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

ENTERED

REPLY TO
ATTENTION OF
Directorate of Public Works

JUN 03 2011

Mr. John Kieling, Acting Chief
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 Report for the Main Post POL AST Release Site, SWMU 219

Dear Mr. Kieling:

Enclosed for your review is the report submittal titled: *Revised RCRA Facility Investigation Report for the Main Post POL AST Release Site SWMU 219(CCWS-77) White Sands Missile Range, New Mexico, May 2011.*

The revised report was prepared in response to the New Mexico Environment Department (NMED) Notice of Disapproval dated February 21, 2011 (HWB-WSMR-10-003) 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."

Should you have any questions regarding this matter, please contact Mr. Benito Avalos, Environmental Compliance Branch, Environmental Division, at (575) 678-2225.

I am forwarding this letter with enclosure (1 print copy w/CD) to Leona Tsinnajinnie, NMED-HWB; and without enclosure to Mr. Dave Cobrain, MED-HWB; Mr. Chuck Hendrickson, EPA Region VI; Ms. Laurie Rodriguez, ARACDIS-US, Inc.

Sincerely,

Thomas A. Ladd
Director, Public Works

Enclosure

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ORGANIZATION.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
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5e. TASK NUMBER

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White Sands Missile Range, NM 88002

10. SPONSOR/MONITOR'S ACRONYM(S)

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12. DISTRIBUTION/AVAILABILITY STATEMENT

13. SUPPLEMENTARY NOTES

14. ABSTRACT

This RFI Report describes activities conducted to characterize soil and groundwater conditions at the Main Post POL AST Release Site (the Site), SWMU 219 in the WSMR Permit. 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 the 3 6,000 gallon gasoline ASTs. A crack in the southeastern corner of the concrete containment allowed the majority of the fuel to escape and be released to the subsurface below. The release was verbally reported to the PSTB and the NMED HWB in December of 2005. Soil samples were collected from beneath the outside the containment area. The vertical extent of the impacted soil is defined by the soil samples collected during this RFI and is limited to approximately 2 to 3 ft bgs. The lateral extent of the impacted soil has also been defined and is limited to the area beneath the southeast corner of the containment area. A human health risk assessment screening was conducted by comparing the analytical results from the RFI to NMED published soil screening levels. Based on the screening results, soils at the Site do not pose a current or future risk to human health. No further investigation is recommended.

15. SUBJECT TERMS
SWMU 219, CCWS-77, Main Post POL, RFI, RCRA, investigation, soil, groundwater, HHRA, SLERA, BERA, GRO, BTEX, Lead

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unclassified	unclassified	unclassified			19b. TELEPHONE NUMBER *(Include area code)* 575-678-1007

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Revised RCRA Facility Investigation Report for the Main Post POL AST Release Site

SWMU 219 (CCWS-77)

Original: September 2010

Revised: May 2011

ARCADIS

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Revised RCRA Facility Investigation Report for the Main Post POL AST Release Site

SWMU 219 (CCWS-77)

Prepared for:
U.S. Army, White Sands Missile Range
Directorate of Public Works –
Environment Division
White Sands Missile Range, New Mexico

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Our Ref.:
GP08WSMR_0RFI_0CC77_R_1_052611

Date:
Original: September 2010
Revised: May 2011

Appendices

Executive Summary

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report was written on behalf of White Sands Missile Range (WSMR) pursuant to requirements of WSMR's Hazardous Waste Permit Number NM2750211235 (Permit) dated December 2009. This RFI Report describes activities conducted to characterize soil and groundwater conditions at the Main Post Petroleum, Oil, and Lubricant (POL) Above Ground Storage Tank (AST) release site (the Site), where a fuel spill of approximately 1,370 gallons of gasoline occurred in December 2005. The Site is listed as Solid Waste Management Unit (SWMU) 219 in the WSMR Permit.

Following is a brief chronology describing the corrective action activities related to this Site:

- December 2005, a release of approximately 1,370 gallons of gasoline occurred at the AST.
- December 2009 – Permit No. NM2750211235 was issued. Table 4-1 of the Permit lists SWMU 219 as a site requiring corrective action. The comment in the table specifies the AST Release Site.
- August 2009 – the RCRA Facility Investigation (RFI) Work Plan for the Site was submitted to the New Mexico Environmental Department (NMED).
- November 2009 – the NMED issued a Notice of Disapproval (NOD) of the August 2009 RFI Work Plan.
- February 2010 – WSMR submitted the Revised RFI Work Plan to the NMED. The Revised Work Plan addressed the comments from the November 2009 NOD and included a table summarizing WSMR's response to the comments.
- January through April 2010 – field activities were conducted and data collected according to the February 2010 Revised RFI Work Plan.
- May 2010 – the NMED issued a NOD for the February 2010 Revised RFI Work Plan.
- July 2010 – WSMR sent a letter to the NMED requesting a 60-day extension to respond to the NOD and notifying the NMED that they intended to implement the

RFI Work Plan and respond to the May 2010 NOD in the RFI Report rather than submit a second revised RFI Work Plan.

- August 2010 – the NMED approved the request for a schedule extension and acknowledged WSMR's notification that they would respond to the comments in the RFI Report. October 2010 – WSMR submitted the RFI Report. The RFI Report included responses to the NMED's May 2010 NOD for the RFI Work Plan.

- February 2011 – the NMED issued a NOD for the October 2010 RFI Report.

This Revised RFI Report represents a revision to the original October 2010 RFI Report and includes responses to the NMED's February 2011 NOD. Several of the comments contained in the February 2011 NOD pertain to what constitutes SWMU 219 and request that the entire POL Area, not just the AST Release Site, be included in the RFI. Appendix 4, Table 4-1 of the Permit identifies SWMU 219 as Main Post POL AST Release Site. No other releases have been identified at the Main Post POL and SWMU 219 was identified and listed as a SWMU because of the reported gasoline spill. Based on this information, investigation of areas outside the AST Release Site is not warranted and is not required by the Permit.

The Main Post POL Storage Area provides storage and a fueling point for the Main Post official vehicles and consists of a number of ASTs, underground piping, and a filling station. The POL Storage Area has been in service since the 1960s and currently has 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. 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. To the east side of the fueling island, there are three 25,000 diesel ASTs and three 25,000 gasoline ASTs. Underground lines 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.

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 the 6,000 gallon gasoline ASTs. The 6,000 gallon ASTs are filled simultaneously at an even rate by the transfer system. According to reports from personnel knowledgeable about the release, during the transfer, one of the tanks was overtopped and gasoline

was released to the concrete secondary containment. The identification of which tank overtopped was not recorded. The released gasoline was captured by the concrete secondary containment; however, a crack in the southeastern corner of the floor of the concrete containment 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.

The work conducted as part of this RFI focused on the area of the AST release and included the following specific tasks:

- Collection of soil samples to characterize subsurface conditions and complete lateral and vertical delineation of affected soils to the NMED residential soil screening levels (SSLs).

- Identification of whether subsurface soil impacts could potentially affect the underlying groundwater.

- Screening of potential risks to human health and ecological receptors.

As part of this RFI, soil samples were collected from a total of eight (8) soil borings during two separate sampling events in January and April 2010. Soil samples were analyzed for Total Petroleum Hydrocarbons (TPH) Gasoline Range Organics (GRO), benzene, toluene, ethylbenzene, and xylenes (BTEX), and lead. The majority of the samples did not contain detectable concentrations of these constituents; however, one sample collected from immediately below the AST containment area indicated that a limited area of soils had been affected by the spill.

The field screening performed on soil samples using a photoionization detector (PID) corresponded to the analytical results obtained from the soil samples. Based on both the PID and analytical results, limited impacts appear to be present immediately below the southeast corner of the concrete containment area holding the three 6,000 gallon gasoline ASTs.

The vertical extent of the impacted soil is defined by the soil samples collected during this RFI and is limited to approximately 2 to 3 feet below ground surface (ft bgs). The lateral extent of the impacted soil has also been defined and is limited to the area beneath the southeast corner of the containment area.

A human health risk assessment screening was conducted by comparing the analytical results from the RFI to NMED published SSLs. Based on the screening results, soils at the Site do not pose a current or future risk to human health.

