIS

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Phase Manager

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Revised RCRA Facility Investigation Work Plan for the Main Post POL Storage Site SWMU 219

White Sands Missile Range

Prepared for:
White Sands Missile Range

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Our Ref.:
GP08WSMR.0C77

Date:
February 2010

Tables

Figures

Appendices

List of Acronyms

AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CCWS	Compliance-related Cleanup Program White Sands Missile Range
CFR	Code of Federal Regulations
DOT	Department of Transportation
DQO	Data Quality Objective
°F	Degrees Farenheiht
ft	feet
ft bgs	feet below ground surface
GRO	Gasoline Range Organics
HSA	Hollow Stem Auger
HWB	Hazardous Waste Bureau
IDW	Investigation Derived Waste
NELAC	National Environmental Laboratory Accreditation Conference
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
PID	Photo-ionization Detector
POL	Petroleum, Oil, Lubricant
PSTB	Petroleum Storage Tank Bureau
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SSL	Soil Screening Level
TSD	Transportation, Storage, Disposal
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds
WMC	Waste Management Center
WSMR	White Sands Missile Range
WSNM	White Sands National Monument

1. Introduction

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan was developed by ARCADIS on behalf of White Sands Missile Range (WSMR) pursuant to requirements of WSMR's Hazardous Waste Permit (No. NM2750211235) dated October 24, 1989. The work plan describes activities proposed to characterize soil and groundwater conditions at the Main Post Petroleum, Oil, and Lubricant (POL) Storage Site (CCWS-77) (the Site), which was the location of a fuel spill of approximately 1,370 gallons of fuel that occurred in December 2005. The Site location within the Main Post area of WSMR is shown on Figure 1.

The primary objectives of the proposed activities are: 1) to determine whether the spill resulted in a release to the surrounding soils or groundwater; 2) to characterize the nature and extent of affected soils and groundwater (if applicable); and 3) to evaluate potential risks to human and ecological receptors exposed to the affected media. The proposed work includes the following specific tasks.

- Conduct soil sampling to complete vertical and lateral delineation to New Mexico Environmental Division (NMED) residential soil screening levels (SSLs).
- Determine whether subsurface soil impacts extend to a depth that may affect the underlying groundwater.
- Perform Human Health and Ecological Risk Assessments, if needed (Appendices A and B, respectively).
- Perform a statistical evaluation of analytical results and background levels.

These activities are described in more detail in the following sections.

2. Background Information

The Site is located at the Main Post POL Storage Facility, Building 1785, POL Station. The station provides storage and a fueling point for the Main Post official vehicles and consists of a number of aboveground storage tanks (ASTs), underground piping, and a filling station.

The Site has been in service since the 1960s. Currently, there are eight fuel pumps located at the fueling island. Two of the eight pumps are used to dispense diesel fuel

while the remaining six pumps dispense gasoline. As shown in Figure 2, there are three 6,000 gallon diesel ASTs located to the northwest of the fueling island and three 6,000 gallon gasoline ASTs located to the west of the fueling island. On the east side of Wesson Street, there are three 25,000 diesel ASTs and three 25,000 gasoline ASTs. There are underground lines that convey diesel from the 25,000 gallon diesel ASTs to the 6,000 gallon diesel ASTs and from the 6,000 gallon diesel ASTs to the diesel fuel pumps. Likewise there are underground lines that convey gasoline from the 25,000 gallon gasoline ASTs to the 6,000 gallon gasoline ASTs and from the 6,000 gallon gasoline ASTs to the gasoline fuel pumps. The approximate locations of these underground lines is shown in Figure 2.

On December 7, 2005, a release of approximately 1,370 gallons of gasoline occurred while transferring gasoline between one of the 25,000 gallon gasoline ASTs to one of the 6,000 gallon gasoline ASTs. The smaller capacity tank was overfilled during the transfer. The released gasoline was captured by the concrete secondary containment; however, a crack in the concrete allowed the majority of the fuel to escape and be released to the subsurface below. The release was verbally reported to the Petroleum Storage Tank Bureau (PSTB) and the NMED Hazardous Waste Bureau (HWB) in December of 2005. No record of a written report has been discovered, and no investigations have occurred at this site to date. Because there is no documentation of any recovery of the released gasoline, it is assumed that no recovery of the released gasoline occurred.

The only documented release from the POL Station is the December 2005 release, which is the scope of this RFI work plan. Thus, there are no other known releases that have occurred at the Site. The potential extent of undocumented leakage and/or spillage from secondary containment at the POL Station is not known. However, due to the time the POL Station was in service, approximately 40 to 50 years, it is possible that there may have been additional leakage and/or spillage in the area.

3. Site Conditions

Current site conditions at the Main Post POL area consist of an asphalt-covered area with concrete-bermed ASTs and a fueling station for WSMR official vehicles. The damaged secondary containment has been surficially repaired and is still in use.

3.1 Geology

WSMR lies within the Mexican Highland Section of the Basin and Range Province. This province is characterized by a series of tilted fault blocks forming longitudinal, asymmetric ridges, or mountains, and broad intervening basins.

