APPENDIX A

2010 Regulatory Correspondence between the NMED HWB and the Air Force Regarding the Kirtland AFB, BFF Spill

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ATTACHMENT 1

April 2, 2010 Correspondence from the NMED HWB to Colonel Michael S. Duvall, Base Commander, 377 ABW/CC Re: SWMUs ST-106 and SS-111, BFF Spill, Kirtland, AFB

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AR Doc # 3451

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April 2, 2010

APR 19 2010

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Director, Environmental Management Section
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RE: SOLID WASTE MANAGEMENT UNITS ST-106 AND SS-111, BULK FUELS FACILITY SPILL
KIRTLAND AIR FORCE BASE
EPA ID# NMD9570024423, HWB-KAFB-10-004

Dear Colonel Duvall and Mr. Pike:

As you are aware, the U. S. Department of Defense Kirtland Air Force Base ("Permittee") is conducting an investigation of contaminated groundwater at the Bulk Fuels Facility Former Fuel Offloading Rack (Solid Waste Management Unit ["SWMU"] ST-106) and the associated Light Non-Aqueous Phase Liquid ("LNAPL") plume (SWMU SS-111, or Phase-Separated Hydrocarbon Bulk Fuels Facility Remediation) (collectively, the "Bulk Fuels Facility Spill"). Data submitted by the Permittee show that the contamination caused by the Bulk Fuels Facility Spill represents a significant threat to human health and the environment, particularly to well water in urban neighborhoods adjacent to Kirtland Air Force Base ("KAFB"). Despite the fact that this release of hazardous constituents was first discovered 10 years ago, the Permittee has not completely characterized the Bulk Fuels Facility Spill, nor conducted adequate remediation.

As stated in the New Mexico Environment Department ("Department") Ground Water Quality Bureau ("GWQB") letter enclosed with this letter, the GWQB has transferred oversight of the Bulk Fuels Facility Spill to the Hazardous Waste Bureau ("HWB"),

which will direct corrective action at the Bulk Fuels Facility Spill pursuant to the New Mexico Hazardous Waste Act ("HWA") NMSA 1978, §74-4-1 to 74-4-14 and the Hazardous Waste Management Regulations ("HWMR", 20.4.1 NMAC).

Releases of hazardous waste or hazardous constituents are subject to corrective action under Sections 3004(u) and (v) and 3008(h) of the Resource and Conservation Recovery Act "RCRA"; 42 U.S.C. §§ 6924(u) and (v) and 6928(h); Sections 74-4-4(A)(5)(h) and (i), 74-4-4.2(B), and 74-4-10(E) of the HWA; and the HWMR at 40 C.F.R. Part 264, Subpart F (incorporated by 20.4.1.500 NMAC).

Pursuant to 20.4.1 NMAC incorporating 40 CFR § 264.101(a), the Permittee must institute corrective action as necessary to protect human health and the environment for all releases of hazardous waste or constituents from any SWMU. Additionally, in accordance with 20.4.1 NMAC incorporating 40 CFR § 264.101(c), the Permittee must implement corrective actions beyond the facility boundary.

Section R.5 of the Hazardous and Solid Waste Amendments ("HSWA") Module IV of the Permittee's RCRA Permit states:

> The Permittee shall conduct those investigations of SWMUs previously identified with known or suspected releases of contamination as necessary to protect human health and the environment to: characterize the facility (Environmental Setting); define the source (Source Characterization); define the degree and extent of contamination (Contamination Characterization); and to identify actual or potential receptors.

Additionally, pursuant to Section R.5(b):

> The Permittee shall collect analytical data to completely characterize the waste and areas where waste have been placed, including: type, quantity, physical form, disposition (containment or nature of deposits), and the facility characteristics affecting releases.

And, in accordance with Section R.5(c):

> The Permittee shall collect analytical data on groundwater, soils, surface water, sediment, and subsurface gas contamination when necessary to characterize contamination from a SWMU. The data shall be sufficient to define the extent, origin, direction and rate of movement of the contaminant plumes.

Therefore, in accordance with Section K.1 of the HSWA Module IV of the Permittee's RCRA Permit, the Permittee is directed to immediately implement interim measures to remediate the LNAPL plume, to excavate and remove structures and contaminated soil in

the vadose zone at and in the vicinity of the Former Fuel Offloading Rack, to install additional wells, and continue operation of the existing soil-vapor extraction units as directed below. Additionally, pursuant to Section R.5 of Module IV of the Permit, the Permittee is directed to immediately complete characterization of contaminated soil and soil-gas in the vadose zone, and to immediately complete characterization of the dissolved-phase contamination in groundwater. Furthermore, in accordance with Section M.1 of Module IV of the Permit, the Permittee will be directed by NMED to conduct one or more Corrective Measures Evaluations. The Permittee shall comply with the detailed instructions specified below by the indicated deadlines.

A. REQUIREMENT FOR COMPLETING CHARACTERIZATION OF CONTAMINATION IN THE VADOSE ZONE

The Department finds that contaminant characterization is inadequate at the tank farm, the piping extending from the tank farm to the Former Fuel Offloading Rack, and areas in the vicinity of the Former Fuel Offloading Rack. More specific details on this finding are presented in the next two paragraphs.

Based on information provided by the Permittee, only four soil borings have been completed at the fuel tanks and no borings have been completed along the ancillary piping leading from the fuel tanks to the Former Fuel Offloading Rack. The four soil borings at the tanks were completed to shallow depths ranging from 25-48 feet. Diesel Range Organics ("DRO") contamination was detected in all four boreholes, with the highest concentrations (1800-2400 mg/kg) found in borehole SB-09. A number of hazardous constituents were also detected in soil samples from SB-09 and SB-06. Despite these findings, the Permittee did not determine the extent of contamination near the tanks. The latter is particularly notable given that the Permittee's *Stage 1 Abatement Plan Report* (February 8, 2006) contains the following recommendation (in Section 4.4):

> It is recommended that additional field investigation at the east side of the Bulk Fuels Facility be conducted to determine the full extent of petroleum hydrocarbons in soil and soil vapor beneath Tank 2422...Additional investigation will also determine whether release(s) associated with this tank are the source of sorbed-phase and vapor-phase petroleum hydrocarbons previously indentified in distal monitoring wells SVMW-13 and SVMW-15.

To date, the Permittee has not conducted the additional field investigation to determine the full extent of petroleum hydrocarbons and hazardous constituents in soil and soil vapor around the Bulk Fuels Facility.

The Permittee has also not completed characterization of the contaminated soil in the vicinity of the Former Fuel Offloading Rack, as previous investigative efforts seem to have been arbitrarily terminated once Total Petroleum Hydrocarbons ("TPH") concentrations in soil were found to be less than 100 mg/kg. Additional soil borings should have been completed to investigate the full

extent of soil contamination above background levels regardless of the concentration levels of the contaminants. Similarly, characterization of soil-gas contamination near the Former Fuel Offloading Rack is inadequate; investigative efforts appear to have been terminated once TPH concentrations were found to be below 1000 ppmv in the area. Additional soil-gas monitoring wells should have been installed to investigate the full extent of soil-gas contamination from the surface to groundwater, even in areas where the contamination is less than 1000 ppmv.

Thus, the Permittee has not adequately characterized LNAPL contamination in the vadose zone. Characterization must be complete to design and implement an appropriate final remedy. Accordingly, pursuant to the deadlines established below, the Permittee must:

1. Determine the amount of fuel that exists within the vadose zone as sorbed or residual liquid, or as soil gas.
2. Identify the source of the LNAPL fuel plume.
3. Describe the vadose zone hydrology, its relationship to observed and potential to-be-discovered groundwater contamination, and the potential for continuing contamination of groundwater by vadose zone contamination sources.
4. Characterize the geology and extent of contamination in the soil and soil gas to determine distribution, fate, and migration of contaminants.

Therefore, on or before **June 7, 2010**, the Permittee must submit to the Department for its review and approval a Vadose Zone Investigation Plan that describes the additional actions the Permittee will take to investigate the vadose zone hydrology and geology of the affected area, to identify and characterize the source of the releases at the Bulk Fuel Facility, and to identify the extent of soil and soil-gas contamination in the vadose zone from the surface to groundwater. The area covered under this Vadose Zone Investigation Plan must include the tank farm and the ancillary piping between the farm and the Former Fuel Offloading Rack. The Vadose Zone Investigation Plan must describe in detail all research, locations, depths and methods of exploration, field procedures, sampling and analysis of soil and soil gas and related quality control procedures. The Vadose Zone Investigation Plan shall also describe the results and the means (for example, cross-sections, plan views) by which these results will be reported after the investigation is completed, and a schedule for implementation of the work that complies with the compliance schedule in Table 1 of this letter.

Table 1. Compliance Schedule for Vadose Zone Investigation

Task	Date Due
Submit Vadose Zone Investigation Plan to the Department	June 7, 2010
Complete all subsurface-soil sampling and installation of all soil-gas monitor wells	Within 12 months after Department approval of Vadose Zone Investigation Plan

Report results for subsurface-soil sampling	Within 15 months after Department approval of Vadose Zone Investigation Plan
Complete first four quarters of soil-gas sampling and analysis	Within 24 months after Department approval of Vadose Zone Investigation Plan
Soil-gas sampling	Quarterly after well installations completed
Submit quarterly soil-gas monitoring reports to the Department	60 days after the quarter during which sampling occurred

Furthermore, in addition to any other locations the Permittee identifies, the locations listed in Table 2 of this letter shall be included in the Vadose Zone Investigation Plan and must be sampled for contaminants in soil and soil gas (all coordinates in this table are State Plane Coordinates in feet, NAD83). Soil samples shall be collected at a frequency of at least one sample every 10 feet for the first 50 feet, and at least one sample thereafter every 50 feet to total depth, and at least one sample at total depth in each boring. Each boring at each location shall be drilled from the surface to the water table, and each boring shall be completed as a permanent soil-gas monitoring well. All of the soil-gas monitoring wells shall be capable of yielding discrete samples of soil gas recovered from depths of 25, 50, 150, 250, 350, and 450 feet below the ground surface. While the Permittee shall continue to analyze samples for TPH and hazardous constituents, the investigation shall not be limited to only those areas containing or suspected to contain TPH at concentrations of greater than 100 mg/kg (100 ppm) in soil or 1000 ppmv in soil gas. Instead, investigation of the Bulk Fuels Facility Spill shall be designed to determine the full extent of contamination above background levels regardless of contaminant concentration levels.