The data were reviewed to evaluate the potential for cross-media contamination from soil to groundwater. This evaluation consisted of comparing the data to published Dilution Attenuation Factor (DAF) 20 values, while considering other site-specific conditions including depth of contamination, depth to groundwater, and surface water infiltration conditions. Benzene, toluene and total xylenes were the only constituents of potential concern (COPC) present at concentrations above the DAF 20 value. The only reported concentrations of the COPCs above the DAF 20 value were contained in the sample collected from immediately below the concrete (0.5 to 1 ft bgs) in boring SB-006. The samples collected from deeper intervals (4- 5', 9-10', 14-15' and 19-20') in this same boring did not contain detectable COPCs and the detection limits were an order of magnitude lower than the respective DAF 20 values. In fact, no other sample collected contained any detectable concentrations of these COPCs. Based on the very shallow exceedances of DAF 20 in SB-006 (0.5-1') relative to the very deep occurrence of groundwater (greater than 300 feet) and the relatively small size of the source area, there is little or no risk that the COPCs in the shallow soils represents a threat to the groundwater. This is further supported by the fact that surface water infiltration depths in the area do not exceed about 15 feet because of the very high evapotranspiration rates (ARCADIS, 2010). In addition, the area is covered with concrete and asphalt, which should limit infiltration of surface water and further reduce the potential for leaching to occur.

The results of the Screening Level Ecological Risk Assessment (SLERA) and Baseline Ecological Risk Assessment (BERA) for direct contact exposure and for food chain modeling indicate that adverse impacts are unlikely to occur for ecological receptors potentially exposed to constituents in soil. Therefore, no further ecological evaluation of the Site is warranted.

The RFI for the Site was successfully completed and meets the RFI requirements described in the Permit. No further investigation is recommended.

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

Comment No.	NMED Comments	WSMR Response	Section/Page Reference
1	The Report's cover letter dated October 7, 2010, states that it "already completed investigation activities based on the first NOD and therefore requested an extension to complete the investigation report in lieu of submitting another revised work plan." NMED's Approval for Extension letter dated August 17, 2010, states, "NMED understands that the Permittee is conducting the investigation at risk without an approved Work Plan. The Permittee must adhere to the requirements in NMED's November 6, 2009 NOD and May 12,2010 NOD related to the RCRA Investigation Work Plan for the Main Post POL, [Solid Waste Management Unit (SWMU)] 219 when conducting the investigation activities and when preparing the Investigation Report." The Permittee did not comply with the requirements included in either NOD, nor did the investigation include the entire SWMU. Submit a work plan to address all comments in both of NMED's NODs as well as describe the proposed investigation methods for the entire SWMU 219 for approval by NMED prior to beginning further investigations.	The Permittee respectfully disagrees with this comment. The requirements of both NODs, with the exception of expanding the investigation to areas outside the AST Release Site, were incorporated into the RFI Report. Permittee does not agree with the extent of the SWMU identified by NMED and contends the AST Release Site constitutes SWMU 219, not the entire POL Area. This is reflected in the Comment section of Table 4-1 in Appendix 4 of the Permit. There have been no other documented releases in the Main Post POL Area. The POL area is an active fueling station, and routine inspections and leak tests are conducted. Based on this information, the RFI performed is appropriate. It should also be noted that the initial NOD to the work plan dated November 6, 2009 did not comment on the proposed scope, which focused only on the AST area. WSMR does not understand why the second NOD dated May 23, 2010 contained separate unrelated comments to the first NOD.	Not applicable
2	The second NOD dated May 12, 2010 (Second NOD), Comment 1, required the Permittee to investigate the entire SWMU. In the response to NMED's Comment 1, the Permittee states, "Appendix 4, Table 4-1 specifically notates SWMU 219 as the AST Release Site." However, the Permittee's Hazardous Waste Facility Permit (Permit) does not identify the "AST Release Site" as SWMU 219; it is merely a "Comment" from the table. The "Unit Description" provides the clear definition of the SWMU, which is the Main Post POL. The Permittee must submit another work plan to fulfill the aforementioned Permit requirement to investigate the entire SWMU and clearly define the boundary of the entire SWMU 219 site. NMED has attached two figures that define the aerial extent of SWMU 219. NMED notes that the Permittee did not define the site boundary as requested in the first and second NODs.	As discussed in the response to Comment 1, the Permittee respectfully disagrees with this comment. The site boundary was adequately defined in the Work Plan and in the RFI, as confirmed by the analytical data delineating the vertical and horizontal extents of impacts.	Not applicable
3	Comments from NMED's November 6, 2009 NOD (First NOD) and the Second NOD directed the Permittee to revise the figures to include the entire SWMU 219 site. The relevant comments are reiterated here: a. Figure 1 (Main Post Site Map) must include the newly illustrated boundary of SWMU 219 provided by NMED and properly label the site "SWMU 219" in relation to the Main Post. The aerial photograph used to illustrate the Main Post must also be a current photograph. This figure must also include any other AOCs and SWMUs located in the vicinity of the Main Post POL. The title of Figure 1 must be changed to "White Sands Missile Range, New Mexico, Main Post POL SWMU 219."	As discussed in the response to Comment 1, the Permittee respectfully disagrees with the NMED regarding the extent of the SWMU. Therefore, the figure titles have not been changed. a. The aerial photograph used by NMED from Google Maps is actually a 2007 image. The aerial photograph used to create Figure 1 in the RFI was a 2008 aerial photograph. The most recent photograph available is from 2009. Figure 1 has been updated using the 2009 aerial photograph. Figure 1 has been updated to depict other AOCs/SWMUs in the vicinity of the Main Post POL AST Release Site. These SWMUs include SWMUs 10, 12 and 14, located approximately 300 feet to the north-northwest of the AST Release Site. SWMU 10 is the Wash Pad, Drains, & Sump at Building1778 (formerly identified	Figure 1 Figure 2

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

Comment No.	NMED Comments	WSMR Response	Section/Page Reference
	b. Figure 2 (Site Layout SWMU 219) must be a site plan scaled to focus on SWMU 219 and adjacent features and structures that clearly "illustrate the boundaries, structures, [and/or] features" of the entire SWMU 219 site as listed in the Permit (Appendix 7, Section 7.3.13, Item 2). Provide additional figures to identify specific features if they are unable to be clearly displayed on one figure. All utilities (aboveground and underground) must be depicted and labeled. All existing and former buildings and structures must be properly labeled. All existing and former ASTs and underground storage tanks (USTs) must also be identified on the figure(s). Historical and current aerial photographs and assessments must be used to compile this information on appropriate figure(s). Figure 2 must be titled "White Sands Missile Range, New Mexico, Main Post POL SWMU 219" and Figure 2.	as SWMUs 10 and 11). SWMU 12 is the Wash Ramp, Drains, Sump, & Oil/Waste Separator @ Building 1778 (formerly identified as SWMUs 12 and 13). SWMU 14 is Used Battery Accumulation Area at Main Post (formerly identified as SWMUs 14 and 15). Consistent with our response to Comment 1, the title of this figure was not changed. b. Figure 2 has been revised to show buildings and structures in the immediate vicinity of the Main Post POL AST Release Site. Buildings include Building 1719 (Main Post POL Operations Building which is the operations headquarters for the Main Post fuel facility), Building 1788 (Main GSA Vehicle Maintenance Building) and Building 1789 (GSA Maintenance Shop Annex Building where WMSR repairs heavy vehicles and semi trucks), Building 1776 (Battery Accumulation Area where used batteries are stored), and Building 1791 (Canopy Storage Area where trailers and building materials are stored). Locations of current USTs, ASTs and known utilities are shown on Figure 2. However, as-built drawings were not available and the locations of some utilities could not be identified. Historical aerial photographs of this area were not available for review. Consistent with our response to Comment 1, the title of this figure was not changed.	
4	Comment 8, Second NOD, states that "past sampling has not been conducted at SWMU 219, the scope of work must be expanded to include the entire SWMU. Additionally, fuel lines are present at the site. Therefore, the sampling suite must be revised to include volatile organic compounds (VOCs) using EPA Method 8260, semi volatile organic compound (SVOCs) using EPA Method 8270, GRO, diesel range organics (DRO) extended, and RCRA 8 metals." The Permittee did not address this comment. Address all requirements specified by NMED in the Second NOD in the work plan proposing investigation of the entire SWMU.	As discussed in the response to Comment 1, the Permittee respectfully disagrees with the NMED regarding the extent of the SWMU. WSMR contends the AST Release Site constitutes SWMU 219, not the entire POL Area. The analytical suite used was adequate and appropriate to characterize a release of gasoline, which is the focus of this RFI Report. It should be noted that the November 6, 2009 NOD did not contest the selected analytical suite, or the general scope of the proposed investigation.	Not applicable
5	The Executive Summary, paragraph 1, page b, explains that the AST gasoline release in December 2005 occurred while transferring fuel from the higher capacity 25,000 gallon tanks to the three smaller capacity 6,000 gallon tanks. a. Reword the description to verify that all three 6,000 gallon tanks were filled simultaneously and the release was a result of overfill from all three 6,000 gallon tanks and provide a more specific description of the location of the release from the secondary	a. The Executive Summary has been revised to state that all three 6,000 gallon ASTs are filled at the same time; however, according to WSMR personnel knowledgeable about the release, only one tank was overtopped. There were no records t as to which tank overtopped. The location of the crack in the containment has been further clarified in the report. b. The background section has been revised to reflect the following:	Executive Summary Sections 2.1 and 2.2