The geology of WSMR consists predominantly of the Tularosa Basin and surrounding mountain ranges. The San Andres Mountains, San Augustin, and Oscura Mountains border the Tularosa Basin on the west while the Sacramento Mountains form the eastern border. A narrow region of north-south-trending, large-displacement normal faulting separates the mountains from the basin resulting in the change in relief across the missile range. The average elevation of the Tularosa Basin is 4,000 feet above mean sea level. The majority of WSMR property, including most test facilities, is located within the Tularosa Basin (WSMR, 1998). The Tularosa Basin contains thick sequences of Tertiary and Quaternary age alluvial and bolson fill deposits. These sediments, more than 5,000 feet thick in some areas, consist mainly of silt, sand, gypsum and clay weathered from the surrounding mountain ranges. The average elevation of the basin floor is 4,000 feet above mean sea level and surface features consist of flat sandy areas, sand dunes, basalt flows, and playas (dry lake beds).

The nature of the bolson-fill deposits varies both laterally and vertically throughout the Tularosa Basin. Coarse-grained, poorly sorted sediments deposited near mountain fronts grade into fine-grained, well sorted sediments towards the center of the basin (Kelly, 1973). Sediments further from the mountain fronts also contain a greater percentage of clay and gypsum. Vertically, the sediments are reported to become finer-grained and more consolidated until reaching a laterally continuous clay unit at about 1,000 feet below ground surface (Kelly and Hearne, 1976). In general, the stratigraphy is represented by unconsolidated to partially consolidated, fine to medium-grained sand with subordinate amounts of clay. Caliche is present as discrete layers and nodules throughout the stratigraphic section.

Although no faults within the basin fill are mapped within the immediate area, quaternary faulting is known to exist within the region. These faults are reported to occur within the unconsolidated bolson sediments, trend north to south, and are most common near the mountain fronts. Orr and Myers (1986) divide the Tularosa Basin fill deposits into five distinct mapable units which include:

- Coarse to fine-grained deposits occur in gently sloping alluvial fans along the basin margin. The alluvial fans spread outward from the surrounding mountain slopes

and coalesce into flat alluvial plains toward the basin interior. These fan deposits interfinger with lacustrine (lake) and alluvial deposits of the central part of the Tularosa Basin.

- Fine-grained sediments formed from lacustrine deposition extend throughout most of the Tularosa Basin. These deposits consist mainly of clay and evaporites with minor sand beds and occur near surface in the northern part of the basin and at depth in the southern part of the basin.

- Fluvial-eolian sand, gravel, and clay deposits occur in the southern part of the basin, near Fort Bliss, extending from the Organ and Franklin Mountains and south to the Hueco Mountains.

- Gypsiferous evaporite deposits of the Lake Lucero-White Sands area occupy the White Sands National Monument (WSNM) and areas administered by WSMR including the Lake Lucero area and the alkali flats north of Lake Lucero. These deposits occur as dense recrystallized gypsum, gypsum sand dunes, and alluvial deposits. Hard caliche (cemented with recrystallized gypsum) is present at or near surface in the dry lake gypsum deposits of the central portion of the basin.

- The last depositional unit is described as composed of coarse-grained deposits saturated with saline water in the central portion of the Tularosa Basin.

The Main Post is situated on the distal portion of the alluvial fan complex eroded from the Organ Mountains to the west. Deposits expected to be encountered at the Main Post correspond to the first mapable units described above. The predominant slope across the area causes runoff water to flow to the east towards the center of the Tularosa Basin. Coincidentally, the prevailing wind direction is from the west and southwest. Wind and water currents winnow fine-grained particles and disperse them eastward, while coarser (and very dense) material remains behind as sediment.

3.2 Surface Hydrology

Very little surface water exists at WSMR due to low annual precipitation, high evapotranspiration rates, and high infiltration characteristics of the soils. During the summer season, when thunderstorm activity is most common, playas within the basin may contain standing water. Arroyos which drain the surrounding mountains usually contain water only following heavy precipitation events. The Tularosa Basin is a closed basin with no surface water drainage outside of WSMR.

3.3 Hydrogeology

The WSMR Main Post obtains its potable water supply from an aquifer in the upper bolson deposits. The closest production well is approximately ¼ mile to the south of the Site. The majority of the groundwater recharge to this bolson aquifer occurs through the coarse, unconsolidated Tertiary/Quaternary alluvial fan deposits and arroyos along the eastern flank of the Organ, San Augustin and San Andres Mountains. This aquifer consists of a wedge-shaped belt of potable water more than 30 miles long from north to south, and 3 to 5 miles east from the mountain front.

Groundwater in the vicinity of the Main Post is of sufficient quality (less than 1,000-mg/L total dissolved solids) for human consumption. This freshwater zone is assumed to extend down to about 1,800 feet below ground surface. Recharge to the regional aquifer is from precipitation falling on the mountain ranges and alluvial fans. This precipitation infiltrates the unconsolidated, relatively coarse deposits of the alluvial fans, and the resultant groundwater flows toward the center of the Tularosa Basin, generally to the east-southeast. To the east, groundwater becomes more mineralized, primarily with sulfate and chloride, most likely due to the slow lateral migration rate of groundwater from recharge to discharge areas in the presence of readily soluble minerals in the bolson sediments. However, groundwater flow direction within the western Tularosa Basin region is presumed to discharge to the south as underflow into the contiguous, northern Hueco Basin of western Texas. No surface expressions of groundwater discharge have been reported within the western Tularosa Basin.

There are no monitoring wells within the vicinity of the POL area. However, depth to groundwater on the Main Post, based on numerous monitoring wells, including T-12, OS-12, 0063MW-11, and 0063MW-12, is greater than 200 feet below ground surface (bgs). The site is covered by asphalt which has a low permeability if intact, thus indicating little to no water available in the subsurface strata for leaching.