Table 2. Borehole locations for soil sampling and for conversion to soil-gas monitoring wells.

Location #	Easting	Northing	Characterization Purpose
1	1541119	1473793	Step out from Fuel Offloading Rack beyond 100 mg/kg contaminated zone
2	1540808	1473503	Step out from Fuel Offloading Rack
3	1541123	1473310	Step out from Fuel Offloading Rack
4	1541425	1473313	Step out from Fuel Offloading Rack
5	1541961	1473492	Path from Fuel Offloading Rack to LNAPL Plume
6	1542002	1473057	Piping
7	1541794	1473061	Piping
8	1542370	1473058	Piping
9	1541898	1473276	Path from Fuel Offloading Rack to LNAPL Plume
10	1541720	1473369	Step out from Fuel Offloading Rack

11	1541776	1473740	Step out from Fuel Offloading Rack
12	1541658	1473505	Path from Fuel Offloading Rack to LNAPL Plume
13	1542061	1472928	Fuel tanks
14	1542063	1472775	Fuel tanks
15	1542142	1472847	Fuel tanks
16	1541982	1472845	Fuel tanks
17	1542330	1472796	Fuel tanks
18	1542430	1472897	Fuel tanks
19	1542516	1472810	Fuel tanks
20	1542428	1472716	Fuel tanks
21	1541611	1473238	Piping

In addition to any other location identified by the Permittee, the locations listed in Table 3 of this letter shall also be included in the Vadose Zone Investigation Plan to be sampled for contaminants in soil gas (all coordinates in this table are State Plane Coordinates in feet, NAD83). Each boring at each location listed in Table 3 shall be completed as a permanent soil-gas monitoring well. All of the soil-gas monitoring wells shall be capable of yielding discrete samples of soil gas recovered from depths of 25, 50, 150, 250, 350, and 450 feet below the ground surface.

Table 3. Locations for soil-gas monitoring wells.

Location #	Easting	Northing	Characterization Purpose
1	1543058	1474093	Characterize outside of LNAPL Plume
2	1543194	1474680	Characterize outside of LNAPL Plume
3	1542306	1474093	Characterize within LNAPL Plume
4	1541555	1475049	Characterize outside of LNAPL Plume
5	1541248	1474141	Characterize outside of LNAPL Plume
6	1542259	1472591	Characterize outside of LNAPL Plume
7	1540667	1472823	Characterize outside of LNAPL Plume
8	1542525	1475459	Characterize within LNAPL Plume
9	1542436	1474878	Characterize within LNAPL Plume

B. REQUIREMENT FOR COMPLETING CHARACTERIZATION OF DISSOLVED-PHASED CONTAMINANTS IN GROUNDWATER

The Permittee has not adequately characterized the dissolved-phase contamination in the groundwater and has not analyzed groundwater samples from wells located in the LNAPL plume area. The final remedy for the Bulk Fuels Facility Spill cannot be determined until this characterization work has been completed. Additionally, the Permittee has not installed any groundwater monitoring wells to investigate the vertical extent of the dissolved-phase groundwater contamination, the effects of vertical gradients, and the geology of the aquifer at any appreciable depth below the water table. The dissolved-phase plume is approaching one or more

Water Utility Authority well fields. Given that the pumping of water supply wells is known to induce vertical gradients in groundwater and can cause significant components of vertical flow in the vicinity of such wells, vertical characterization of groundwater quality and geology is required.

The leading edge and the eastern and western margins of the plume are undefined, and the nature and concentrations of contaminants in the core of the plume are poorly characterized because existing wells are located too far apart (generally at distances greater than 500 feet). Additionally, only one upgradient well has been installed that may yield groundwater samples that are free from contamination. Given the magnitude of this spill, several upgradient wells should be installed that are screened at different depths at and below the water table to ensure that all areas of contaminated groundwater have been located, and that the background wells are truly monitoring background water quality.

Therefore, on or before **July 7, 2010**, the Permittee must submit to the Department for its review and approval a Groundwater Investigation Plan that describes the additional actions the Permittee will take to characterize the nature, horizontal and vertical extent, and the fate and rate of migration of the groundwater contamination. The Groundwater Investigation Plan shall include construction details and the locations and depths of the groundwater monitoring wells to be installed, actions to characterize the geology and hydrogeology at and below the water table, and the groundwater flow direction and velocity. The plan shall also present details on field procedures, and the sampling and analysis of groundwater and related quality control. The Groundwater Investigation Plan shall describe the results, the means (*e.g.*, cross-sections, plan views) by which these results will be reported after the investigation is completed, and a schedule for implementation of the work that complies with the compliance schedule in Table 4 of this letter.

Table 4. Compliance Schedule for Groundwater Investigation

Task	Date Due
Submit Groundwater Investigation Plan to the Department	July 7, 2010
Complete installation of all wells	Within 12 months after Department approval of Groundwater Investigation Plan
Submit well installation report to the Department	Within 15 months after Department approval of Groundwater Investigation Plan
Complete first eight quarters of groundwater sampling and analysis	Within 36 months after Department approval of Groundwater Investigation Plan

Groundwater Sampling	Quarterly after well installations completed
Submit quarterly groundwater monitoring reports to the Department	60 days after the quarter during which sampling occurred

In addition to any locations the Permittee identifies, the Groundwater Investigation Plan shall also include a description of the installation of groundwater monitoring wells at the locations listed in Table 5 of this letter (all coordinates in this table are State Plane Coordinates in feet, NAD83). Three groundwater monitoring wells shall be installed at each of the cluster well locations listed in Table 5. The screen depths shown in Table 5 are distances (in feet) that the top of the screens shall be set below the water table. Screen lengths for wells shall not exceed 15 feet, with the exception that wells screened across the water table (those with screen depths of zero in Table 5) shall have screens 20 feet long, with no more than 15 feet of said screen length situated below the water table.

In addition to any other tools the Permittee identifies, the Groundwater Investigation Plan shall also include details describing the geophysical logging of all existing and new wells using induction (deep), neutron, and gamma (large crystal) tools. Geophysical logging at the cluster well locations listed in Table 5 is required in only the well at each location having the deepest screened interval.

Table 5. Cluster well locations and screen depths relative to the water table.

Location #	Easting	Northing	Screen Depths	Characterization Purpose
1	1542189	1476725	0, 15, 40	Plume margin
2	1541984	1476042	0, 15, 40	Plume margin
3	1543703	1476600	0, 15, 40	Plume margin
4	1543372	1475065	0, 15, 40	Plume margin
5	1543643	1477939	0, 15, 85	Leading edge and deep characterization
6	1541430	1472370	0, 15, 40	Background water quality
7	1542812	1473601	0, 15, 40	Plume margin
8	1542722	1477726	0, 15, 40	Leading edge
9	1543054	1477788	0, 15, 40	Leading edge
10	1543774	1477304	0, 15, 40	Leading edge
11	1541774	1473718	0, 15, 85	Plume core, deep delineation
12	1542362	1473801	0, 15, 85	Plume core, deep characterization
13	1542305	1474340	0, 15, 85	Plume core, deep characterization
14	1542736	1474715	0, 15, 85	Plume core, deep characterization
15	1542860	1475860	0, 15, 85	Plume core, deep characterization
16	1542189	1475207	0, 15, 85	Plume core, deep characterization
17	1541891	1473151	0, 15, 85	Plume core, deep characterization
18	1542203	1474071	0, 15, 85	Plume core, deep

				characterization
19	1542653	1475338	0, 15, 85	Plume core, deep characterization
20	1542535	1475975	0, 15, 85	Plume core, deep characterization
21	1543199	1475767	0, 15, 85	Plume core, deep characterization
22	1543068	1476494	0, 15, 85	Plume core, deep characterization

C. REQUIREMENT FOR INTERIM MEASURES

In its October 28, 2009 letter, the GWQB wrote:

> The New Mexico Environment Department (NMED) has determined, based on information generated by Kirtland Air Force Base (KAFB) during its investigations, that the scale and observed impact of the Light Non-Aqueous Phase Liquid (LNLAP) hydrocarbon contamination of groundwater associated with the SS-111 Bulk Fuels Facility constituting the majority of the KAFB ST-106 LNAPL plume has been largely defined. This plume of LNAPL hydrocarbons has been found to have contaminated groundwater over a substantial area that is the source of drinking water supplies for the City of Albuquerque and is also located in the vicinity of several public water supply wells. The volume of LNAPL hydrocarbons on groundwater, which has been estimated by KAFB to be in the millions of gallons, will take a substantial period of time to remediate. Currently, the majority of the LNAPL hydrocarbon plume is located off of KAFB property and is not being actively remediated.

The Permittee's records indicate that the LNAPL and dissolved-phase plumes have migrated horizontally a distance of about 0.5 mile and 0.9 miles, respectively, from the area of the Former Fuel Offloading Rack.

Interim measures are required to reduce or prevent the migration of contaminants, or to reduce or prevent human or environmental exposure to contaminants while long-term corrective action remedies are evaluated and implemented. Section K.1 of the HSWA Module IV of the Permit states:

> If during the course of any activity initiated under this module, the Administrative Authority determines that a release or potential release of hazardous constituents from a SWMU poses a threat to human health and the environment, the Administrative Authority may specify interim measures. The Administrative Authority will determine the specific measure, including potential permit modifications, and the schedule for implementing the required measures.