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

Comment No.	NMED Comments	WSMR Response	Section/Page Reference
	containment [see the Permittee's Response to Comment 5 (Response to Second Notice of Disapproval for the RCRA Facility Investigation Work Plan for the Main Post POL AST Release Site, SWMU 219)]. b. Provide a description (in the background section of the report) of the surface conditions at the location where the release occurred. 1. Describe the base of the secondary containment (e.g., gravel or asphalt). 2. Indicate if the transport path of the release on the ground surface included surface depressions (e.g., storm water drainages, cracks or potholes in the asphalt) where fuel could have ponded.	1. The secondary containment consists of concrete walls and a concrete floor. 2. The transport path of the release was through the floor of the containment area, not along the ground surface.	
6	The Permittee's Response to Comment 6 (Response to NOD for RCRA Facility Investigation Work Plan) states, "[i]t is assumed that no gasoline was recovered from [the] December 2005 release." Verify that no gasoline was recovered from the release and state as such in Section 2.2 of revised Report, or otherwise state the basis for the assumption.	According to facility personnel, some of the released gasoline was pumped out of the secondary containment and recovered. However, the volume of recovered gasoline was not recorded. Section 2.2 of the Revised Report has been modified to include this information.	Section 2.2
7	Section 2.3 (Surface Conditions), page 3, states, "[s]tormwater from the northern portion of the POL Storage Area flows through a culvert located beneath Wesson Street, just south of Aberdeen A venue. The storm water then flows through an unlined ditch toward the east." Propose to collect samples from the storm water lagoons and unlined ditch to verify that gasoline from the AST release site did not reach them. This sampling must be proposed in the work plan to investigate the entire SWMU (see Comment 4).	There are no storm water lagoons in the vicinity of the Main Post POL. A note concerning storm water lagoons was inadvertently included in the legends for Figures 2, 3 and 4. These figures have been changed and the note removed. The figures have been revised to more clearly identify the stormwater features. The gasoline that was released from the AST was contained within the walls of the secondary containment. Although an unknown volume was released through a crack in the floor of the containment, the gasoline that escaped the secondary containment would not have reached the storm water ditches. As described in the RFI Report, the lateral and vertical extents of the affected soils were delineated. This further demonstrates that the release of gasoline constituents did not migrate far beyond the southeastern corner of the AST containment area and therefore, could not have reached the storm water ditches.	Figures 2, 3 and 4; Section 2.3
8	Section 2.6 (Climate), page 5, describes the climate at the Main Post. However, the Permittee does not discuss whether this area experiences seasonal rains nor did the Permittee discuss any major precipitation events that occurred before, on, or around the December 2005 release date. Include this information in the revised Report.	A copy of the daily precipitation records for December 2005, the month in which the release occurred, was obtained from the National Oceanographic and Atmospheric Administration (NOAA). No significant precipitation was recorded during December 2005. This information has been included in the Revised Report.	Section 2.6
9	Section 3.1.2 (Soil Sample Collection and Field Screening Procedures), page 6, states, "[t]he lead auger was used to drill through the asphalt at	The hand augers used for this investigation have a 6-inch solid barrel with cutting teeth. The field geologist inspected the soil at the bottom of the	Section 3.1.2

Table ES-1 – White Sands Missile Range Response to New Mexico Environment Department Comments			
Comment No.	NMED Comments	WSMR Response	Section/Page Reference
	locations SB-00 1 through SB-005 and to drill through the concrete floor of the containment area of location SB-006. A hand auger was used to remove the upper 3 feet of soil at each location to verify that no utility lines were located in vicinity of the borings. Beneath the hand-augered portion of each boring, soil samples were collected by advancing core barrels ahead of the hollow stem augers. Soil cores were collected continuously to the total depth drilled at each location." It is not clear if the hand-augered intervals from the surface to 3 feet below ground surface were continuously sampled or if soil samples were collected only after the Permittee hand-augered to a depth of 3 feet. Identify all the sampling intervals where soil samples were collected and indicate the sample intervals on the soil boring logs. Revise the Report accordingly.	barrel every 6-inches and recorded the observed lithology on the boring logs. Samples were collected from the bottom of the barrel and screened using the PID either at specified intervals or where visual or olfactory screening indicated the potential presence of hydrocarbons. All sample intervals for both PID screening and for laboratory analysis are indicated on the boring logs. Section 3.1.2 has been revised to clarify this information.	
10	Section 3 .1.2 (Soil Sample Collection and Field Screening Procedures), page 6, describes the use of field screening equipment to measure the total VOCs in the headspace of the soil samples collected. Describe the equipment that was used, including manufacturer, bulb strength and detection range, the calibration process, and frequency of calibration. The boring logs from Appendix B must include instrument readings for all soil samples. Provide justification for omitting any of the readings, or if readings were not obtained. Revise the Report accordingly.	The specifications and calibration frequency for the PID used to obtain heated headspace readings have been added to the Revised Report in Section 3.1.2. Heated headspace readings were obtained at each pre-determined sample interval, at intervals where visual or olfactory indications of potential hydrocarbons were present and at other routine intervals throughout each boring. All heated headspace PID readings obtained are provided in the boring logs and no readings were omitted.	Section 3.1.2
11	Section 3 .1.3 (Decontamination Process), paragraph 1 does not include a description of the decontamination procedures for the drilling rig or other heavy equipment used. Revise the Report to include this information.	Flight augers were decontaminated using a high-pressure washer prior to use at each soil boring. Liquids were contained in a stock tank and allowed to evaporate to minimize waste disposal. This information has been incorporated into the Revised Report.	Sections 3.1.3 and 3.1.8
12	Section 3.1.8 (Waste Handling), page 10, states that "waste was disposed of off-site by WMC on April28, 2010." The Permittee also states that the waste generated from the April 2010 event "was disposed of July 2010." Provide additional information pertaining to the investigation derived waste (IDW) management and disposal in accordance with Section 7.3.14.a of the Permit. The additional information must also include the quantities and types of waste generated (solids and/or liquids) and if these wastes were separated for disposal. Submit this information as an additional appendix in the revised Report.	The quantities and types of waste have been clarified in the text of the Revised Report. A copy of the drum logs documenting delivery of the wastes to the WMC is provided in Appendix D in the Revised Report.	Section 3.1.8 and Appendix D
13	Section 4.2 (Soil Sampling Field Screening Results), page 13, includes numerical values that do not have units. Revise the Report to include the units of measure.	The unit of measure for the PID is parts per million (ppm). This information has been included in the Revised Report.	Section 4.2
14	Section 5, (Conclusions), page 17, states, "[b]enzene was the only	The Revised Report has been corrected to reflect the presence of	Section 5