3.4 Ecology

3.4.1 Flora

The vegetation matrix around the Main Post is defined as climax dune vegetation typically consisting of honey mesquite (*Prosopus glandulosa*), four-winged saltbush (*Atriplex canescens*), soaptree yucca (*Yucca elata*), sand dropseed (*Sporobolis cryptandrus*), broom snakeweed (*Gutierrezia sarothrae*), and annuals. Blowouts and wind-sifted actively moving sand dunes with little inter-dunal vegetation comprise dune

land. Competition for moisture by mesquite limits grasses in this habitat. Grasses that sporadically occur include spike dropseed (*Sporobolus contractus*), mesa dropseed (*Sporobolus flexuosus*) and alkali sacatone *(Sporobolus airoides).*

WSMR lists Scheer's pincushion cactus (*Coryphantha scheeri var. scheeri*) as a species of concern that infrequently occurs in this habitat type. A more comprehensive list of vegetation occurring in the Main Post Area is provided below.

Vegetation

Atriplex canescens-Fourwing Saltbush
Gutierrezia sarothrae-Broom Snakeweed
Muhlenbergia porteri - Bush Muhly
Opuntia phaeacantha - Engelman's Prickly Pear
Prosopis glandulosa-Honey Mesquite
Sporobolus contractus - Spike Dropseed
Sporobolus flexuosus-Sand Dropseed
Chilopsis linearis-Desert Willow
Larrea tridentata - Creosotebush
Opuntia imbricata - Tree Cholla
Opuntia violaceae - Purple Prickly Pear
Sporobolus ariodies - Alkali Sacatone
Sporobolus cryptandrus - Mesa Dropseed
Yucca elata - Soaptree Yucca

3.4.2 Fauna

Black-tailed jackrabbits (*Lepus californicus*) and desert cottontail rabbits *(Sylvilagus audubonii*) occur in the WSMR Main Post area with high frequency. Oryx (*Oryx gazella*), mule deer (*Odocoileus hemionus*), mourning dove (*Zenaida macroura*), and scaled quail (*Callipepla squamata*) also occur in the area. Nongame wildlife sited around the Main Post includes raptors such as red-tailed hawks (*Buteo jamaicensis*), Swainson's hawks (*Buteo swainsoni*), and American kestrels (*Falco sparverius*). Songbirds common around the Main Post include black-throated sparrows (*Amphispiza bilineata*), house finches (*Carpodacus mexicanus*), and Say's phoebes (*Sayornis saya*).

The Texas horned lizard (*Phrynosoma cornutum*) does occur in this habitat. This species is not listed as threatened or endangered, but is a New Mexico candidate (2C) species. The Texas horned lizard is very common and widespread throughout suitable habitats on WSMR. Herpetologists for the New Mexico Department of Game and Fish have recommended that the Texas horned lizard be removed from the State candidate list. A more comprehensive list of wildlife species occurring in the Main Post Area is provided below.

Avians

Amphispiza bilineata-Black-throated Sparrow
Buteo jamaicensis-Red-tailed Hawk
Buteo swainsoni-Swainson's Hawk
Callipepla squamata-Scaled Quail
Carpodacus mexicanus-House Finch
Corvus cryptoleucus – Chihuahuan Raven
Falco sparverius-American Kestrel
Geococcyx californianus-Greater Roadrunner
Lanius ludovicianus - Loggerhead Shrike
Mimus polyglottos-Mockingbird
Sayornis saya-Say's Phoebe
Zenaida asiatica-White-winged Dove
Zenaida macroura-Mourning Dove
Zonotrichia leucophrys-White Crowned Sparrow

Invertebrates

Acrididae – Grasshopper (2 species)
Anthophoridae - Carpenter Bee
Ceribicidae – Longhorn Beetle
Coccinelidae - Lady Beetle
Formicidae - Red Black and Harvester Ants (3 species)
Halictidae - Sweat Bee
Lycosidae - Wolf Spider
Mantidae - Praying Mantis
Pieridae – Moth
Simuliidae – Gnats
Tenebrionidae - Tenebrionid Beetle
Termitidae – Termite

Mammals

Canis latrans-Coyote
Lepus californicus - Black-tailed Jackrabbit
Odocoileus hemionus-Mule Deer
Oryx gazella - Oryx
Sylvilagus audubonii-Desert Cottontail
Thomomys botae-Gopher

Reptiles

Cnemidophorus tigris – Western Whiptail
Crotalus atrox-Western Diamondback Rattlesnake
Gambelia wislizinii - Leopard Lizard
Masticophis flagellum - Coachwhip
Pituophis melanoleucas-Gopher Snake
Uta stansburiana-Side-blotched Lizard

3.5 Climatology

The elevation of the WSMR Main Post is approximately 4,000 feet above mean sea level. Snowfall is infrequent, although heavy snows have occurred. With an average annual rainfall of only 10.8 inches, mostly occurring during late summer as thunderstorms, often accompanied by hail, the area is considered semi-arid. Intense localized thunderstorms have caused flash flooding in the past. The average summer high temperature is 92 °F with lows of about 65 °F. During the winter months (December, January and February), the average high is 57 °F, with lows of about

36 °F. Average annual humidity readings are approximately 37 percent. Westerly winds can reach approximately 40 miles per hour, and wind is a climatic factor from February to about May.