Additionally, Section K.2 of Module IV of the Permit states:

The following factors may be considered by the Administrative Authority in determining the need for interim measures.

1. Time required to develop and implement a final remedy;
2. Actual and potential exposure to human and environmental receptors; and
3. The potential for the further degradation of the medium absent interim measures.

The Department has determined that the Bulk Fuel Facility Spill poses a threat to human health and the environment, and furthermore, endangers the groundwater resource – including water supply wells – relied upon by the Albuquerque Bernalillo County Water Utility Authority for delivery of safe drinking water to its customers. The contamination also threatens KAFB water supply wells, and those that supply the Veterans Administration ("VA") Hospital. The large size of the LNAPL plume and its proximity to these water supply wells requires that urgent action be taken to prevent the LNAPL plume from contaminating more of Albuquerque's drinking-water supply.

The Permittee has estimated the volume of fuel released from the Bulk Fuels Facility to range from about 1-2 million gallons, but the actual volume could be considerably larger because characterization of the vadose zone is inadequate. For example, the Department has estimated the volume of sorbed fuel at or greater than 100 ppm in soil to be about 4.8 million gallons; this does not include fuel in soil gas, fuel dissolved in groundwater, and floating fuel forming the LNAPL plume. The Department has estimated the fuel included in the LNAPL plume to be approximately 3 million gallons, giving a total volume of fuel sorbed to soil and that contained within the LNAPL plume at nearly 8 million gallons. The Permittee's records indicate that it has installed and is operating "interim ICE SVE" units on the Permittee's property; however, these four soil-vapor extraction (SVE) units are not an adequate interim measure to address the existing ground water contamination, including the LNAPL plume that has migrated beyond the facility boundary. From April 2003 to September 2009, these SVE units have extracted an estimated 286,600 gallons of fuel. From April through September 2009, the average extraction rate has declined by 25 per cent. The average extraction rate for each SVE unit is about 2,975 gallons per month.

At the rate of extraction achieved so far by the existing SVE units, the operation of these units would take over 14 years to remove 2 million gallons of fuel. This length of time is unacceptable because additional groundwater within the capture zone of Water Utility Authority water supply wells could become contaminated before the remediation could be completed. Furthermore, should the Department's calculations prove to be more accurate than the Permittee's estimated volume of fuel, it would take over 56 years for the remediation of the fuel to be completed.

Additionally, although the Permittee knows that considerable volumes of fuel have leaked from the Former Fuel Offloading Rack, the Permittee has not removed all of the

structures associated with the Former Fuel Offloading Rack (mostly the underground portions of the original structures), and has not excavated and removed contaminated soil around the Former Fuel Offloading Rack. The Permittee has instead abandoned the structures and contaminated soil in place. Soil containing considerable amounts of sorbed fuel, thus containing high concentrations of hazardous constituents, must exist at the Former Fuel Offloading Rack at shallow depths, posing a continuing source of contamination and threat to the groundwater resource.

Therefore, on or before **June 7, 2010,** the Permittee must submit to the Department for its review and approval an Interim Measures ("IM") Plan that describes what immediate actions it will take to remediate and stop the migration of the LNAPL plume. The IM Plan must also describe excavation and removal of all structures of the Former Fuel Offloading Rack, including the underground components, and the excavation and removal of contaminated soil at and in the vicinity of the Former Fuel Offloading Rack to a depth of at least 20 feet. The IM Plan must also include an implementation schedule showing that remediation of the LNAPL plume will be completed within five years of the Department's approval of the IM Plan, and that excavation and removal of structures and contaminated soil at and in the vicinity of the Former Fuel Offloading Rack will be completed within one year of the Department's approval.

Furthermore, on March 16, 2010, the Permittee sent a *Stage 2 Abatement Plan Modification Addendum* (dated March 16, 2010) concerning the proposed installation of three additional offsite groundwater monitoring wells. The March 16 submittal does not address the deficiencies identified by the GWQB in its letters of June 23 and October 28, 2009. This plan would not adequately characterize the LNAPL plume, the dissolved-phase groundwater contamination, or contaminated soil and soil gas at the Bulk Fuels Facility. However, given the urgency to complete characterization and implement an effective remedy, the NMED nevertheless approves the March 16, 2010, submittal as a second and separate interim measure, subject to the modifications described herein:

1. The March 16 plan proposes that well screens are to be constructed with lengths of 25 feet or more. Screen lengths for the wells shall not exceed 20 feet, with 15 feet of screen situated below the water table, and 5 feet of screen constructed above the water table.
2. The March 16 plan proposes that wells completed in the area of the LNAPL plume will not be developed after installation, and proposes that groundwater samples will not be acquired for laboratory analysis from wells located within the area of the LNAPL plume. Although existing wells within the area of LNAPL plume have in the past served only as sampling points to measure LNAPL thickness and as soil-vapor extraction points, these wells must now also be available to sample groundwater below the floating LNAPL so that concentrations of dissolved-phase contaminants can be assessed in this area. This same requirement will also apply to all future wells installed to address the Bulk Fuels Facility Spill, including the wells required under this letter. Thus, all wells that address the Bulk Fuels Facility Spill, including those located within the LNAPL

plume area, shall be properly developed to reduce turbidity and to remove residual drilling fluids (if any).

3. Groundwater at all wells within the LNAPL plume shall be sampled for laboratory analysis of hazardous constituents (volatile and semi-volatile organic compounds) and TPH after the wells are developed.
4. Proposed wells KAFB-10626 and KAFB-10628 shall be installed across the water table at the locations proposed in the March 16 plan. These two wells correspond to locations #5 and 13, respectively, in Table 5 above.
5. Proposed well KAFB-10627 shall be installed at location #6 listed in Table 5 above, which is a different location than that proposed by the Permittee in the March 16 submittal.
6. A tremie pipe shall be used to install the filter pack and seal for each well, and to place grout.
7. Grout shall be placed in lifts, with the first lift no greater than 100 feet in length and subsequent lifts no greater than approximately 200 feet. All lifts shall be allowed to dry until stable before the next lift is placed.
8. The March 16 plan does not contain a schedule for implementation. The March 16, 2010, plan shall be implemented **within two weeks** of approval from the City of Albuquerque to access the City property (e.g., Bullhead Park), to the extent access from the City is required for well installation. The Permittee shall otherwise implement the submittal **immediately**. All work shall be completed no later than **July 6, 2010**, or **90 days** after required access from the City is granted, whichever is later. Completion includes development of all new and existing wells that have not been previously developed, and the sampling of all wells within the LNAPL plume.
9. Sampling results (from item #3) above shall be reported to the NMED in writing on October 5, 2010, or 120 days after required access from the City is granted, whichever is later.

Table 6. Compliance Schedule for Interim Measures

Task	Date Due
Submit Interim Measures Plan to the Department	June 7, 2010
Complete excavation and removal of structures and soil at Former Fuel Offloading Rack	Within one year of approval of Interim Measures Plan
Complete remediation of LNAPL plume	Within five years of approval of Interim Measures Plan

Implement March 16, 2010 Stage 2 Abatement Plan Modification Addendum with required modifications	Immediately, except within two weeks of gaining permission for that portion of the March 16 Plan that requires access to City property.
Submit report to the Department on well installations conducted under March 16 Plan	July 6, 2010, or 90 days after required access from the City is granted, whichever is later
Submit report to the Department on groundwater sampling results conducted under March 16 Plan	October 5, 2010, or 120 days after required access from the City is granted, whichever is later

Until such time that the IM Plan is approved by the NMED, the Permittee shall continue to operate the four SVE units already in service 24 hours per day, 7 days a week, except when necessary to perform maintenance or repairs. If maintenance or repairs are necessary, the maintenance or repairs shall be completed as quickly as practicable, and the unit returned to service immediately after maintenance or repairs are completed. Any maintenance or repairs that will take more than 3 calendar days shall be reported in writing to the Department within 24 hours of discovery that the maintenance or repairs will take more than 3 days. The Permittee shall explain in the report why the maintenance or repairs will take more than 3 calendar days and why the delay is beyond the control of the Permittee.

D. REQUIREMENT TO CONDUCT A CORRECTIVE MEASURES EVALUATION

In accordance with Section M.1 of HSWA Module IV of the Permit, if the Administrative Authority has reason to believe that a SWMU has released concentrations of hazardous constituents, or if the Administrative Authority determines that contaminants present a threat to human health and the environment given site-specific exposure conditions, the Administrative Authority may require a Corrective Measures Study (herein referred to a Corrective Measures Evaluation, or "CME"). With this letter, the Department hereby notifies the Permittee that it is required to conduct a CME for the Bulk Fuels Facility Spill. The CME shall be conducted to develop remedial alternatives that, if implemented, would be appropriate to effectively arrest and remediate contamination in the vadose zone, the LNAPL plume, and the dissolved-phase groundwater contamination in a reasonable period of time. A CME Report shall be prepared that describes in detail the results of the CME. The CME Report shall be submitted to the Department within 180 days after the Department notifies the Permittee that characterization of the Bulk Fuels Facility Spill has been completed and approved by the Department. The CME and CME Report shall also be completed in accordance with Sections O and S of HSWA Module IV of the Permit.

E. REPORTING REQUIREMENTS

The investigation plans required under this letter shall include relevant maps and cross-sections that show concentration data for contaminants and other relevant information with supporting data posted on the maps and cross-sections in a legible manner, and clearly showing which borings/wells contributed data towards construction of the maps and cross-sections and which did not. Tables including all existing soil borings, soil-gas monitoring wells, and groundwater monitoring wells, listing their surveyed location, sampling points and maximum depth of exploration shall also be included in the reports and plans. For soil-gas monitoring wells, tables and graphs shall also be included providing trends of TPH concentrations versus time for the depths below ground surface of 25, 50, 150, 250, 350, and 450 feet.