Table ES-1 – White Sands Missile Range Response to New Mexico Environment Department Comments			
Comment No.	NMED Comments	WSMR Response	Section/Page Reference
	[constituent of potential concern (COPC)] present at concentrations above the DAF 20 value." However, Figure 4 (BTEX and GRO Concentrations) and Table 3 (Summary of Soil Sample Analytical Results) show that ethylbenzene and total xylenes also exceed the NMED DAF 20 screening values. Revise this conclusion to include discussion of all results that exceed screening levels and explain why a DAF 20 was chosen for comparison.	ethylbenzene and total xylenes at concentrations above the NMED DAF20 SSL in the shallow soil sample at one location. A discussion of why the DAF20 SSL was used was provided in Section 3.2.1.	
15	Section 5 (Conclusions), page 18, states, "[t]he RFI for the Site was successfully completed and meets the RFI requirements described in the Permit. No further investigation is recommended." The Permittee has not demonstrated that "no further investigation" is warranted for SWMU 219 because the entire site was not investigated. The Permittee must submit another work plan to investigate the rest of SWMU 219 (see Comment 2).	The Permittee respectively disagrees with this comment. SWMU 219, the Main Post POL AST Release Site has been properly investigated, delineated and no further investigation is warranted at this time. No justification has been provided by NMED for investigation of additional areas in the vicinity of the documented release.	Not applicable
16	Table 1 (Depth to Groundwater in Nearby Wells), does not include a description for the locations of each of the monitoring wells (e.g. NW of "Site"). Revise the table to include a column labeled "Location" that describes where the monitoring wells are located with respect to SWMU 219.	The locations of the wells listed in Table 1 are provided in Figure 1. Additional descriptions of the well locations have been added to Table 1.	Table 1
17	Table 2 (Soil Sample Locations and Depth Intervals), must be revised to separate the row cells for SB-007 and SB-008, and include units of measure for the PID readings. It must be explained in the text and comments section why lead was not included in the analysis for samples SB-007 and SB-008.	Table 2 has been corrected to separate the locations and depth intervals between locations SB-007 and SB-008. Lead was not analyzed in samples collected from SB-007 and SB-008 because lead was adequately delineated by the earlier samples (SB-001 through SB-006). This explanation was included in Section 3.1.6 of the original RFI Report.	Table 2
18	Table 3 (Summary of Soil Sample Analytical Results), must highlight values that exceed soil screening levels (SSLs) and DAF 20 to identify the exceedances on the tables (see also Comment 17 regarding lead data).	Table 3 shows exceedances of the DAF20 screening value in italics font. No exceedances of the SSL occurred; thus, no highlighting of data exceeding SSLs is required.	No change
19	Table 4 (Waste Characterization Samples Analytical Data Summary), must provide a note/comment for sample CS-001 that identifies the sample matrix (i.e., solids or liquids). Revise "Acronym/Notes" to define "NA" and explain why analysis was not conducted for certain constituents.	The source of sample CS-001 was a composite of IDW soil, as discussed in Section 3.1.8. A note has been added to Table 4 to clarify the matrix. As discussed in Section 3.1.8, the WMC did not request specific waste characterization sampling be performed after all samples had been collected and submitted for laboratory analyses during the January 2010 event. Therefore, analysis of full VOCs and SVOCs was requested for the sample that most likely had impacts after that sample had been submitted to the laboratory. WMC did not request additional analysis of metals or ignitability for the waste generated during the January 2010 event, but did request those analyses be performed on the composite soil sample collected from the April 2010 event. A note has been added to Table 4 to clarify that those constituents were not analyzed because they were not	Table 4

Table ES-1 – White Sands Missile Range Response to New Mexico Environment Department Comments			
Comment No.	**NMED Comments**	**WSMR Response**	**Section/Page Reference**
		required by WMC.	
20	The following comments pertain to figures: a. The current Figure 2 must be changed to Figure 3 (AST Release Site Layout) in the revised Report. Clearly "illustrate the boundaries, structures, [and/or] features" of the December 2005 AST Release as required by the Permit, Appendix 7, Section 7.3 .13, Item 2. All existing and former buildings and structures must be properly labeled. Provide additional figures to identify specific features if they are unable to be clearly displayed on one figure. All existing and former ASTs and USTs must be identified on the figure(s). Ensure all text on figure(s) is consistent and legible (see Comment 3). Differentiate between buildings, ASTs, and USTs on the figure(s). Ensure the USTs, ASTs and associated secondary containment are shown to scale. The figure(s) must depict surface conditions (e.g., asphalt and gravel) and topography. b. The current Figure 3 must be changed to Figure 4 (Soil Boring Locations) in the revised Report. Revise the symbol color of soil sample locations from yellow to black so it does not conflict with Note 2 on the figure reporting the BTEX and GRO concentrations. c. The current Figure 4 must be changed to Figure 5 (BTEX and GRO Concentrations) in the revised Report. Revise the symbol color of the soil sample locations from yellow to black as required by Item C above. Also define "NA" from the SB-006 (3-4) result table.	a. Figure 2 has been revised and contains the site plan with site structures and features identified, as discussed in our response to Comment No. 3. The figure number was not changed because no new figures were added. b. Note 2 on Figure 4 refers to the data boxes and not to the boring locations. Because none of the reported results exceed the Residential SSL, this note has been removed from Figure 4. There is no need to change the color of the boring location symbol. The figure number was not changed because no new figures were added. c. Figure 4 has been corrected to depict <0.00556 mg/kg as the result for total xylenes for the sample from 3-5 ft bgs at location SB-006. See responses to items a and b above. The figure number was not changed because no new figures were added.	Figures 2, 3 and 4
21	Revise the table formats for the Boring/Well Construction Logs as described below: a. Reformat the cells to show all field parameters recorded, and provide the appropriate units (e.g., air temperature in degrees Fahrenheit or Celsius). b. Provide consistent names on all figures, (e. g., "Pumps" used instead of "Dispenser Island" and "Tanks" used instead of "ASTs, 3 X 6,000 gallon unleaded gasoline"). c. Explain why the number of blow counts was not recorded when split barrel samplers were utilized. d. On the SB-006 boring log, the column labeled "Color" is incomplete. Explain why the log was not completed.	The Boring/Well Construction Logs have been updated as follows: a. The log format used is a standardized form that can be used for multiple purposes. All field parameters recorded are included on the logs. A note has been added to indicate the unit and location of the air temperature recorded. b. The sketch on the logs has been modified. The sketch included on the logs is not intended to be used as a detailed site map, but to generally show the location of the boring and/or well. Site details are provided in the report figures. c. No blow counts were recorded because no split spoons were driven with a slide hammer on the rig. All samples were collected from core barrels which were driven with the auger. Blow hammers cannot be used with this type of equipment. Furthermore, blow counts are	Appendix B

Table ES-1 – White Sands Missile Range Response to New Mexico Environment Department Comments			
Comment No.	NMED Comments	WSMR Response	Section/Page Reference
	e. Define "TOC." f. Provide a key to symbols and identify the soil or rock classification system used to log the soil borings in accordance with Appendix 7, Section 7.3 .14.b of the Permit. The soil classification must be included in the boring logs.	typically used for geotechnical borings and the information they provide are of limited use for environmental investigations. d. The boring log for SB-006 has been modified to include color for all intervals logged. e. TOC is a standard term used for top of casing. Because no wells were installed, no top of casing was recorded. The notes section has been updated to reflect this definition. f. All soils were described using the Unified Soil Classification System (USCS), as discussed in the text of the RFI Report. A note has been added to the boring logs to confirm the use of the USCS. A copy of the official USCS Chart describing the soil symbols has been added to Appendix B.	
22	Appendix D does not show the PID readings collected at all depths. Explain how the screening intervals were selected and why not all measurements were recorded (including readings of 0 ppm). Provide this information in the revised Report and in the boring logs.	See response to Comment 10. All PID readings collected are provided in the Boring Logs and no change is required.	Section 3.1.2 and Appendix B
23	Remove Appendix E (Risk Assessment) from the Report because it is not appropriate for such a small portion of a SWMU.	Permittee respectfully disagrees with this comment and requests that the NMED provide a regulatory basis for this comment and for determining the size of area for which a Risk Assessment may or may not be appropriate. The Risk Assessment was performed because impacts were present above the default screening levels and further evaluation was appropriate to determine whether actual risks to human health or the environment are present. Based on this, WSMR believes that performing a risk assessment is the most appropriate response and is consistent with the regulations and with Army policy for waste minimization and sustainability.	No change required.

List of Acronyms

AST	Above Ground Storage Tank
ASTM	American Society for Testing and Materials
BERA	Baseline Ecological Risk Assessment
BTEX	benzene, toluene, ethylbenzene, and xylenes
COPC	constituents of potential concern
COPEC	constituents of potential ecological concern
DoD	Department of Defense
DQO	data quality objectives
ELAP	Environmental Laboratory Accreditation Program
ELCR	Excess Lifetime Cancer Risk
eV	Electron Volt
ft bgs	Feet Below Ground Surface
GPR	Ground Penetrating Radar
GRO	Gasoline Range Organics
HHRA	human health risk assessment
HI	hazard index
HWB	Hazardous Waste Bureau
IDW	Investigation derived waste
mg/L	Milligrams per Liter
mg/kg	Milligrams per Kilogram
NELAC	National Environmental Laboratory Accreditation Conference
NMED	New Mexico Environmental Department
NOAA	National Oceanographic and Atmospheric Administration
NOD	Notice of Disapproval
PID	photoionization detector
POL	Petroleum, Oil, and Lubricant

PPE	personal protective equipment
ppm	Parts Per Million
PSTB	Petroleum Storage Tank Bureau
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RSL	Regional Screening Levels
SLERA	Screening Level Ecological Risk Assessment
SSL	soil screening levels
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
TPH	Total Petroleum Hydrocarbons
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
VOC	volatile organic compounds
WMC	waste management center
WSMR	White Sands Missile Range

1. Introduction

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report was written on behalf of White Sands Missile Range (WSMR) pursuant to requirements of WSMR's Hazardous Waste Permit (No. NM2750211235) dated December 2009. This RFI Report describes activities conducted to characterize soil and groundwater conditions at the Main Post Petroleum, Oil, and Lubricant (POL) Aboveground Storage Tank (AST) Release Site (the Site), where a fuel spill of approximately 1,370 gallons of gasoline occurred in December 2005. The Site is listed as Solid Waste Management Unit (SWMU) 219 in the WSMR Permit under Table 4-1 requiring corrective action.