4. Previous Investigations

There have been no previous investigations at the Main Post POL Storage Area. However, a site-wide background study was performed for the Main Post Area.

Samples representative of background soils were collected and results tabulated and reported in the *Background Soils RCRA Facility Investigation Report for the Main Post, White Sands Missile Range* (BAE Systems, 2004). The report was approved with reservation by the NMED on December 7, 2008. The scope of that investigation described the background levels for all 40 CFR 265 Appendix IX inorganic constituents in soils for the Main Post area of WSMR. Results from this investigation will be used in this RFI to statistically compare background lead concentrations to site concentrations.

5. Field Methodologies

5.1 Soil Sampling

A total of six (6) soil borings are proposed near the southeast corner of the secondary containment where the cracks were located. The proposed borings are located on Figure 2. The site will be cleared of all utilities prior to drilling.

The borings will be drilled to 20 ft bgs using Hollow Stem Auger (HSA) drilling and sampling methodologies appropriate to the soils encountered. Anticipated sample collection tools include 18-inch to 24-inch split spoons and 24-inch to 60-inch Shelby tubes or split core barrels. During drilling, soil cores will be collected continuously to the total depth drilled at each location. The soil cores will be examined visually and described according to the Unified Soil Classification System, ASTM Standard D 2487-83 (ASTM, 1985). The sampling tools used, depth and length of soil core, amount of soil recovered, soil classification, and other visual observations will be recorded on a lithologic log for each sampling location. A copy of the form used to record the field observations that will be used to prepare the lithologic logs is included in Appendix A of this Work Plan.

Aliquots of the soil cores will be placed into re-sealable plastic bags and allowed to equilibrate for approximately 10 minutes. After equilibration, a photoionization detector

(PID) will be used to puncture the plastic bag and measure the total volatile organic concentration in the headspace samples. The highest PID measurement from each aliquot of soil will be recorded on the lithologic log along with the depth from which the aliquot was obtained. The ambient air temperature will also be recorded on the lithologic log.

Soil samples will be collected from each boring at depths of 4 to 5 feet, 9 to 10 feet, 14 to 15 feet, and 19 to 20 feet, unless visual and/or PID readings indicate impacts at different intervals. If this is the case, samples will be taken at those depths in which the highest PID readings and/or highest level of visual impacts occur.

Soil samples will be submitted to a National Environmental Laboratory Accreditation Conference (NELAC) accredited laboratory. The soil samples will be analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) using United States Environmental Protection Agency (USEPA) Method 8021B; Gasoline Range Organics (GRO) using USEPA Method 8015; and lead using USEPA Method 6010A. A summary of analytical methods is presented in Table 1.

During the course of the investigation, if ARCADIS determines through field observation and PID readings that 20 ft bgs is not the bottom of the vertical extent of contamination, the boring will continue until clean soil is encountered or to approximately 50 ft bgs. In the event that field observations indicate that the vertical extent of contamination extends deeper than 50 ft bgs, a sample will be collected from the bottom of the boring and the investigation will stop at that depth. The analytical results from the bottom sample and the field observations will be evaluated to determine an appropriate scope for additional investigation.

Following completion of sample collection, each boring will be abandoned by backfilling the boring with a lean cement or non-shrinkable grout. The cement will be placed in such a fashion as to ensure that the entire depth of the boring is filled. The boring located within the AST containment will be filled with lean cement or non-shrinkable grout to the bottom of the containment floor. The remainder of the boring will be filled with grout that is compatible with hydrocarbons. The containment floor will be properly sealed to ensure the integrity of the containment.

A surveying contractor will survey the location and ground surface elevation of each of the soil borings. The survey data will be referenced to a common benchmark and tied into the site-wide survey.

5.2 Groundwater Sampling

Groundwater is not anticipated to be encountered during RFI activities based on site knowledge of the Main Post area. Gauging information from monitoring wells on the Main Post, specifically, T-12, OS-12, 0063MW-11, and 0063MW-12, indicate that groundwater is encountered greater than 200 ft bgs. However, if saturated soils are observed during drilling activities, temporary monitoring wells will be installed and groundwater sampled.

In the event that shallow groundwater is encountered, the drilling company will perform the installation of the temporary well(s) according to the requirements of 19.27.4 NMAC. The temporary well(s) will be developed by purging groundwater until water quality parameters (temperature, pH, and turbidity) have stabilized. Groundwater samples will then be collected for analysis of BTEX and GRO. Groundwater samples will be submitted to the same laboratory as the soil samples.

5.3 Field Quality Assurance/Quality Control Samples

Field quality control samples will include field duplicates, equipment blanks, field blanks and trip blanks. Data from the quality control samples will be used to validate the data as described in Appendix B, but will not be used to adjust sample results. The quality control (QC) samples will be collected as follows:

- Field duplicate samples will be collected from the soil samples; however, because contaminants are not homogeneously dispersed in these media, it is difficult, if not impossible, to collect representative duplicate samples. Field duplicate samples will be collected at a rate of one for every 10 primary samples. The duplicate samples will be collected by splitting the soil from a selected interval into two separate sample containers without mixing of the soil. The field duplicate samples will be analyzed for the same parameters as the primary soil samples. The locations of field duplicates will be recorded on the field lithologic log.