F. CONCLUSIONS

The requirements in this letter to conduct corrective action at the Bulk Fuel Facility Spill are mandatory. If the Permittee fails to comply with the directives of this letter, the Department may take the following actions, or some combination of the following actions, to enforce these requirements: 1) issue a compliance order under section 74-4-10 of the HWA seeking injunctive relief or civil penalties for noncompliance; 2) file a civil action under sections 74-4-10 and 74-4-10.1(E) of the HWA or section 7002(a) of RCRA, 42 U.S.C. § 6972(a), seeking injunctive relief or civil penalties; or 3) file an action seeking criminal penalties under section 74-4-11 of the HWA. This list of authorities is not exhaustive and NMED reserves its rights to take any action authorized by law to enforce the requirements of the HWA and the HWMR.

The Permittee shall respond directly to my attention, with copy to Mr. Bill Olson of the GWQB, and Mr. William Moats (NMED HWB, 5500 San Antonio NE, Albuquerque, NM 87109), on all correspondence and required plans and reports related to the Bulk Fuels Facility Spill upon receipt of this letter, unless otherwise directed by HWB. All submittals and correspondence must be submitted in hardcopy and electronic format. Assessment of fees for the submittal of corrective action documents pursuant to 20.4.2. NMAC shall be made under separate cover.

If you have any questions or comments concerning the technical matters in this letter, you may contact William McDonald or Sid Brandwein of my staff at (505) 222-9582 and (505) 222-9504, respectively. If you have other questions or comments, I may be contacted directly at 505-476-6000.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

cc: M. Leavitt, Director, NMED WWMD
J. Kieling, NMED HWB
W. Moats, NMED HWB
B. McDonald, NMED HWB
S. Brandwein, NMED HWB
B. Olson, Chief, NMED GWQB
A. Puglisi, NMED GWQB
B. Swanson, NMED GWQB
L. Barnhart, NMED OGC
B. Gallegos, AEHD
B. Gastian, ABCWUA
L. King, EPA-Region 6

File: Reading and KAFB 2010

APR 19 2010

ATTACHMENT 2

August 6, 2010 Correspondence from the NMED HWB to Colonel Robert L. Maness, Base Commander, 377 ABW/CC Re: SWMUs ST-106 and SS-111, BFF Spill, Kirtland, AFB

Directive for Conducting Interim Measures and Notice of Disapproval, Interim Measures Work Plan, June 2010 Vadose Zone Work Plan, June 2010 Groundwater Investigation Work Plan, June 2010

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NEW MEXICO ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

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SARAH COTTRELL
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

August 6, 2010

Colonel Robert L. Maness
Base Commander
377 ABW/CC
2000 Wyoming Blvd. SE
Kirtland AFB, NM 87117-5606

Mr. John Pike
Director, Environmental Management Section
377 MSG/CEANR
2050 Wyoming Blvd., Suite 116
Kirtland AFB, NM 87117-5270

RE: BULK FUELS FACILITY SPILL, SWMUS ST-106 AND SS-111
DIRECTIVE FOR CONDUCTING INTERIM MEASURES AND NOTICE OF DISAPPROVAL
INTERIM MEASURES WORK PLAN, JUNE 2010;
VADOSE ZONE WORK PLAN, JUNE 2010;
GROUNDWATER INVESTIGATION WORK PLAN, JUNE 2010
KIRTLAND AIR FORCE BASE, EPA ID# NM9570024423
HWB-KAFB-10-015, HWB-KAFB-10-016, HWB-KAFB-10-019

Dear Col. Maness and Mr. Pike:

The contamination caused by the Bulk Fuels Facility Spill at Kirtland Air Force Base (KAFB) represents a significant threat to human health and the environment, particularly to well water that supplies drinking water to portions of Albuquerque, KAFB, and the Veterans' Administration Hospital. Even though this release was first discovered 10 years ago, the U. S. Air Force (Permittee) has not characterized the nature and extent of Bulk Fuels Facility Spill, nor conducted adequate remediation. The threat posed by this release demands immediate and aggressive action as called for in the New Mexico Environment Department's (NMED's) April 2, 2010 letter.

The NMED has reviewed the Interim Measures Work Plan (June 2010), Vadose Zone Work Plan (June 2010), and Groundwater Investigation Work Plan (June 2010) regarding the KAFB Bulk Fuels Facility Spill, Solid Waste Management Units (SWMUs) ST-106 and SS-111. The plans were submitted in response to the NMED's letter of April 2, 2010, which concerned the need for

additional site characterization and interim measures to remediate contamination in groundwater, source areas, and fuel floating on the water table.

NMED finds that all three plans are deficient. This Notice of Disapproval (NOD) is issued to the Permittee with the intent that the Permittee correct the deficiencies identified herein. This NOD includes general comments that apply to all three documents, and general and specific comments concerning deficiencies found in each of the individual plans. These comments comprise Part 1 of this letter.

Due to the urgent need to accelerate certain aspects of remediation and characterization, the Permittee is also directed herein to implement interim measures in the form of additional soil vapor extraction and to take various other actions including establishing sentry groundwater monitoring wells and providing NMED certain critical information. This direction comprises Part 2 of this letter, and also sets forth requirements related to well construction, sampling of environmental media, field and laboratory quality assurance, and reporting.

PART 1

A. Deficiencies Common to All Three Plans

1. Appendix A of the Vadose Zone and Interim Measures Work Plans and Appendix D of the Groundwater Investigation Work Plan – Appendix A and Appendix D are exactly the same plan (about 500 pages, dated April 2004), appended to and occupying 80% or more (by number of pages) of the Vadose Zone, Interim Measures, and Groundwater Investigation Work Plans. Although the plan presented in Appendices A and D is voluminous, it is only a general plan that lays out the Permittee's internal requirements for conducting corrective action for the entire base. Furthermore, the copies of this plan provided to the NMED are missing figures (Figure 3-4), have their own appendices that are noted as "to be provided at a later date", and, in places, have outdated information (Table B7.2-1, page B-177 of Appendix B of Appendix A).

Because Appendices A and D are not specific to the Bulk Fuels Facility Spill, they do not describe in sufficient detail how, for example, project organization, data management, and quality assurance will be implemented under the Vadose Zone, Groundwater Investigation, and Interim Measures Work Plans. For example, under the project management plan, the organizational chart only shows KAFB management. The field sampling plan discusses the various types of field quality control (QC) samples that could be utilized during an investigation, but does not set forth the specific types of QC samples that should be prepared or collected for the Bulk Fuels Facility Project. Furthermore, because it is only a general plan for the entire base, the plan does not commit to the collection of QC samples for any project.

Appendices A and D must be deleted from the Vadose Zone, Groundwater Investigation, and Interim Measures Work Plans. They have little value because they do not contain the appropriate level of detail for characterization and clean up of the Bulk Fuels Facility Spill and do not

commit the Permittee to do anything. The Permittee shall revise the Vadose Zone, Groundwater Investigation, and Interim Measures Work Plans to include the appropriate level of detail and commitment on project organization, data management, and field and laboratory quality assurance.

2. Appendix B of the Vadose Zone and Interim Measures Work Plans and Appendix A of the Groundwater Investigation Work Plan – These appendices include only a 2006 NMED guidance document. The guidance is outdated and adds little, if any, value to the Vadose Zone, Interim Measures, and Groundwater Investigation Work Plans, and thus, must be deleted from all three plans. NMED guidance documents may be cited, if necessary, in future submittals.
3. Community Relations - The community relations plan is not included in Appendix A of the Vadose Zone and Interim Measures Work Plans and Appendix D of the Groundwater Investigation Work Plan. Instead, the appendices state "*Appendix I, Community Relations Plan, (to be provided at a later date)*". The Permittee shall revise the Vadose Zone, Interim Measures, and Groundwater Investigation Work Plans to include a community relations plan specific to the Bulk Fuels Facility spill. The plan must specify how the Permittee will inform the public, including the Albuquerque Bernalillo County Water Utility Authority (WUA), the City of Albuquerque, and the Veterans Administration of progress made on characterization and clean up of the Bulk Fuels Facility spill.

4. Schedules – Characterization and clean up of the Bulk Fuels Facility Spill is expected to be a large, complex, and interactive project with many deadlines that will have to be met by the Permittee. The Gantt charts provided in the Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans do not contain sufficient detail and are unacceptable because they over simplify field work on the schedules as only a few tasks. A Gantt chart showing all major tasks, their dependency if any on other tasks, and their early/late starts, early/late completions and critical paths must be provided in each of the plans. NMED expects that charts of sufficient detail would likely require presentation on sheets larger than 11" x 17".

The Permittee must also submit to the NMED a Gantt chart that integrates all of the work to be done under the three plans. This Gantt chart must be submitted with the Vadose Zone Work Plan.

5. Organization - The organization plans in the Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans only include mention of a project manager and a field team manager, and again reference the general site plan under Appendix A of the Vadose Zone and Interim Measures Work Plans and Appendix D of the Groundwater Investigation Work Plan. NMED notes that there are personnel mentioned by name under the Project Management Plan of Appendix A and Appendix D that have not worked for the Permittee at KAFB for the last several years.

It is likely that more than a project manager and a field team manager will be required to manage and execute a project of this size and complexity. Furthermore, it is unclear if there will be a separate field team manager for different tasks, such as conducting geophysical logging, drilling

and installation of wells, operating and maintaining soil vapor extraction (SVE) units, and sampling of environmental media. Also, the plans do not include details on the responsibilities and the qualifications of the personnel (by position) that will be involved.