A brief chronology describing the corrective action activities related to this Site follows:

- December 2005, a release of approximately 1,370 gallons of gasoline occurred at the AST.
- December 2009 – Permit No. NM2750211235 was issued. Table 4-1 of the Permit lists SWMU 219 as a site requiring corrective action. The comment in the table specifies the AST Release Site.
- August 2009 – the RCRA Facility Investigation (RFI) Work Plan for the Site was submitted to the NMED.
- November 2009 – the NMED issued a Notice of Disapproval (NOD) of the August 2009 RFI Work Plan.
- February 2010 – WSMR submitted the Revised RFI Work Plan to the NMED. The Revised Work Plan addressed the comments from the November 2009 NOD and included a table summarizing WSMR's response to the comments.
- January through April 2010 – field activities were conducted and data collected according to the February 2010 Revised RFI Work Plan.
- May 2010 – the NMED issued a NOD for the February 2010 Revised RFI Work Plan.
- July 2010 – WSMR sent a letter to the NMED requesting a 60-day extension to respond to the NOD and notifying the NMED that they intended to implement the

RFI Work Plan and respond to the May 2010 NOD in the RFI Report rather than submit a second revised RFI Work Plan.

- August 2010 – the NMED approved the request for a schedule extension and acknowledged WSMR's notification that they would respond to the comments in the RFI Report. October 2010 – WSMR submitted the RFI Report. The RFI Report included responses to the NMED's May 2010 NOD for the RFI Work Plan.

- February 2011 – the NMED issued a NOD for the October 2010 RFI Report.

This Revised RFI Report represents a revision to the original October 2010 RFI Report and includes responses to the NMED's February 2011 NOD. Several of the comments contained in the February 2011 NOD pertain to what constitutes SWMU 219 and request that the entire POL Area, not just the AST Release Site, be included in the RFI. Appendix 4, Table 4-1 of the Permit identifies SWMU 219 as Main Post POL AST Release Site. No other releases have been identified at the Main Post POL and SWMU 219 was identified and listed as a SWMU because of the reported gasoline spill. Based on this information, investigation of areas outside the AST Release Site is not warranted and is not required by the Permit.

The primary objectives of the RFI were: 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; and 3) to evaluate potential risks to human and ecological receptors exposed to the affected media.

The work conducted as part of this RFI included the following specific tasks.

- Collection of soil samples to characterize subsurface conditions and complete lateral and vertical delineation of affected soils to the NMED residential soil screening levels (SSLs).

- Identification of whether subsurface soil impacts could potentially affect the underlying groundwater.

- Screening of potential risks to human health and ecological receptors.

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

2. Background Information

2.1 Operational History

The Site is located at the WSMR Main Post (Figure 1), within the Main Post POL Storage Area. The POL Storage Area provides storage and a fueling point for the Main Post official vehicles and consists of a number of ASTs, underground piping, and a filling station.

The POL Storage Area 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 gallon diesel ASTs and three 25,000 gallon gasoline ASTs. The ASTs are located within containment areas which are constructed of concrete walls with a concrete floor. The ASTs are elevated on saddles within the containment to allow for routine inspection.

Underground lines 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, underground lines 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 are shown in Figure 2.

2.2 Regulatory History

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 the 6,000 gallon gasoline ASTs. The 6,000 gallon ASTs are filled simultaneously at an even rate by the transfer system. According to WSMR personnel knowledgeable about the release, one of the tanks was overtopped during the transfer and gasoline was released to the concrete secondary containment. The identification of the actual tank that overtopped was not recorded. The concrete walls of the containment prevented the release of the gasoline to the surrounding ground surface. However, a crack in the southeastern corner of the floor of the concrete containment allowed fuel to escape and be released to the subsurface below. According to base personnel, some of the gasoline was pumped out of the containment following the release, but the volume of

gasoline recovered was not recorded. The release was verbally reported to the Petroleum Storage Tank Bureau (PSTB) and the NMED HWB in December of 2005. Following this incident, the concrete containment was repaired to prevent a similar release in the future.

2.3 Surface Conditions (Topography)

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 (BAE Systems, 2004). Very little surface water exists at WSMR due to low annual precipitation, high evapotranspiration rates, and high infiltration characteristics of the soils (BAE Systems, 2004).

The POL AST Release Site is covered with concrete and the surrounding area is relatively flat and covered with either asphalt or concrete. As shown in Figure 2, there is an asphalt-lined ditch located immediately west of the MP POL AST Release Site. Stormwater runoff from areas immediately outside of and surrounding the MP POL AST Release Site containment structure flows into this ditch and flows northward into a culvert under Aberdeen Avenue, then into a concrete lined ditch located on the north side of Aberdeen Avenue, which drains stormwater to the east.

2.4 Geology

The geology of WSMR is dominated by 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 (IT, 1992). 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 (ft bgs) (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.

2.5 Hydrogeology

The WSMR Main Post obtains its potable water supply from an aquifer in the upper bolson deposits. 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 (BAE Systems, 2004). The closest production wells for the Main Post are approximately 6 miles to the northwest of the Site.

Groundwater in the vicinity of the Main Post is of sufficient quality (less than 1,000-milligrams per liter (mg/L) total dissolved solids) for human consumption. This freshwater zone is assumed to extend down to about 1,800 feet bgs. 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 (BAE Systems, 2004).

The nearest groundwater monitoring wells are located between 1,600 to 2,200 feet to the southwest of the Main Post POL AST Release Site, as shown in Figure 1. One test well is located approximately one mile west of the Main Post POL AST Release Site. Depth to groundwater in the monitoring wells ranges from 335 to 341 ft bgs, as shown in Table 1, while depth to groundwater in the test well is between 236 to 238 ft bgs. It is expected that the depth to groundwater beneath the Main Post POL area is at a similar

depth to that of the monitoring wells located to the southwest and is expected to be greater than 300 ft bgs.

2.6 Climate

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 are capable of causing flash flooding (WTS, 2006).

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 (WTS, 2006).

Precipitation records were reviewed for the month of December 2005 for available weather stations from the National Oceanographic and Atmospheric Administration (NOAA) website. Data were available from 12 different reporting stations within a 100 mile radius of the Site. No significant precipitation was reported during the month, with only one recorded value of 0.10 inches of precipitation recorded on December 13, 2005 at the Sacramento reporting station, which is located approximately 60 miles to the northeast. No recordable precipitation was noted at the 3 stations within 25 miles of the Site.

3. Scope of Activities

Activities performed to complete the field sample collection effort and data evaluation are described in this section. All sample collection and screening procedures were conducted in general accordance with Appendix 5, specifically Section 5.2, of the Permit. Specific activities conducted are described in the following subsections.

3.1 Field Activities

3.1.1 Utility Clearance

Zia Engineering and Environmental Consultants (Zia) performed a utility clearance prior to the start of sample collection activities, as per Appendix 5, Section 5.2.2.a of

the Permit. Zia marked the proposed boring locations at the Site and obtained WSMR clearance for the proposed soil sampling locations. On January 8, 2010, Ground Penetrating Radar (GPR) was used to field verify the locations of underground utilities at the Site. The GPR technician marked the locations of utility lines using fluorescent paint. The proposed boring locations were altered slightly to ensure that underground piping was not damaged by the proposed drilling activities. The actual locations of the borings are shown in Figure 3 and a copy of the GPR report is provided in Appendix A.

WSMR personnel inspected the Site and viewed the GPR markings as well as the proposed boring locations on January 14, 2010. WSMR personnel approved the locations for drilling.

3.1.2 Soil Sample Collection and Field Screening Procedures

Soil samples were collected and screened following the general guidance of Sections 5.2.2.b and 5.2.2.d of Appendix 5 of the Permit.

Soil samples were collected from locations SB-001 through SB-006 (Figure 3) using a mobile drilling rig equipped with hollow stem augers on January 18 and 19, 2010. Hollow stem auger drilling was chosen due to the potential presence of volatile organic compounds (VOCs). The drilling and sample collection procedures were supervised by a qualified geologist.

Soil was qualitatively screened for visual and olfactory presence of hydrocarbons. Quantitative screening of soil was conducted using a photoionization detector (PID) to obtain a heated headspace reading of VOCs. The PID used was a MultiRAE Plus Monitor with a 10.6 electron Volt (eV) lamp, with a detection range of 0 to 2000 parts per million (ppm) and a 0.1 ppm resolution. The PID was calibrated daily using the "fresh air calibration", which zeroes the unit, followed by a single sensor calibration for VOCs using 100 ppm isobutylene.