- One equipment blank will be collected from the soil sampling equipment each day during this field investigation. The equipment blanks will be collected by pouring distilled water over a piece of previously decontaminated sampling equipment (such as a split spoon) and catching the rinsate in a laboratory container. The equipment blank will be analyzed for the same parameters as the primary soil samples.

- One field blank will be collected by pouring distilled water directly into sample containers, while working at the site. The field blank is intended to detect any air-borne constituents that might affect sampling results. The field blank will be analyzed for the same parameters as the primary soil samples. One trip blank will be included with each laboratory cooler that includes volatile organic compound (VOC) samples. The trip blanks will be analyzed for the same VOC parameters (BTEX) as the primary samples.

5.4 Sampling Handling and Shipping

Sampling personnel will wear new disposable latex gloves and work surfaces will be lined with new foil or polyethylene sheeting to minimize the potential for cross-contamination of samples. Gloves and liners will be replaced between samples. Immediately after collection, the samples will be placed into the appropriate sample containers provided by the laboratory. A label will be affixed to each sample and will include the sample designation, the project number, the date and analytical requirements. The samples will be placed in a laboratory shipping container with packaged ice and will be held at approximately 4° Celsius prior to and during shipment to the laboratory. A completed chain-of-custody form will be enclosed in each shipping container and will accompany the samples to the laboratory. The samples will be shipped by overnight messenger service to the laboratory.

5.5 Instrument Calibration

The only field instrument expected to be used during the RFI is a PID. The PID will be calibrated to a specified gas standard according to the manufacturer's instructions. The PID will be calibrated prior to beginning field work each day. Calibration checks will be conducted at a minimum of every 4 hours during field activities. If the calibration check indicates that the measurements are off by more than 5% of the gas standard's concentration, the instrument will be re-calibrated until the measurement is within 5% of the standard. All calibration data will be recorded in the field logbook.

5.6 Decontamination Procedures

All down-hole drilling equipment will be steam-cleaned prior to use at each boring. All sampling utensils will be decontaminated according to the following procedures prior to use with each sample. Equipment decontamination procedures will include removing loose soil from surfaces with nylon brushes, cleaning with a solution (e.g., LiquiNox, Alconox) and rinsing with distilled water. Decontamination of environmental sample

collection equipment will follow the same procedure. For additional discussion of this process please refer to *Standard Practices for Decontamination* of *Field Equipment Used at Waste Sites* (ASTM 05088-02). In general the decontamination procedure will be as follows:

- LiquiNox (or other non-phosphate detergent solution) water wash. Debris should be removed with a nylon (or similar non-reactive material) brush.
- Tap water rinse. This can be followed with an additional Liquinox water wash if necessary.
- Distilled water rinse.
- Air dry.
- Store in aluminum foil or polyethylene plastic. Smaller sampling equipment may be stored in Ziploc bags.

Decontamination will be conducted at a designated on-site location. Decontamination fluids will be collected and placed into a 55-gallon drum. The decontamination area will be lined with polyethylene sheeting to contain incidental spills.

5.7 Management of Investigation Derived Wastes

Investigation Derived Wastes (IDW) expected to be generated during the RFI include soil drill cuttings, decontamination fluids, and miscellaneous wastes such as used disposable sampling equipment, plastic sheeting and personal protective equipment. Each of these types of waste will be segregated and placed into separate 55-gallon drums.

It is anticipated that the analytical results from the soil sampling will be adequate to characterize the wastes. However, additional characterization sampling may be conducted if required by WSMR's Waste Management Center (WMC). Such additional characterization may include collection of composite samples from soil drums and analysis of specific parameters required for disposal purposes only. All containers of IDW will be staged at WSMR's WMC until the waste is transported for off-site disposal.

All containers used to store IDW at the WSMR will be individually labeled as soon as waste is placed into the container. Containers will be numbered sequentially and

correspond with the field logbook. Containers will be marked on the side and lid using a permanent marker and will include the following information:

- Container number;
- Dates of first use and last use;
- Site Identification (include SWMU #, sample type, sample No., sample date);
- Level of personal protective equipment (PPE) worn when IDW was generated;
- Emergency Contact Number; and
- Activity from which the waste was derived.

Containers will also be labeled as described below:

- Non-hazardous waste containers will be labeled using the green label (Figure 3). The contents will be written in the space provided at the bottom.
- Hazardous waste containers will be labeled using the yellow label (Figure 3). The proper shipping name will be filled in at the bottom of the label. The contents of the container (i.e., soil cuttings, decontamination water, etc.) will be marked on the side and top of the container, with the other information listed above.

Containers of IDW without a hazardous waste determination will be labeled as Hazardous Waste using the Pending Analysis label shown in Figure 3.

All container inventory information will be kept in the field logbook. The logbook will contain the following information.

- Container ID number;
- Site ID;
- Container contents;
- Dates;

  - Container filled
  - Sample collected
  - Container transfer to WMC
  - Analytical results received

- Hazardous waste determination; and

- Date containers delivered to the WMC.

Once characterization is complete, WSMR will determine which treatment, storage and disposal (TSD) facility will be used for off-site disposal of the wastes. The WMC maintains a list of pre-approved TSD facilities that accept wastes generated at the WSMR.

Disposal of IDW will adhere to the most current versions of applicable State of New Mexico regulations and EPA laws and regulations. All material disposal actions will be coordinated through WSMR's WMC.