Simply stating that a kick off meeting " ...will outline roles and responsibilities of all participants..." is not acceptable. It must be clearly understood in writing prior to project start who (by position) will be responsible for overseeing and conducting the myriad of events that need to happen such as field work, interpretation and management of various data, data validation, updating of the conceptual site model, communicating and reporting, and so forth. The Permittee must revise the Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans to correct these deficiencies.

6. Data Management - The Data Management Plan provided in Appendix D of Appendix A of the Vadose Zone and Interim Measures Work Plans and Appendix D of Appendix D in the Groundwater Investigation Work Plan is a general plan for entire base (see Comment #1 of Section A, Part 1) and, thus, is not specific to the Bulk Fuels Facility Spill. The plan specifically fails to provide detail concerning the types of data that are to be managed, schedules for data submittals and entries into the database, how accuracy and completeness of the data will be ensured, and data availability to the NMED. The Permittee must revise the Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans to correct these deficiencies.

7. Identification of and Approach to Addressing Data Gaps - Section 1.2 of each of the plans states "following previous investigations at the BFF, data gaps were identified...". Because these work plans are meant at a minimum to address data gaps identified in NMED's letter of April 2, 1010, the Permittee must list the data gaps that apply to each of the three plans, as appropriate for the topic of the plan, and indicate where in each of the plans the data gaps are addressed. The Permittee must revise the Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans to include a description of the data gaps identified by the NMED and point specifically to where in each the document these data gaps are addressed.

8. Extent of Contamination and Clean Up Criteria – The extent of contamination in the various media (soil, soil vapor, groundwater) shall be based upon determining at what locations hazardous constituents occur at levels that exceed approved background concentrations. This was stated in the NMED's letter of April 2, 2010, and applies to all RCRA facilities in New Mexico that must conduct correction action.

Regarding clean up criteria, any soil contamination left in place within 20 feet of the surface must meet NMED's risk requirements for an acceptable level of risk for all hazardous constituents (10^{-5} for carcinogens and Hazards Index < 1 for noncarcinogens under a residential land-use scenario). Any soil contamination left in place at any depth must also have sufficiently low concentrations of hazardous constituents to be protective of groundwater. The Permittee may use the NMED's Soil Screening Levels in lieu of conducting a baseline risk assessment to determine the risk of contaminants.

While the use of total petroleum hydrocarbons (TPH) as an indicator of contamination is convenient for field screening, the risk to human health and the environment must be assessed through the use of laboratory analysis of hazardous constituents (e.g., benzene, toluene, ethylene dibromide (EDB), naphthalene, xylenes). The Permittee must revise the Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans accordingly.

9. Site Specific Conceptual Model - The plans continue to provide what appears to be an outdated conceptual model of geologic, hydrologic, and contaminant conditions. However, regardless of the use of current data or the lack thereof, graphical representations of the conceptual model are of poor quality because the graphics are not always legible, are often too small to convey details, don't present sufficient numbers of cross-sections, and rely too much on the presentation of cartoons in lieu of detailed and accurate drawings (for example, Figures 2-8 and 2-9 in the Groundwater Investigation Work Plan).

NMED expected more in the discussion of site specific geology, as what was provided is similar to that presented in reports for the last 8 years or so. A site conceptual model encompassing the source area(s), the fuel percolation area, the light non-aqueous phased liquid (LNAPL) plume floating on groundwater, and the dissolved-phase contaminant plume in groundwater must be included in each of the plans. The model should be illustrated through the liberal use of detailed, accurate, and scaled geologic cross-sections, maps in plan view, and any other necessary graphical representations to clearly and accurately show geologic and hydrologic features, and contaminant levels.

NMED suggests that the geophysical logs, especially the electric logs, for KAFB-0115, KAFB-10624, KAFB-16 and Ridgecrest-3 wells would be useful for assisting in the interpretation of the stratigraphy of the area of interest, as these logs clearly show certain stratigraphic horizons in the vadose zone that are distinctive and widespread units ("marker beds"). The site-specific conceptual model in the Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans must be revised to correct the above noted deficiencies.

10. Failure to Provide Graphics and Data Submittals – Section E of NMED's April 2, 2010 letter states "The investigation plans required under this letter shall include relevant maps and cross-sections that show concentration data for contaminants and other relevant information with supporting data posted on the maps and cross-sections in a ***legible*** (emphasis added) manner, and clearly showing which borings/wells contributed data towards construction of the maps and cross-sections and which did not. Tables including all existing soil borings, soil-gas monitoring wells, and groundwater monitoring wells, listing their surveyed location, sampling points and maximum depth of exploration shall also be included in the reports and plans. For soil-gas monitoring wells, tables and graphs shall also be included providing trends of TPH concentration versus time for the depths below ground surface of 25, 50, 150, 250, 350, and 450 feet."

Many of the figures in the Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans are illegible and the required tables and graphs were not included, or were not provided in the format required. These tables and graphs are necessary to assess the adequacy of proposed

locations of borings/wells/SVE units. These tables and graphs of the required types, formats, and in legible form must be included in the revised Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans.

11. Quality Assurance (QA)/Quality Control (QC) plan - The Quality Assurance Plan provided in Appendix D of Appendix A (or Appendix D of Appendix D in the GW Plan) is a general plan for the entire base (see Comment #1, Section A, Part 1 of this letter) and is not specific to the Bulk Fuels Spill Project. The Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans must specify exactly what field and laboratory quality control samples are to be prepared or collected, as appropriate, and other aspects about quality control that are important to the Bulk Fuels Facility project, including the quality control targets that will be considered acceptable for each of the analytes of concern for each given media. The Permittee must revise the Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans to correct these deficiencies.

12. Certification Statements - The Vadose Zone, Interim Measures, and Groundwater Investigation Work Plans and associated transmittal letters do not contain the required signed certification statement under RCRA and the New Mexico Hazardous Waste Act. Pursuant to 20.4.1.900 NMAC, incorporating 40 C.F.R. § 270.1 1 (d)(1), all plans and reports shall include a certification, signed by a chief or senior executive officer of the Facility stating:

> 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.

The revised Vadose Zone, Interim Measures, and Groundwater Investigation Work Plans or associated transmittal letters must include this signed certification.

13. Waste Management - The Waste Management Plan provided in Appendix E of Appendix A of the Vadose Zone and Interim Measures Work Plan, and Appendix E of Appendix D in the Groundwater Investigation Work Plan) is a general plan for entire base (see Comment #1, Section A, Part 1 of this letter) and is not specific to the Bulk Fuels Facility Spill project.

Investigation Derived Waste (IDW) includes, but is not limited to, general refuse, drill cuttings, excess sample material, water (e.g., decontamination, development, purge), spent materials, and used disposable equipment generated during the course of investigation, corrective action, or monitoring activities. All IDW shall be properly characterized and disposed of, and otherwise

managed in accordance with all federal, state, and local laws and regulations. The Permittee shall include a description of the anticipated IDW management process as a revision to the Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans.

B. Interim Measures Work Plan

1. General Comments on Interim Measures Work Plan

The Interim Measures Work Plan was to address two major requirements of NMED's letter of April 2, 2010: 1) remove the Fuel Offloading Rack and excavate to a depth of 20 feet contaminated soil surrounding the Fuel Offloading Rack; and 2) conduct interim measures to remediate the LNAPL plume within five years. This Part (Part 1) of this letter addresses the deficiencies on addressing the first requirement; Part 2 addresses the second requirement to immediately take action to remediate the LNAPL plume floating on the groundwater. Rather than complying with NMED's April 2, 2010 direction to take immediate action vis à vis LNAPL remediation, the Permittee proposes characterization of the vadose zone for some unspecified time period, followed later by SVE. More specifically, the Interim Measures Work Plan includes: testing six wells to determine LNAPL transmissivity (Tn); conducting air sparging and multi-phase extraction pilot tests, and conducting characterization studies using PneuLog tests.

NMED emphasizes that interim measures are actions quickly taken to reduce or prevent the migration of contaminants, or reduce or prevent exposure to contaminants while long-term remedies are evaluated. While characterization studies may be useful for improving remediation efforts, or for proposing and designing a final remedy, interim measures for remediating LNAPL floating on groundwater need to be implemented immediately. Any effort to successfully remove LNAPL floating on groundwater must also involve the removal of LNAPL from the source(s) and fuel percolation areas within the vadose zone.

2. Specific Comments on Interim Measures Work Plan

1. Page 2-10, Section 2.4 – This section of the plan indicates that the Permittee is preparing a report on indoor air quality, and that the report is currently in draft. A copy of the final indoor air quality report must be provided to the NMED by **October 6, 2010**, and as indicated in the Compliance Schedule of Table 5 of this letter.
2. Page 3-1, Section 3 - Throughout Section 3 (for example, Sections 3.2, 3.2.2, 3.4.1, 3.4.2, 3.5) the Permittee states its intent to characterize and excavate only soils with "mobile LNAPL", and to leave any other contaminated soil for later remediation under the Corrective Measures Implementation Plan (CMI), which the Permittee referred to as a Corrective Measures Evaluation (CME). The term "mobile LNAPL" was coined by the Permittee and apparently means soil containing such a high concentration of fuel contamination that the soil is dripping wet with fuel.

The reasons given by the Permittee not to excavate other contaminated soils (soil without mobile LNAPL) is that a risk assessment would have to be developed separately for such soils, and the Permittee expresses its desire to delay excavation of such soils until long-term corrective actions

are initiated for the site. Due to the urgent need for action at this site, such an approach is not acceptable. The Permittee can rapidly develop target clean up goals based on NMED's risk requirements noted above, or simply use NMED's soil screening levels for hazardous constituents. Soils do not need to be dripping wet with fuel to pose a risk to human health or the environment. NMED estimates that a Corrective Measures Implementation Plan will not be approved for at least several years because of the inadequate state of site characterization today. Leaving contaminated soil in the ground that poses a significant risk to human health or the environment for what will likely be a fairly long time period before long-term corrective actions are initiated is unacceptable. As indicated in Comment #8 in Section A of Part 1 of this letter, all contaminated soil to a depth of 20 feet that represents an unacceptable risk to human health or the environment shall be excavated and removed from the Fuel Offloading Rack area.