The lead auger was used to drill through the asphalt at locations SB-001 through SB-005 and to drill through the concrete floor of the containment area at location SB-006. A hand auger was used to remove the upper 3 feet of soil at each location to verify that no utility lines were located in vicinity of the borings. Soil was observed for lithology and for visual or olfactory indications of the potential presence of hydrocarbons every 6 inches throughout the upper 3 feet of soil. When visual or olfactory indications of hydrocarbons were present or at pre-determined intervals, soil was collected from the bottom of the auger, at the cutting blades, for PID screening or for laboratory sample

collection. Information from the upper 3 feet of soil was recorded on the boring logs in Appendix B.

Beneath the hand-augered portion of each boring, soil samples were collected by advancing core barrels ahead of the hollow stem augers. Soil cores were collected continuously to the total depth drilled at each location. The soil cores were examined visually and described according to the Unified Soil Classification System (USCS), American Society for Testing and Materials (ASTM) Standard D 2487-83 (ASTM, 1985). A copy of the USCS chart summarizing the classification system is provided in Appendix B. The sampling tools used, depth of the soil core, amount of soil recovered, soil classification, and other visual observations were recorded on a lithologic log for each sampling location. The boring logs are provided for each boring in Appendix B.

Aliquots of the soil from each soil core were placed into glass sample jars and covered with aluminum foil. The jars were placed into the heated cab of the truck and allowed to equilibrate for approximately 10 minutes. The foil was then pierced with the probe portion of the PID and the highest PID measurement from each aliquot of soil was recorded on the boring logs, along with the depth from which the aliquot was obtained. This heated headspace screening was performed on aliquots of soil from each of the pre-determined sample intervals, at intervals where visual or olfactory indications of potential hydrocarbons were present, and at other routine intervals throughout each boring. All heated headspace readings obtained are provided on each soil boring log. The ambient air temperature was also recorded on the boring log.

Soil samples were planned to 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 field observations indicated that a different interval should be sampled. Actual depths of samples collected are shown in Table 2 and are also indicated on the boring logs in Appendix B.

Soil samples were collected from two additional borings in April 2010 to provide additional lateral delineation of the Total Petroleum Hydrocarbons (TPH) GRO concentrations detected in shallow soil samples from Boring SB006 (discussed later in Section 5.2). The additional borings, SB-007 and SB-008, were located immediately adjacent to the western and northern walls of the AST containment area. These soil samples were collected using a hand auger. The soil borings were advanced with the hand auger in approximately 1 foot increments. The soil was inspected and observations recorded on boring logs. Headspace analyses were performed in the same manner as described for the January 2010 sampling event. The boring logs for these sample locations are also provided in Appendix B.

3.1.3 Decontamination Procedures

All field equipment, including hand augers, core barrels, knives and other non-disposable equipment was decontaminated between each sample and each location, and in accordance with Section 5.2.3 of Appendix 5 of the Permit. The flight augers were decontaminated between each sampling location. Decontamination of large equipment, such as the flight augers and other down-hole equipment, was performed using a high-pressure washer to wash off the equipment over a portable stock tank. Wash water collected in the stock tank was allowed to evaporate in order to minimize waste requiring disposal. Decontamination of smaller equipment, such as the hand augers and knives, included washing the equipment with a solution of potable water and laboratory-grade detergent, scrubbing with a brush, rinsing with potable water, rinsing with distilled water, then allowed to air dry. Any soil that collected in the bottom of the stock tank was placed into the waste soil container, as discussed in Section 3.1.8. The decontamination procedures used during the RFI were consistent with the Standard Practices for Decontamination of Field Equipment Used at Non-Radioactive Waste Sites (ASTM 05088-02).

During the January 2010 event, decontamination water that did not evaporate was collected and stored in a closed-top 55-gallon drum, labeled and disposed of as discussed in Section 3.1.8.

During the April 2010 event, decontamination water was stored in spray bottles and as a result, very little decontamination water was generated. The liquids generated were collected in a 5-gallon open-top bucket and allowed to evaporate in order to minimize the waste generated.

3.1.4 Field Quality Control Samples

Field quality control (QC) samples were collected to evaluate the data quality, according to the work plan, and in accordance with Section 5.2.2.e of Appendix 5 of the Permit. Field QC samples included a total of two equipment rinsate blanks, three field blanks, three trip blanks, and three field duplicate samples.

The equipment rinsate blanks were collected by pouring distilled water over a piece of previously decontaminated sampling equipment (such as the hand auger) and catching the rinsate in a laboratory container. The equipment rinsate blanks were analyzed for the same parameters as the primary soil samples.

The field blanks samples were collected by pouring distilled water directly into sample containers, while working at the Site. The field blank is intended to detect any airborne constituents that might affect sampling results. The field blank was analyzed for the same parameters as the primary soil samples.

One trip blank was included with each laboratory cooler that included VOC samples. The trip blanks were analyzed for the same VOC parameters as the primary samples.

Field duplicates were obtained by collecting an aliquot of soil from the same portion of the soil core as the corresponding primary sample. No field compositing of soil was performed prior to collection of the field duplicate samples. The field duplicate samples were analyzed for the same parameters as the parent sample.

3.1.5 Sampling Handling and Shipping

Sample handling was performed in general accordance with Section 5.2.2.j and 5.2.6.b of Appendix 5 of the Permit. Samples were handled with new disposable gloves that were replaced prior to use with each sample. After each sample was placed into the appropriate container and labeled, it was placed into a cooler with ice. The ice was double-bagged using plastic zipper bags. Each sample was recorded on a chain-of-custody form with the requested analyses for that sample. The chain-of-custody form was sealed inside the cooler prior to shipment to the laboratory. A copy of the chain-of-custody forms is provided in Appendix D.

Shipping containers were sealed with a custody seal and shipped to the laboratory via overnight courier. None of the custody seals had been broken upon receipt at the laboratory. Copies of the container custody seals and the shipping labels are provided in the final laboratory reports in Appendix D.

3.1.6 Analytical Tests Requested

The samples were submitted to DHL Analytical of Austin Texas, a laboratory accredited by the National Environmental Laboratory Accreditation Conference (NELAC) and Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP). DHL Analytical performed analyses of the samples using the most current approved methods, in general accordance with Section 5.3 of Appendix 5 of the Permit. Appendix D of this report contains a copy of the analytical laboratory reports.

All of the soil samples collected in January 2010 from soil borings at the Main Post POL AST Release Site were submitted to the laboratory under proper chain-of-custody for the following analyses:

- TPH GRO by United States Environmental Protection Agency (USEPA) Method 8015 Modified;
- BTEX by USEPA Method 8021B; and
- Lead by USEPA Method 6020.

All of the soil samples collected in April 2010 from Borings SB-007 and SB-008 were submitted to the laboratory under proper chain-of-custody for the following analyses:

- TPH GRO by USEPA Method 8015 Modified; and
- BTEX by USEPA Method 8021B.

None of the April samples were analyzed for lead because no additional delineation of lead was required based on the results of the January 2010 sampling event.

3.1.7 Abandonment of Soil Borings

Boring abandonment was performed in general accordance with Section 6.4 of Appendix 6 of the Permit. All of the soil borings were filled with slurry composed of Type II Portland Cement, quick gel bentonite, and potable water. This slurry was placed into each hole to the surface. An asphalt patch was placed over the borings where asphalt had been removed in order to advance the borings. After the boring inside the concrete containment was abandoned, the concrete floor of the containment was patched with a concrete patch.

3.1.8 Waste Handling

All wastes generated during the investigation described in this report were handled in general accordance with Section 5.2.2.b.iv of Appendix 5 of the Permit.

Miscellaneous trash (drinking water bottles, shipping boxes, paper trash, etc.) that did not come into contact with soil or decontamination equipment was containerized and disposed of as solid waste.

Investigation derived waste (IDW) generated during the sampling events included soil cuttings, decontamination fluids, disposable gloves, plastic sheeting, aluminum foil, and other materials that came into contact with either the soil or decontamination equipment and liquids. IDW soils generated during the January 2010 event were placed into one one-cubic yard pallet box, while decontamination liquids were placed into one 55-gallon closed-top drum. Other solid wastes that came into contact with soils, such as gloves and paper towels, were contained in one 5-gallon plastic bucket. The IDW generated during the April 2010 included soil and personal protective equipment (PPE) since the liquid was allowed to evaporate. The IDW from this event was placed into one 55-gallon open-top drum. Each container was labeled with the date, contents, and point of contact information and delivered to the WSMR waste management center (WMC) for storage pending waste characterization and disposal. A copy of the drum logs documenting delivery of the IDW to the WMC is provided in Appendix D.