Hazardous and non-hazardous waste may be transported within the boundaries of the WSMR without a manifest, bill of lading, placarding, Department of Transportation (DOT) container marking or Hazardous Material Transporter registration. The waste may also be transported across non-range roads between contiguous properties of WSMR, without being subject to the DOT Hazardous Materials Regulations or the Uniform Hazardous Waste Manifest (the manifest) requirements of RCRA.

If hazardous waste will be transported off-site, a manifest will be used. The manifest is a form used to track the movement of hazardous or non-hazardous waste from the point of generation to the point of ultimate disposition ("cradle to grave") (40 CFR Part 262, Subpart B). The manifest generally requires the following information:

- Name, address and US EPA ID No. of the generator, transporter, and the destination facility;

- U.S. DOT description of the waste being transported and any associated hazards;

- Waste quantity;

- Name and phone number of a contact in case of an emergency;

- Special handling or hazard information;
- Generator's Certification (Signature required by authorized Army's point of contact); and
- Other information required either by EPA or the state.

In all cases, the "Generator" shall be "White Sands Missile Range" and the manifest will be signed by the authorized Government point of contact.

6. Data Evaluation

6.1 Evaluation of Data Quality

The primary data quality objectives (DQOs) for this work are to provide representative data that can be used to characterize site conditions, delineate the nature and extent of affected media and support corrective action decisions.

The data collected during this RFI will be evaluated using Level II quality control guidelines developed from the National Functional Guidelines for Organic and Inorganic Data Review (USEPA, 1991 and 1994). The data usability evaluation will include: review of field documentation; verification of chain-of-custody documentation; comparison of data on duplicate samples; comparison of field blank values (equipment blanks, field blanks) to sample values; verification of sample analysis dates and preparation dates with respect to sample holding times; evaluation of internal data on laboratory blanks, method blanks, laboratory control samples, laboratory control sample duplicates, surrogates, matrix spike and matrix spike duplicate samples; evaluating method quantitation limits with respect to the level of required performance; summarizing and assigning validation codes to the sample data; and documentation of usability. Data validation procedures are discussed in detail in Appendix B.

6.2 Evaluation of Data for Site Characterization

Data collected during the RFI that will be used for site characterization include qualitative and quantitative data. The primary sources of the qualitative data are field observations made during the drilling and sampling activities. As discussed in Section 5, detailed lithologic logs will be completed during the drilling and sampling process. These data will be evaluated to help characterize geologic and hydrogeologic

conditions as they pertain to natural conditions and the fate and transport of constituents of potential concern.

Quantitative data consist primarily of the analytical data collected at the site. Soil analytical data will be evaluated according to the guidance contained in the Technical Background Document for Development of Soil Screening Levels, Revision 4.0 (NMED, 2006). Specifically, soil data will be compared to the NM Soil Screening Levels published by the NMED and current at the time the field investigation is completed. These soil screening levels are health based screening standards established by the NMED. Soil data will also be compared to the Dilution Attenuation Factor (DAF) 20 values published by the NMED to evaluate the potential for soils to leach. Lead data collected during the investigation will be compared with the background lead value established from the site wide background study conducted for the Main Post Area (BAE Systems, 2004). Analytical data will also be evaluated for the risk assessments, as discussed in the following sections.

7. Risk Assessment

7.1 Human Health Risk Assessment

A Human Health Risk Assessment (HHRA) may be conducted, if necessary, to evaluate potential risks associated with human exposure to any constituents of concern identified at the site as a result of this RFI. The risk assessment approach will be based on NMED guidance (NMED, 2006) and USEPA guidance for risk assessments (USEPA, 2008a,b; 2007; 2004a,b; 2003; 2002a,b; 2000; 1997a,b; 1992a,b; 1991a,b,c; 1989). The results of the HHRA will be used along with other considerations, such as compliance with RCRA regulations, and the results of the Ecological Risk Assessment, to determine if the site requires corrective action.

The approach to the HHRA, if necessary, will include the following four steps: (1) selection of chemicals of potential concern (COPCs), (2) exposure assessment, (3) toxicity assessment, and (4) risk characterization. If performed, the HHRA will be included in the RFI report.

7.2 Ecological Risk Assessment

An Ecological Risk Assessment (ERA) may be conducted, if appropriate, to evaluate potential risks associated with ecological receptors exposed to any constituents of concern at the site identified as a result of this RFI. The ERA, if necessary, will

address receptors and media of particular interest identified during the initial review of site conditions, identify screening values and describe their use. The ERA, if performed, will follow the NMED and USEPA paradigms for conducting an ERA (NMED, 2008; USEPA, 2000a and 2001a).

If an ERA is necessary, an initial Screening Level Ecological Risk Assessment (SLERA) will be prepared for the site. If the SLERA indicates significant ecological risks, a baseline ecological risk assessment (BERA) will be prepared. The risk assessment approach will be based on NMED guidance for SLERAs (NMED, 2008) and USEPA guidance for SLERAs and BERAs (USEPA, 2001a, 2000a, 1998, 1997c). The results of the SLERA, or BERA if necessary, will be used along with other considerations, such as the results of an HHRA and compliance with RCRA regulations, to determine whether the site requires corrective action.