As mentioned above, due to the urgent need to accelerate remediation, the Permittee is directed in Part 2 of this letter to implement interim measures, which includes removal of the remaining components of the Fuel Offloading Rack and excavation of contaminated soil. This work shall be completed in accordance with the Interim Measures Work Plan as modified by the requirements of this letter and in accordance with the Compliance Schedule in Table 5 of this letter.

3. Page 3-2, Section 3.2.2 – This section indicates that soil samples will be analyzed in the laboratory only if samples do not respond to a field test kit. This is an unacceptable approach. The Permittee shall use laboratory analysis all soil samples in shallow borings for TPH, VOCs, SVOCs, and lead.

4. Page 3-4, Section 3.4.2 – This section indicates that a detailed excavation plan for the Fuel Offloading Rack will be submitted to the NMED at a later date. NMED's April 2, 2010 letter intended for the Interim Measure Work Plan to be the detailed plan.

The excavation of contaminated soil and removal of structures at the Fuel Offloading Rack is a relatively simple "dig and haul" operation, and represents by far the easiest of the two major interim measures that the Permittee was directed to accomplish in NMED's letter of April 2, 2010. NMED requires the Permittee to begin excavation and removal of structures at the Fuel Offloading Rack immediately (see Section A of Part 2 of this letter).

5. Page 4-1, Section 4.2 – In part, this section states "Kirtland AFB proposes to install an IRM to remove, to the extent practicable within five years of work plan approval, mobile LNAPL present at the water table that has the potential to migrate along the water table and potentially further endanger the regional aquifer that provides drinking water for ABCWUA. Immobile LANPL and sorbed and dissolved fuel contamination in groundwater will be addressed by the future CME."

The NMED finds several unacceptable concepts related to these statements. First, as previously mentioned, NMED does not agree with the Permittee-coined terms "mobile LNAPL" and "immobile LNAPL." The point of the interim measure is to clean up contamination (LNAPL)

that poses a threat to groundwater, regardless of contaminant concentrations. Even LNAPL that is not migrating along the water table has the potential to contaminate groundwater with concentrations of hazardous constituents that are at unsafe levels for human consumption. Second, the phrase "to the extent practicable" suggests that the Permittee has already admitted defeat without even attempting to clean up the groundwater and the floating LNAPL. Third, the LNAPL floating on the water table endangers water supply wells in addition to those operated by the WUA. Lastly, like the cleaning up of contaminated soil around the Fuel Offloading Rack, the Permittee is stating its desire to delay clean up for at least several years while a final remedy through an approved CMI Plan is implemented, which is unacceptable. The Permittee must revise the Interim Measures Work Plan to remove the above-noted deficiencies.

6. *Page 4-4, Section 4.6* - In the last paragraph the Permittee states that "Routine system optimization will be performed … to maintain the highest mass extraction rate…"

The Permittee shall revise this section to explain in detail how the system will be optimized.

7. *Page 5-1, Section 5* - The Permittee states: "Vadose zone interim remedial measures will be implemented if data collected during the PneuLog profiling, supplemented by results of the concurrent vadose zone investigation, identify the presence of potentially mobile LNAPL within the vadose zone."

As mentioned above, the NMED does not agree with the Permittee-coined terms "mobile LNAPL" and "immobile LNAPL." It should be inarguable that fuel infiltrated from near or at the ground surface and has percolated through the vadose zone to groundwater. Some fuel is likely still draining to groundwater. However, hazardous constituents can still migrate to groundwater as vapor even in areas where the draining of liquid fuel to groundwater has stopped or never took place. The Permittee must revise the Interim Measures Work Plan to indicate that remediation of the vadose zone will be conducted to accomplish clean up of LNAPL floating on the groundwater, regardless of whether fuel-saturated conditions exist in the vadose zone in a given area.

8. *Page 5-2, Section 5.2* - The fourth paragraph states: "PneuLog will be performed at three locations…starting from the point(s) of release to the water table."

Figure 5-1 shows the proposed locations for PneuLog testing about 750 feet northeast of the Fuel Offloading Rack and approximately 750 feet north of the southern extent of the LNAPL plume that is floating on groundwater. According to the conceptual model provided in the Interim Measures Work Plan, the proposed locations for PneuLog testing could lead to missing the path of percolation that the fuel took to groundwater.

The Permittee must revise the Interim Measures Work Plan to include some PneuLog testing in the fuel percolation area. See Comment #4 in Section C of Part 1 of this letter for information on the area NMED has identified as the fuel percolation area. Indicate also in the Interim Measures Work Plan the significance of using three locations for PneuLog testing and explain in more

detail how the air flow potential of the geologic units will be assessed and used in the design to optimize SVE.

The Interim Measures Work Plan shall also be revised to indicate that geologic and geophysical (induction, gamma, and neutron) logs will be made for the boreholes used for PneuLog testing.

9. Figures. Figures 2-2 through 2-5 are very difficult, and in some cases impossible to read. Cross-section A-A' is not the view seen in Figure 2-8.

The Permittee shall revise the Interim Measures Work Plan to include corrected and legible figures.

C. Vadose Zone Work Plan

1. General Comments on Vadose Zone Work Plan

In NMED's letter of April 2, 2010, the Permittee was directed to submit a Vadose Zone Investigation Plan that describes the additional actions the Permittee will take to investigate vadose zone hydrology and geology, to identify and characterize the source of the releases at the Bulk Fuel Facility, and to identify the extent of soil and soil-gas contamination in the vadose zone from the surface to groundwater. The Vadose Zone Plan was to describe in detail all research, locations, depths and methods of exploration, field procedures, sampling and analysis of soil and soil gas and related quality control procedures, the results and the means by which the results are to be reported, and a schedule of the work.

The Vadose Zone Work Plan that has been submitted is inadequate to accomplish the objectives established in NMED's letter of April 2, 2010. A major reason is that the proposed borings and soil-vapor wells are located too far apart to characterize in adequate detail the contaminant and geologic conditions in the vadose zone. NMED therefore directs herein a general increase in the number of sampling points. The Permittee shall revise the Vadose Zone Work Plan to include all of the soil borings and soil-vapor well installations required by this letter.

For the convenience of providing further discussion in this letter, NMED has divided the vadose zone into five principal areas: the tank farm, pipeline, Fuel Offloading Rack, fuel percolation area, and the far field area of the soil-vapor plume. Each of these areas is discussed below.

1. Tank Farm – Contamination is known to occur from the surface to deep levels at the Tank Farm. In its letter of April 2, 2010, NMED directed that nine deep soil borings/soil-vapor wells be completed in the tank farm area; the Permittee proposed only three. Through its direction in it April 2, 2010 letter, NMED was hoping to avoid the time-consuming process of "dickering" with the Permittee on numbers of borings (and wells, to be discussed later). Nevertheless, in the interest of comity and upon further consideration, NMED agrees that by adjusting locations and completing some shallow borings, the tank farm area could be covered at least initially by five deep soil borings/soil-vapor wells and five shallow soil borings. Depending on what is found,

additional soil borings/soil-vapor wells may be needed, and NMED reserves its rights to require such additional borings, wells, or both in the future.

The Permittee shall complete the soil borings/soil-vapor wells at locations #16, 17, 19 and 20; and the soil vapor well at location #6 that are listed in Tables 1 and 2 of this letter, respectively, and shown on Figure 1 enclosed with this letter. The Permittee shall also complete shallow soil borings to a depth of at least 20 feet at locations #1 through 5, which are listed in Table 3 of this letter and shown also on Figure 1. Soil samples from the shallow borings shall be collected at depths of 0, 5, 10, 15, and 20 feet and shall be analyzed for TPH, VOCs, SVOCs, and lead.

2. *Pipeline* – The Permittee has not investigated the pipeline that runs between the tank farm, the pump house, and the Fuel Offloading Rack. In NMED's letter of April 2, 2010, the Permittee was directed to complete four deep soil borings/soil-vapor wells along the buried and exposed portions of the pipeline. The Permittee proposed none.

In lieu of completing deep soil borings/soil-vapor wells, the Permittee proposed to complete shallow borings along the buried portion of the pipeline extending south of the pump house. However, the Vadose Zone Work Plan is unclear as to the number of shallow boreholes that would be completed. Additionally, the proposed plan is inadequate because the entire length of pipeline between the tank farm and the Fuel Offloading Rack is not included in the investigation.

The Permittee shall complete the deep soil borings/soil-vapor wells at locations #4, 6, 7, 8, and 24 that are listed in Table 1 of this letter and shown on Figure 1. The Permittee shall also complete shallow borings along the entire length of the pipeline between the tank farm and the Fuel Offloading Rack, regardless of whether the pipeline runs underground or on the surface. The borings shall be spaced at intervals not to exceed 25 feet and are to be located on both sides of the pipeline. Soil samples from the shallow borings shall be collected at depths of 0, 5, 10, 15, and 20 feet. The soil samples from deep and shallow borings shall be analyzed for TPH, VOCs, SVOCs, and lead. Depending on the results, NMED may require further investigation of this area, including more and deeper borings.