To supplement the RFI data and provide additional data for waste characterization purposes, one soil sample collected during the January 2010 sampling event [MNPA-MPOL-SB-006-(3.0-4.0)] was analyzed for the full VOC list by USEPA Method 8260B and for the full semi-volatile organic compound (SVOC) list by USEPA Method 8270C. The analytical data were provided to the WMC and WSMR personnel determined that the waste was characterized as non-regulated. The waste was disposed of off-site by the WMC on April 28, 2010.

A separate composite sample (MP01-CS-001) of the IDW solids was collected during the April 2010 sampling event and this sample was submitted to the laboratory under a separate chain-of-custody for waste characterization analyses. The composite sample was collected by obtaining three aliquots of soil from the drum using a clean stainless steel auger. The aliquots were obtained from near the top of the drum, near the center of the drum and near the bottom of the drum. The three aliquots of soil were placed in a clean stainless steel bowl and mixed with a clean trowel to composite the soil. The sample was submitted to the laboratory for specific waste characterization analyses. The drum of IDW generated during the April 2010 event was transported to the WMC on April 13, 2010. The laboratory report for the composite waste characterization sample was provided to WSMR personnel on May 18, 2010. According to subsequent communication with WMC personnel, the IDW was classified as non-regulated and was disposed off-site in July 2010.

3.1.9 Survey

In accordance with Section 5.2.2.f of Appendix 5 of the Permit, following completion of each field effort, the physical coordinates and ground surface elevation was measured at each boring. The first six borings at the Site were surveyed on February 12, 2010. The additional two borings installed in April 2010 were surveyed on April 28, 2010.

All of the locations were surveyed in relation to a control point. Northing and easting data were measured to the nearest 0.001 meter and elevation was measured to the nearest 0.001 foot. A copy of the survey data is provided in Appendix C.

3.2 Data Evaluation

3.2.1 Regulatory Criteria

Data developed during the RFI were evaluated according to the NMED risk-based soil screening guidance document *Technical Background Document for Development of Soil Screening Levels Revision 5.0* (NMED, 2009). SSLs are presented in Table A-1 of that document (SSG Table A-1) for various exposure scenarios.

Additional screening values were obtained from the combined USEPA Regional Screening Levels (RSLs), found on the USEPA website, which is located on the internet at http://www.epa.gov/region09/superfund/prg/index.html. The RSL summary table includes soil screening values for both Residential Soil and for Industrial Soil.

The NMED guidance document for evaluation of TPH (NMED, 2006) provides several screening levels for TPH, depending on the source of the petroleum product. The source of potential impacts at the Site is gasoline. No screening level is provided for TPH GRO in the NMED guidance document.

The Site is located within the Main Post of WSMR and access to the Site is limited to personnel approved to enter the area. Although this would imply that an industrial/occupational exposure would be appropriate, the Residential SSLs were used in order to provide a conservative evaluation of potential impacts.

In addition to the Residential SSLs, the SSL for protection of groundwater due to leaching was used to screen the samples. Because the samples were not saturated, depth to groundwater in the vicinity is greater than 300 ft bgs, and the source area is

less than 0.5 acres, a Dilution Attenuation Factor of 20 (DAF 20) was used to evaluate leaching potential.

3.2.2 Data Quality Evaluation

The primary data quality objectives (DQOs) for this investigation were to provide representative data usable to characterize site conditions, delineate the nature and extent of affected media (if present), and to support corrective action decisions as appropriate. Analytical data reports were reviewed and evaluated in accordance with Appendix 5 of the Permit and in accordance with applicable USEPA SW-846 method requirements as described in the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, October 1999), USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, July 2002) and the site-specific requirements defined in the *White Sands Missile Range Site-Wide Quality Assurance Project Plan* (ARCADIS, 2009).

The analytical data were validated using Level II quality assurance (QA) and quality control (QC) criteria. A copy of the analytical data reports and the data validation summary reports are provided in Appendix D. The data validation results indicated that all the data are usable and meet the project's data quality objectives.

3.2.3 Risk Assessments

Human health and ecological risk assessments were performed using data collected during both the January and April 2010 sampling events.

The human health risk assessment (HHRA) was performed to evaluate potential risks associated with human exposure to constituents of potential concern (COPCs) at the Site. The HHRA was conducted following the approach provided in the NMED guidance and USEPA guidance for risk assessments (see Appendix E for references). Both a screening level ecological risk assessment (SLERA) and a baseline ecological risk assessment (BERA) were performed for the Site. These assessments evaluated potential risks associated with ecological receptors that may be exposed to constituents of potential ecological concern (COPECs). The SLERA and BERA were performed using an approach based on NMED and USEPA guidance (see Appendix E for references).

For purposes of the risk assessment, the soil data were divided by sample depth interval based on the exposure pathways identified for the Site. In brief, the soil data were categorized as follows:

- Surface soil data, including soil samples collected from depths of 0 to 2 ft bgs, were used to evaluate potential exposure of human (current/future site worker; hypothetical future resident) and ecological receptors;

- Surface and subsurface soil data (0 to 10 ft bgs) were used to evaluate potential exposure of human (future construction worker) and ecological receptors that could be exposed to subsurface soil (e.g., burrowing wildlife); and

- Total soil data (vadose zone) were used to evaluate potential exposure of human receptors through the vapor intrusion exposure pathway.

The detailed procedures followed for the risk assessments are described in Appendix E.

4. Investigation Results

Results of the field investigation and data evaluation activities are discussed in this section.

4.1 Subsurface Conditions

The boring logs (Appendix B) indicate that the upper 2 to 3 feet of soils consist of well-graded sand that extends across the area investigated. A clay layer was encountered in all but one boring (SB-001) from depths of 2 to 3 ft bgs and was approximately 3 to 4 feet in thickness. This clay layer was underlain by well-graded to poorly graded sand to a depth of 20 ft bgs. None of the borings extended more than 20 ft bgs.

As shown in the boring logs, the soils were moist throughout the depth of the investigation, but no saturated soil was encountered.

4.2 Soil Sampling Field Screening Results

The PID measurements collected during field screening are presented in the soil boring logs (Appendix B). The only soil samples that contained organic vapors as measured by the PID were from the 4 to 5 ft bgs interval at Boring SB-002 and several

samples from Boring SB-006. The PID measurements recorded from samples collected at Boring SB-006 declined significantly with depth, with a recording of 308 ppm immediately below the concrete to 10 ppm at a depth of 9 ft bgs. No measureable organic vapors were recorded from the samples collected deeper than 9 ft bgs at location SB-006.

4.3 Soil Sampling Analytical Results

The analytical results for soil samples collected during the RFI are provided in Table 3. Analytical reports from the laboratory are provided in Appendix D along with the data validation summary.

The reported concentrations in samples collected from the upper 10 ft bgs were compared to the Residential SSL for each constituent. The reported concentrations in all samples were compared to the DAF 20 SSL. Both the Residential SSL and the DAF 20 SSL, where available, are provided for each constituent analyzed in Table 3.

4.3.1 Gasoline Range Organics

The NMED guidance document for evaluation of TPH (NMED, 2006) does not provide an SSL for gasoline; thus no SSL is available for GRO.

GRO was reported at a concentration of 1.04 milligrams per kilogram (mg/kg) in the sample collected from 4 to 5 ft bgs from location SB-002. The samples collected from deeper intervals in this boring did not contain detectable GRO.

GRO was reported at a concentration of 511 mg/kg in the sample collected from immediately below the concrete at location SB-006. Samples from surrounding borings (SB-001 through SB-005, SB-007 and SB-008) provide lateral delineation of the TPH GRO. The deeper samples from SB-006 did not contain detectable amounts of TPH GRO, providing vertical delineation of the TPH GRO. The distribution of TPH GRO concentrations in the soils is shown on Figure 4. The data are summarized in Table 3.

4.3.2 Volatile Organic Compounds

The sample collected from immediately below the concrete at location SB-006 contained benzene, ethylbenzene and xylenes at concentrations above the DAF 20 SSL but below their respective Residential SSLs. Samples from surrounding borings (SB-001 through SB-005, SB-007 and SB-008) provide lateral delineation of the BTEX

concentrations in SB-006. The deeper samples from SB-006 did not contain detectable amounts of BTEX, providing vertical delineation of the BTEX. The distribution of BTEX concentrations in the soils is shown on Figure 4. The data are summarized in Table 3.

4.3.3 Lead

Lead was reported in the samples collected from SB-001 through SB-006 at concentrations ranging from 4.9 to 47.5 mg/kg, all of which are below the Residential SSL. No DAF value is available for lead.

4.3.4 Waste Characterization Analytical Results

Table 4 contains a summary of the waste characterization sample analytical results. The analytical data were provided to the WMC, as discussed in Section 3.1.8.