8. Reporting

After the work is completed, a RFI report will be prepared for submittal to NMED. At a minimum, the submittal will include:

- Summary tables of the analytical data compared to residential SSLs and background levels;
- Lithologic logs for the new soil borings;
- Maps showing all soil data with detections that exceed the residential SSLs (these will include separate maps for soil for each suite of chemicals [BTEX, GRO, and Lead]);
- A description of the work completed during this phase of the investigation;
- An evaluation of the data;
- Human Health and Ecological Risk Assessments; and
- Conclusions regarding the nature and extent of constituents of concern and findings from the risk assessments.

9. Project Schedule

A general project schedule is provided as Figure 4. The implementation schedule is subject to change, depending on weather conditions, site accessibility and other factors. As shown on Figure 4, it is anticipated that the soil investigation will require approximately one week. The final laboratory reports should be completed within three weeks after completion of the soil borings. Data evaluation and reporting will require an additional five to six weeks after the analytical results are available. The Army requires a maximum of four weeks for review of the draft report. The final RFI report will be prepared and submitted to the NMED approximately fourteen weeks after the completion of investigation activities.

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Table 1. Summary of Analytical Methods
White Sands Missile Range
White Sands, New Mexico

Constituent of Concern	Analytical Method
Benzene, Toluene, Ethylbenzene, Xylene	USEPA Method 8021B
Gasoline Range Organics (GRO)	USEPA Method 8015
Lead	USEPA Method 6010A

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Revised RCRA Facility Investigation Work Plan for the Main Post POL Storage Site

White Sands Missile Range

Appendix A

Field Boring Log Form

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Boring/Well Construction Log

JOB NUMBER	CLIENT	LOCATION	BORING/WELL ID	PAGE _____ OF _____	BORING/ WELL LOCATION
DRILLING METHOD		SAMPLING METHOD			N
DRILLING START FINISH		DEVELOP START FINISH			
STATIC DTW DTO	TIME DATE	DRILLED BY			
ELEV. GROUND TOC		LOGGED BY			

WELL CONSTRUCTION	DEPTH FEET	CLASS-IFICATION	NAME	COLOR	DESCRIPTION: GRADATION, SECONDARY CHARACTERISTICS, ODOR, REMARKS	MOISTURE	SAMPLING DEVICE	BLOW COUNT	PERCENT RECOVER	OVM/PID (PPM)	AIR TEMP	SAMPLE NO	DEPTH
	1												
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
	11												
	12												
	13												
	14												
	15												
	16												
	17												
	18												
	19												
	20												

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Boring/Well Construction Log

JOB NUMBER	CLIENT	LOCATION	WELL NO.	PAGE _____ OF _____	WELL LOCATION
DRILLING METHOD		SAMPLING METHOD			N
DRILLING START FINISH		DEVELOP START FINISH			
STATIC DTW DTO	TIME DATE	DRILLED BY			
ELEVATION TOC GL		LOGGED BY			

WELL CONSTRUCTION	DEPTH FEET	CLASS	NAME	COLOR	DESCRIPTION: GRADATION, SECONDARY CHARACTERISTICS, ODOR, REMARKS.	M.C.	OVA/PID (PPM)	SAMPLE NO.	SAMPLE DEPTH	BLOWS	RECOV %	TYPE
	1											
	2											
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	0											
	1											
	2											
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	0											

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Revised RCRA Facility Investigation Work Plan for the Main Post POL Storage Site

White Sands Missile Range

Appendix B

Data Quality Objectives

Appendix B.

Data Quality Objectives and Data Validation Procedures

Data Quality Objectives

The primary data quality objectives (DQOs) for this work are to provide representative data that can be used to characterize site conditions, delineate the nature and extent of affected media and support corrective action decisions. The data quality objectives are summarized in the table at the end of this section.

The data collected during this RFI will be evaluated using Level II quality control guidelines developed from the National Functional Guidelines for Organic and Inorganic Data Review (USEPA, 1991 and 1994). The data usability evaluation will include: review of field documentation; verification of chain-of-custody documentation; comparison of data on duplicate samples; comparison of field blank values (equipment blanks, field blanks) to sample values; verification of sample analysis dates and preparation dates with respect to sample holding times; evaluation of internal data on laboratory blanks, method blanks, laboratory control samples, laboratory control sample duplicates, surrogates, matrix spike and matrix spike duplicate samples; evaluating method quantitation limits with respect to the level of required performance; summarizing and assigning validation codes to the sample data; and documentation of usability.

Data Review, Verification, and Validation

Data generated will be reviewed for conformance with the DQOs and other applicable work plans, as well as specific project requirements. Quality assurance (QA) information provided by the laboratory will be evaluated relative to the methods performed, the laboratory standard operating procedures (SOPs), the laboratory Quality Assurance Manual (QAM), Chain of Custody (COC) requests, Laboratory Task Orders (LTOs) or similar directive document, and the laboratory's QAPP, as appropriate. The laboratory will be responsible for internal review of all calibrations, raw data, and calculations. The final analytical report will be reviewed by the laboratory project manager (PM) and other appropriate laboratory management personnel for compliance with the above listed documents including peer and supervisory review prior to releasing data to ARCADIS.

The ARCADIS Project Chemist and data validation team will perform additional verification and validation of laboratory data to assess the quality and usability of the data generated. Field record review will include instrument calibration logs, sampling

logs, COC records, field notes, and field parameter results. The field information assessment will evaluate the potential for impact to sample integrity and chemical data quality.

Chemical analytical data collected will be reviewed and, as appropriate, qualified using guidelines established in the USEPA National Functional Guidelines modified to incorporate method and project-specific requirements.