3. *Fuel Offloading Rack* – The Fuel Offloading Rack is supposedly the main source of the fuel spill, but it has not been adequately characterized since discovery of the fuel leak 10 years ago. Previous investigative efforts appear to have been arbitrarily terminated once TPH concentrations were found to be less than 100 mg/kg in soil and below 100 ppmv in soil vapor. In NMED's letter of April 2, 2010, the Permittee was directed to complete a ***minimum*** of six deep soil sampling/vapor wells at the Fuel Offloading Rack to determine the full extent of contamination; the Permittee proposed four. NMED reaffirms its previous direction. The Permittee shall complete the soil borings/soil-vapor wells at locations #1, 2, 3, 4, 11, and 12 that are listed in Table 1 of this letter and shown in Figure 1.

4. *Fuel percolation area* – This area, east of the Fuel Offloading Rack, is currently believed to constitute the core of the contamination in the vadose zone, and represents the place where fuel presumably migrated to groundwater. In NMED's letter of April 2, 2010, the Permittee was

directed to complete a ***minimum*** of six deep soil sampling/vapor wells in order to significantly improve characterization of this area. This is critical to understanding the amount of fuel contamination in the vadose zone that must be remediated. The Permittee proposed to complete only two of the deep soil sampling/vapor wells that the NMED specified.

The Permittee did, however, propose an additional 3 deep soil sampling/vapor wells at locations further to the east. NMED agrees that these latter locations are necessary to properly characterize this area. Thus, to improve the understanding of the amount of fuel contamination in the vadose zone that must be remediated, the Permittee shall complete the soil borings/soil-vapor wells at locations #5, 9, 10, 21, 22, 23, 25, 26, and 27 listed in Table 1 and shown on Figure 1.

5. Far field area of Soil-Vapor plume – In its letter of April 2, 2010, NMED directed the Permittee to install six soil-vapor wells at locations north of the Fuel Offloading Rack and fuel percolation area to investigate the concentrations of hazardous constituents in soil gas that overlies groundwater in these areas. The Permittee shall complete the soil-vapor wells at locations #1, 2, 4, 3, 5, 6, 8, and 9; and the soil boring/soil-vapor well at location #24, that are listed in Tables 2 and 1, respectively, and shown on Figure 1.

6. Sampling Requirements Applicable to all Five Vadose Zone Areas - Soil samples from the deep borings shall be collected at a frequency of at least one sample every 10 feet for the first 50 feet, and at least one sample thereafter every 50 feet to total depth, and at least one sample at total depth in each boring. Each deep boring at each location shall be drilled from the surface to the water table, and each deep boring shall be completed as a permanent soil-gas monitoring well. The soil-gas monitoring wells shall be capable of yielding discrete samples of soil gas recovered from depths of 25, 50, 150, 250, 350, and 450 feet below the ground surface.

All boreholes that will have soil-vapor monitoring wells constructed in them shall be logged using induction (medium and deep), neutron, and gamma tools. Geologic logs shall also be prepared for these boreholes showing the geologic conditions from the surface to the total depth of each borehole.

The coordinates in Tables 1-3 are State Plane Coordinates in feet, NAD83. All boring/soil vapor well locations are also shown on Figure 1 enclosed with this letter.

Table 1. Borehole Locations for Soil Sampling and for Conversion to Soil-Vapor Monitoring Wells.

Location #	Easting	Northing	Characterization Purpose
1	1541119	1473793	Step out from Fuel Offloading Rack
2	1540808	1473503	Step out from Fuel Offloading Rack
3	1541123	1473310	Step out from Fuel Offloading Rack
4	1541425	1473313	Step out from Fuel Offloading Rack and piping

5	1541961	1473492	Fuel percolation area
6	1542002	1473057	Piping
7	1541794	1473061	Piping
8	1542370	1473058	Piping
9	1541898	1473276	Fuel percolation area
10	1541720	1473369	Fuel percolation area
11	1541776	1473740	Step out from Fuel Offloading Rack
12	1541658	1473505	Fuel percolation area and Fuel Offloading Rack
16	1541992	1472768	Fuel tanks
17	1542229	1472916	Fuel tanks
19	1542485	1472911	Fuel tanks
20	1542428	1472716	Fuel tanks
21	1541611	1473238	Fuel percolation area
22	1542137	1473266	Fuel percolation area
23	1542131	1473571	Fuel percolation area
24	1541620	1472955	Far Field and piping
25	1542807	1473592	Fuel percolation area
26	1542422	1473506	Fuel percolation area
27	1542360	1473808	Fuel percolation area

Table 2. Locations for Soil-Gas Monitoring Wells.

Location #	Easting	Northing	Characterization Purpose
1	1542900	1474092	Far Field
2	1543194	1474680	Far Field
3	1542306	1474093	Far Field
4	1541555	1475049	Far Field
5	1541248	1474141	Far Field
6	1542259	1472591	Far Field and fuel tanks
8	1542504	1475414	Far Field
9	1542436	1474878	Far Field

Table 3. Locations for Shallow Soil Borings in Tank Farm Area.

Location #	Easting	Northing
1	1542544	1472810
2	1542282	1472806
3	1542125	1472784
4	1542081	1472959
5	1541941	1472867

The Permittee shall revise the Vadose Zone Work Plan to incorporate the general comments and correct the deficiencies noted above.

2. Specific Comments on Vadose Zone Work Plan

1. Downhole Geophysical Logging - Section 3.2.1.1, Table 3-1, Topic 3, states "If proposed vapor monitoring points are screened in zones determined to be fine grained lithologic units adjust the screen location vapor monitoring points up or down to the nearest coarser grained unit."

Because individual fine grained or coarse grained beds do not necessarily extend laterally for any significant distances, any geophysical logs used to adjust screen locations must be generated for that particular borehole.

The Permittee must revise the Vadose Zone Work Plan to indicate the maximum distance that screened zones are to be adjusted from the required screen depths should adjustment be necessary. For screens that are to be set 100 feet apart as directed under this letter, the Permittee may adjust screens by no more than 25 feet. For screens that are to be set 25 feet apart, the Permittee may adjust screens by no more than 5 feet.
2. Seismic Refraction, Section 3.2.1.2 - NMED encourages the use of geophysical techniques; however, NMED is doubtful that seismic refraction will prove useful in this case. NMED is concerned that refraction will only detect shallow loose material near the surface, somewhat more dense subsurface material, and saturated material beginning at the water table. Although KAFB is free to conduct the refraction survey, the NMED will not allow such survey to delay completion of other work required for characterizing and cleaning up the Bulk Fuels Facility Spill.

If the Permittee proceeds with conducting the refraction survey, the following issues must be addressed in the revised work plan.

A. Explain why seismic refraction was chosen and not shallow reflection.

B. Explain how seismic refraction is expected to identify the difference between a fine-grained unit and a coarse-grained unit above the saturated zone at depths of 450-500 feet (see DQO step 5 for topic 1 on Table 3-1). Table 3-1, DQO step 6, topic 1 implies that refraction will be able to define a unit within 1-foot depth at a depth of 500 feet. These Data Quality Objectives cannot likely be achieved.

C. If the 1-foot depth is actually referring to the location of geophones, specify what the QC targets are for the seismic survey (for example, how close should the interpreted seismic interface be to the actual depth to water). Specify the site-specific conceptual model of the seismic layering. Indicate the expected thicknesses versus depth of units to be detected.

D. Explain what seismic source is planned to be used in this "noisy" environment that can carry an off-the-end shot for the 1500 foot line. Conceptually, specify how many shot points and what locations are planned per line.

E. Figure 3-1 shows 13 seismic lines that are all oriented in an east-west direction. Section 3.2.1.2 discusses orthogonal lines. Clarify how many lines are planned. Specify how the orthogonal lines will be placed, and show them on a corrected Figure 3-1. Explain why the proposed seismic lines are shown crossing buildings.

3. Resistivity, Section 3.2.1.3 – Like the refraction survey discussed in the proceeding comment, the NMED is doubtful that the IP/RES techniques will prove useful in this case. Although KAFB is free to conduct the resistivity survey, the NMED will not allow such a survey to delay completion of other work required for characterizing and cleaning up the Bulk Fuels Facility Spill.

If the Permittee proceeds with conducting the survey, the following issues must be addressed in the revised work plan.

A. As described in Section 3.2.1.3 of the plan, 56 stakes are proposed to be situated along 1,850 feet transects. This amounts to an electrode separation of about 30 feet, which would yield a shallowest apparent resistivity of the upper nominal 30 feet, with a value every 30 feet horizontally. Explain how the resistivity survey is expected to provide good results with all the surface interferences, cultural conditions, pipelines, surface topography changes, utilities, and other conditions known to be present at the site. Explain how close, for example, does the interpreted depth to groundwater need to be to meet the "Specify Limits on Decision Errors" concept on Table 3-1. Specify the QC procedures to be performed, such as calibrating to a known resistance and reciprocity tests.

B. Explain why the proposed resistivity lines are shown crossing buildings.

C. Indicate whether the geophysical parameters measured in the Sunbelt Geophysics report were taken into account in planning the resistivity investigation.

D. Specify what size transmitter is to be used to be able to measure the appropriate parameters with appropriate detail at large depths, and what electrode arrays are to be used.

E. Indicate if an analysis has been conducted modeling what MN, AB, and AB-MN spacings seem plausible based upon site-specific resistivities (estimated from resistivity or induction logs) and equipment specifications.

F. F. Indicate and explain the computer model by which the data are to be interpreted.

4. Page 3-5, Section 3.2.3 – Substitute semi-volatile organic compounds (SVOCs) for polycyclic aromatic hydrocarbons (PAHs) and add lead to the parameters to be analyzed for in soil. The Permittee must revise the Vadose Zone Work Plan accordingly.

5. Page 3-6, Section 3.2.3 – The first paragraph on this page says that soil samples containing LNAPL will not be sent to the laboratory for chemical analysis. All soil samples, including those containing LNAPL, must be sent to a laboratory and analyzed for TPH, VOCs, SVOCs, and lead. The Permittee must revise the Vadose Zone Work Plan accordingly.