4.4 Risk Assessment Screening

4.4.1 Human Health Risk Assessment Screening

A HHRA was conducted to evaluate exposure to COPCs in surface soil (0 to 2 ft bgs), combined surface and subsurface soil (0 to 10 ft bgs), and total soil (0 to 20 ft bgs) for site workers under current and future land use conditions, and construction workers and residents (adult and child) under hypothetical future land use conditions. Appendix E provides additional details of the procedures and results of the HHRA, which are summarized in this subsection.

In accordance with NMED guidance (NMED, 2009), constituent concentrations in surface soil and in combined surface and subsurface soil were compared to health-based screening levels and the calculated ratios summed. The ratios were multiplied by $1x10^{-5}$ for carcinogens and by 1 for non-carcinogens. The results of this data screening process indicate that after comparison to health-based SSLs for industrial worker exposure, residential exposure, and construction worker exposure, no COPCs were selected for surface soil or for combined surface and subsurface soil at the Site. This demonstrates that the constituent concentrations in surface soil and in combined surface and subsurface soil at the Site are unlikely to result in adverse health impacts to current or future site workers, current or future construction workers or future residents via direct contact exposure (i.e., ingestion, inhalation of vapor/dust, dermal).

All the VOCs detected in total soil were selected as COPCs for the vapor intrusion evaluation. The total cumulative Excess Lifetime Cancer Risk (ELCR) for a hypothetical future resident exposed to indoor air at the Site is 9×10^{-5}, which is within the acceptable target risk range of 1×10^{-6} to 1×10^{-4}. The total cumulative hazard index (HI) for a hypothetical future child resident is 26, which is above the benchmark of 1. Xylenes were identified as the primary contributor to the calculated hazard.

A closer examination of the detected and non-detected concentrations and their spatial extent indicates that it is unlikely that xylenes would represent a significant exposure risk to hypothetical future site worker or resident receptors. Xylenes were detected in only 1 of 29 samples, with a maximum concentration of 66 mg/kg. This sample was reported for sample location MPOL-SB-006 and was collected from 0.5 to 1 ft bgs, underneath the concrete pavement area adjacent to the 6,000 gallon gasoline ASTs where the release occurred. Of the 29 total samples that were collected from surface and shallow soil (i.e., from 0 to 20 bgs) at the Site, xylenes were not detected in any other sample, including the four samples collected at 4 ft bgs, 10 ft bgs, 15 ft bgs , and 20 ft bgs from MPOL-SB-006. Xylenes are considered unlikely to represent a significant future exposure concern because of the following reasons:

- The evaluated scenarios (i.e., hypothetical future worker and residential exposure via vapor intrusion) are unlikely because they would involve a significant land use change in the future (i.e., from an operating military installation to commercial/industrial or a single-family residential development); and

- Elevated xylenes concentration was only detected at 0.5 to 1 ft bgs underneath concrete pavement at the release area. In the event that future redevelopment at the Site involves construction of a building over soil containing xylenes, xylenes concentration in surface soil will significantly decrease due to volatilization into ambient air during reconstruction. Given the extremely low frequency of detection (i.e., 3 percent), and that the one detection was limited to surface soil (i.e., 1 ft bgs) from a single sample obtained from underneath concrete pavement, it is unlikely that this detection represents a significant source of vapors that could migrate into an overlying structure at some point in the future.

Based on this evaluation, xylenes are unlikely to represent a significant exposure risk via vapor intrusion under future land use conditions.

4.4.2 Ecological Risk Assessment Results

A SLERA and BERA were completed for the Site to evaluate whether ecological receptors may be adversely impacted by exposure to site-related constituents detected in surface soil and subsurface soil, and to conduct food chain modeling for the COPECs identified as bioaccumulative. Appendix E provides additional details of the procedures and results of the SLERA and BERA, which are summarized in this subsection.

The results of the SLERA and BERA for direct contact exposure and for food chain modeling indicate that adverse impacts are unlikely to occur for ecological receptors potentially exposed to constituents in soil. Therefore, no further ecological evaluation of the Site is warranted.

5. Conclusions

A RFI of the Site was performed in order to evaluate whether the reported release of gasoline resulted in impacts to soil and if the potential exists for impacts to groundwater. The investigation was performed according to the requirements of the WSMR Permit. Soil samples were collected from eight borings within the Site. The analytical reports were reviewed and the data were determined to meet the data quality objectives.

The evaluations of data performed for this RFI have resulted in the following conclusions:

- Based on both the PID and analytical results, limited impacts appear to be present immediately below the southeast corner of the concrete containment area.

- The vertical extent of the impacted soil is defined by the soil samples collected during this RFI and is limited to approximately 2 to 3 ft bgs. The lateral extent of the impacted soil has also been defined and is limited to the area beneath and immediately adjacent to the southeast corner of the containment area.

- A human health risk assessment screening was conducted using the analytical results and most recent screening levels. The impacted soil does not pose a current or future risk to human health.

- An evaluation of the data was performed to determine whether the affected soils represent a risk of potential future leaching to groundwater. Benzene, ethylbenzene and total xylenes are present at concentrations above the respective DAF 20 values. The only reported concentrations of the COPCs above the DAF 20 value were contained in the sample collected from immediately below the concrete (0.5 to 1 ft bgs) in boring SB-006. The samples collected from deeper intervals (4-5', 9-10', 14-15' and 19-20') in this same boring did not contain detectable COPCs and the detection limits were an order of magnitude lower than the respective DAF 20 values. In fact, no other sample collected contained any detectable concentrations of these COPCs. Based on the very shallow exceedances of DAF 20 in SB-006 (0.5-1') relative to the very deep occurrence of groundwater (greater than 300 feet), there is little or no risk that the COPCs in the shallow soils represents a threat to the groundwater. This is further supported by the fact that surface water infiltration depths in the area do not exceed about 15 feet because of the very high evapotranspiration rates (ARCADIS, 2010). In addition, the area is covered with asphalt, which should minimize infiltration of surface water and further reduce the potential for leaching to occur.

- The results of the SLERA and BERA for direct contact exposure and for food chain modeling indicate that adverse impacts are unlikely to occur for ecological receptors potentially exposed to constituents in soil. Therefore, no further ecological evaluation of the Site is warranted.

6. Recommendations

The RFI for the Site was successfully completed and meets the RFI requirements described in the Permit. No further investigation is recommended.

7. References

ARCADIS, 2009. *White Sands Missile Range Site-Wide Quality Assurance Project Plan*, September.

ARCADIS 2010. Revised Phase III RCRA Facility Investigation Report, HELSTF Sites, Second Revision, August 2010.

ASTM, 1985. D 2487-83, *Classification of Soils for Engineering Purposes: Annual Book of ASTM Standards*. Vol. 04.08, pp 395-408.

BAE Systems, 2004. *Background Soils RCRA Facility Investigation Report for the Main Post, White Sands Missile Range*. September 2004.

EPA, 2000. *Amended Guidance on Ecological Risk Assessment at Military Bases: Process Considerations, Timing of Activities, and Inclusion of Stakeholders. Memorandum from Ted W. Simon, Ph.D., Office of Technical Services.* June 23,2000. http://risk.lsd.ornl.gov/homepage/ecoproc2.pdf.

EPA, 1998. *Guidelines for Ecological Assessment*. Office of Research and Development, EPA/630/R-95/002FA, April 1998.

IT Corporation, 1992. *Final RCRA Facility Investigation Report (RFI) Appendix I Sites White Sands Missile Range New Mexico*. March 1992.

Kelly, T.E., 1973. *Summary of Ground-water Data at Post Headquarters and Adjacent Areas, White Sands Missile Range*. USGS Open File Report 72-308.

Kelly, T.E. and Hearne, G.A., 1976. *The Effects of Groundwater Development on the Water Supply in the Post Headquarters Area, White Sands Missile Range, New Mexico*. USGS Open File Report 76-277.

NMED, 2006. *New Mexico Environment Department TPH Screening Guidelines*. October 2006.

NMED, 2008. *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment. Revision 2.0.* Hazardous Waste Bureau.

NMED, 2009. *Technical Background Document for Development of Soil Screening Levels, Revision 5.0. NMED Hazardous Waste Bureau and Ground Water Quality Bureau, Voluntary Remediation Program.*

USEPA. 1999. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*. Office of Emergency and Remedial Response, EPA540/R-99/008 (OSWER 9240.1-05A-P), October.

USEPA. 2002. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic* Data Review, Office of Emergency and Remedial Response, EPA 540-R-01-008 (OSWER 9240.1-35), July.

WTS, 2006. *Phase III RFI Report, Main Post Multiple Sites, SWMUs8-17, 21, 22, 80, 140 and 156 (IRP Sites WSMRs 30-33, 36, 57, 60, 73, 74, 79, and 84).* May 2006.