Verification and Validation Methods

The data review scheme for analytical results from the receipt of the analytical data through the validated report is described below. The laboratory is responsible for performing internal data review. The data review by the analytical laboratory will include 100 percent analyst review, 100 percent peer review, and 100 percent review by the laboratory project manager to verify that all project-specific requirements are met. The laboratory QA Officer will perform a review on 10 percent of the data packages. All levels of laboratory review will be fully documented and available for review if requested or if a laboratory audit is performed.

After receipt from the laboratory, project data will be verified and validated by ARCADIS or experienced contract personnel using the following steps.

Evaluation of Completeness

The Task Management Team or Project Chemistry Team, as appropriate, will verify the following report content for all data, as appropriate, for the required level of data validation:

- Laboratory information matches the field information;
- Fully executed COC records;
- Report completeness and conformance with COC, LTO, Work Plan, and other project requirements;
- Case narrative describing any out-of-control events and summarizing analytical observation or non-conformances;
- Sample receipt information;

- Data report forms;
- QA/Quality Control (QC) summary data; and
- Documentation of any QC problems.

If the data package is incomplete, the Project Chemist will contact the laboratory, which must provide all missing information within a reasonable timeframe (i.e., 1 to 2 days).

Evaluation of Compliance

The data verification and validation procedures are briefly outlined below:

- All chemistry data generated will undergo a Tier 2 validation (Section 7.2.2.1);
- Data will be checked to ensure all analytical problems and corrective actions are reported in the case narrative and/or that appropriate laboratory qualifiers were applied to the analytical data by the laboratory;
- For any problems identified, the laboratory will be contacted to review concerns obtain additional information if necessary, and all related data will be assessed to determine the extent of the error; and
- Data qualifiers will be applied to the analytical results to indicate potential limitations on data usability.

The data validation team will utilize the qualification guidelines in USEPA *Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review,* EPA 540/R-99/008, October 1999; USEPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-04/004, October 2004; as well as analytical method performance criteria and the laboratory QAMo evaluate data acceptability and usability relative to the intended use. Performance criteria will be based on the published analytical methods and laboratory established control limits.

Tier 2 Verification

Tier 2 data verification includes a review of all sample documentation coupled with electronic data screening and manual review. The analytical report will be assessed

for completeness and for compliance with COC requests, LTO, and any additional work plan documents. The electronic data screening will be conducted utilizing the EQuIS Data Qualification Module (DQM), a module within the Earthsoft suite of environmental data management products. All analytical data will be managed within the EQuIS Chemistry database via electronic uploading of laboratory data. The DQM is written in Visual Basic for the EQuIS database and checks for the following parameters:

- Blank contamination;
- MS and MSD recoveries;
- MS/MSD relative percent difference (RPD);
- Laboratory control sample (LCS) and LCS Duplicate (LCSD) recoveries;
- LCS/LCSD RPDs (when available);
- Surrogate recoveries;
- Field duplicate RPDs; and
- Holding times.

The DQM routines apply qualifiers to the data electronically. Select manual reviews will verify appropriate qualifier application and review additional report and quality components not amenable to the electronic screening. Data Qualifiers will not be manually applied to original hard copy analytical reports. The validation reports will be included with any submittal of analytical reports to agencies or other required party.

Data Validation Reporting

The Project Chemist or qualified designee will perform the following reporting functions:

- Alert the Project Manager and the Phase Manager to any QC problems, obvious anomalous values, or discrepancies between the field and laboratory data and resolve any issues;

- Discuss QC problems in a data validation memo for each laboratory report; and
- Assist with summarization of data quality as necessary to complete project reports.

Validation reports will be generated for each data package or combination of data packages for a single sampling event to record the results of the validation effort. The reports will identify all deficiencies and the impact on the results. The data validator or the Database Manager will append qualifiers generated during the verification/validation process to the project database and a summary table of the data qualifiers will be included with the analytical report.

Data Quality Objectives for Site Characterization White Sands Missile Range	
Data Quality Objective	**Project Specific Action**
Problem statement	Past industrial operations at the POL Area resulted in a release of gasoline. The project goal is to characterize subsurface conditions, delineate subsurface media affected by the release, perform human health and ecological risk assessments, if warranted, and prepare a RCRA Facility Investigation Report.
Identify the Goal of the Study	Perform a soil investigation to characterize subsurface conditions.
Identify Information Inputs	Soil samples and analysis.
Define the Boundaries of the Study	The project Site consists of the Main Post POL Area. The spatial boundaries of the Site are shown on Figure 1 of the RFI Work Plan.
Developing the Analytical Approach	Perform a soil investigation to adequately delineate affected subsurface media.
Specify Performance or Acceptance Criteria	Specifications for this step call for: 1) giving forethought to corrective actions to improve data usability; and 2) understanding the representative nature of the sampling design. These DQOs have been designed to meet both specifications for this step. The sampling and analysis activities have been developed based on a review of previous data and knowledge of present Site conditions.
Develop the Plan for Obtaining Data	The overall quality assurance objective is to develop and implement procedures for field sampling; chain of custody, laboratory analysis, and reporting that will provide results to support the evaluation of the Site data consistent with National Contingency Plan (NCP) requirements. Specific procedures for sampling, chain of custody, laboratory instrument calibration, laboratory analysis, data reporting, internal quality control, audits, and preventive maintenance of field equipment are presented in this document.