6. Page 3-6, Section 3.2.4 – This section states that screens on soil-vapor monitoring wells will be set to "anticipated depths" of 25, 50, 150, 250, 350, and 450 feet. The Permittee must revise the Vadose Zone Work Plan to indicate the maximum distance that screened zones are to be adjusted from the required screen depths, should adjustment be necessary. For screens that are to be set 100 feet apart as directed under this letter, the Permittee may adjust screens by no more than 25 feet. For screens that are to be set 25 feet apart, the Permittee may adjust screens by no more than 5 feet. The Permittee must revise the Vadose Zone Work Plan accordingly.

7. Cross-section "A-A" - Cross-section A-A' location shown on Figures 2-2 through 2-5 does not correspond to Cross-Section A-A' shown in Figure 2-8. Supply the intended cross-section A-A' with data shown clearly and legibly, and with appropriate data.

D. Groundwater Investigation Work Plan

General Comments on Groundwater Investigation Work Plan

In NMED's letter of April 2, 2010, the Permittee was directed to submit a Groundwater Investigation Work Plan that describes the additional actions the Permittee will take to characterize the nature, horizontal and vertical extent, and the fate and rate of migration of the groundwater contamination. The Groundwater Investigation Work Plan was also to include construction details and the locations and depths of the groundwater monitoring wells to be installed, actions to characterize the geology and hydrogeology at and below the water table,

groundwater flow direction and velocity, field procedures, and the sampling and analysis of groundwater and related quality control. The Groundwater Investigation Work Plan was also to describe the means *(e.g.,* cross-sections, plan views) by which results would be reported after the investigation and include a schedule to complete the work.

The leading (northern) edge and the eastern and western margins of the dissolved-phase and LNAPL plumes are as yet undefined, and the nature and concentrations of contaminants in the core of each of the plumes are poorly characterized because existing wells are located too far apart (generally at distances greater than 500 feet), vertical characterization information is nonexistent, and water quality beneath the LNAPL plume has not been assessed. Additionally, the vertical extent of contaminated groundwater, key aspects of the hydrology of the groundwater (hydraulic conductivity, velocity), and the geology (horizontal and vertical characteristics) of the saturated zone are poorly defined or are unknown.

In general, the Groundwater Investigation Work Plan proposes too few wells, both in a vertical and horizontal sense, than is needed to adequately characterize the geology, hydrology, and the nature and extent of contamination over such a large area of groundwater contamination. As mentioned earlier, NMED was hoping to avoid the time-consuming process of "dickering" with the Permittee on numbers of borings and wells by providing clear and specific direction in its April 2, 2010 letter. Nevertheless, in the interest of comity and upon further consideration, NMED agrees that by adjusting locations some well locations directed in NMED's April 2, 2010 letter can be replaced with some proposed by the Permittee in the Groundwater Investigation Work Plan. NMED nonetheless directs an increase in the number of sampling points over that proposed by the Permittee, with the goal of achieving adequate site characterization more quickly to address the urgent matter of cleaning up the Bulk Fuels Facility Spill. Depending on what is found, additional wells may be needed, and NMED reserves its rights to require such additional borings, wells, or both in the future. The Permittee shall revise the Groundwater Investigation Work Plan to include all of the well installations required by this letter.

NMED has identified several other general deficiencies with the Groundwater Investigation Work Plan, which includes issues related to background water quality, vertical characterization, water quality beneath the LNPAL plume, rate of contaminant migration, cluster/nested wells, and characterization of plume cores and margins. These general deficiencies are discussed below.

1. Background Water Quality - Only two upgradient wells have been installed that potentially may yield groundwater samples that are free from contamination. Both of these wells were only recently completed; none is screened appreciably below the water table to provide vertical characterization of water quality, geology, and hydrologic conditions. The Permittee must complete the background cluster/nested wells at location #6 listed in Table 4 of this letter and shown on Figure 2 (enclosed).

2. Vertical Characterization – The plan identifies proposed wells that are to be screened at various depths below the water table as "B" and "C" wells, with the "C" wells the deepest screened well at a given cluster/nested well location. Due to urgency of this matter, the NMED

does not approve of "C" well installation being contingent on "B" well results. Given that the pumping of water supply wells is known to induce vertical gradients in groundwater, can cause significant components of vertical flow in the vicinity of such wells, and draws water preferentially from productive zones that may be deeper than the water table, vertical characterization of groundwater quality, hydrology, and geology is required for all well installations specified by this letter.

3. Water Quality Beneath the LNAPL Plume - Although the lack of water quality information was identified specifically by the NMED as a data gap, the Groundwater Investigation Work Plan states that groundwater at well locations within the boundaries of the LNAPL plume will not be sampled and analyzed. This is an unacceptable approach. Knowledge of water quality beneath the LNAPL plume is crucial to understand the full extent and magnitude of the groundwater contamination.

4. Rate of Contaminant Migration - Although a critical question to be answered, it was not clear in the Groundwater Investigation Work Plan if the Permittee has a plan to address the rate of migration of either the dissolved-phase or LNAPL contaminant plumes, and in particular, the time it would take for the dissolved-phase plume to reach surrounding well fields. The Permittee must clarify this point.

5. Cluster versus Nested Wells – The NMED has no objections to the use of nested wells instead of cluster wells, provided the nested wells are properly constructed. However, in this case the NMED will not accept wells that are constructed with 3-inch diameter casing and screens. Three-inch diameter casing and screens are inappropriate for constructing groundwater monitoring wells that will be installed to depths of 500 feet or more. The Permittee shall design wells to be constructed in cluster or nested configurations using casing and screen that are no smaller than 5 inches in diameter. The borehole surrounding the well casing for a nested or cluster well must be of sufficient diameter to allow for an adequate annular space between the borehole and well casing and screen. The annular space must be of sufficient size to allow for proper construction of filter packs and seals, and for the installation of grouting (see the groundwater monitoring well construction requirements set forth in Part 2 of this letter).

6. Characterization of Plume Cores – The dissolved-phase and LNAPL plumes extend off base to nearly 0.9 to 0.5 miles, respectively from the presumed source, yet a total of only eight wells currently exist off-base to characterize the cores of both plumes. Of these eight wells, this includes two wells where groundwater has not been sampled for water quality in the past and one well that was only very recently installed at Bullhead Park for which no water quality data has been submitted to the NMED.

In NMED's letter of April 2, 2010, the Permittee was directed to install groundwater monitoring wells at a ***minimum*** of eight additional locations to characterize the concentrations of contaminants, and the geologic and hydrologic conditions that exist off-base in the plume cores; instead, the Permittee proposed only four.

To achieve the objective of providing initial plume-core characterization, the Permittee shall install the groundwater monitoring wells at locations #11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, and 23 listed in Table 4 and shown on Figure 2.

7. Characterization of Plume Margins – Only five existing wells define the edge of the plume off-base (including one well recently installed). In NMED's letter of April 2, 2010, the Permittee was directed to install groundwater monitoring wells at a ***minimum*** of eight additional locations to characterize the concentrations of contaminants, and the geologic and hydrologic conditions that exist off base along the plume margins; instead, the Permittee proposed five.

To adequately provide initial plume-edge characterization, the Permittee shall install the groundwater monitoring wells at locations #1, 2, 3, 4, 5, 7, 8, 9, 10, 24, 25, 26, 27, and 28 that are listed in Table 4 and shown on Figure 2.

Three groundwater monitoring wells shall be installed at different depths at each of the well locations listed in Table 4. The screen depths shown in Table 4 are distances (in feet) that the top of the screens shall be set below the water table, except wells screened across the water table (those with screen depths of zero in Table 4) may have screens that extend above the water table. Screen lengths for wells shall not exceed 15 feet, with the exception that wells screened across the water table shall have screens 20 feet long, with no more than 15 feet of screen length situated below the water table.

The geologic conditions encountered from the surface to the total depth of the borings at each well location shall be logged. Boreholes completed for well installations at all locations shall also be logged using induction (medium and deep), neutron, and gamma (large crystal) tools. Geophysical and geologic logging at a given cluster well location is required only in the well at the location having the deepest screened interval.

Coordinates in Table 4 are State Plane Coordinates in feet, NAD83. All of the locations listed in Table 4 are also shown on Figure 2 enclosed with this letter.

Table 4. Well locations and screen depths relative to the water table.

Location #	Easting	Northing	Screen Depths	Characterization Purpose
1	1542189	1476725	0, 15, 40	Plume margin, deep characterization
2	1541984	1476042	0, 15, 40	Plume margin, deep characterization
3	1543703	1476600	0, 15, 40	Plume margin, deep characterization
4	1543372	1475065	0, 15, 40	Plume margin, deep characterization
5	1543643	1477939	0, 15, 85	Plume margin, deep characterization
6	1541430	1472370	15, 40*	Background water quality, deep characterization

7	1542812	1473601	0, 15, 40	Plume margin, deep characterization
8	1542722	1477726	0, 15, 40	Plume margin, deep characterization
9	1543054	1477788	0, 15, 40	Plume margin, deep characterization
10	1543774	1477304	0, 15, 40	Plume margin, deep characterization
11	1541774	1473718	0, 15, 85	Plume core, deep characterization
12	1542362	1473801	0, 15, 85	Plume core, deep characterization
13	1542305	1474340	15, 85*	Plume core, deep characterization
14	1542736	1474715	0, 15, 85	Plume core, deep characterization
15	1542860	1475860	0, 15, 85	Plume core, deep characterization
16	1542189	1475207	0, 15, 85	Plume core, deep characterization
17	1541731	1473291	0, 15, 85	Plume core, deep characterization
18	1542203	1474071	0, 15, 85	Plume core, deep characterization
19	1542565	1475360	0, 15, 85	Plume core, deep characterization
20	1542535	1475975	0, 15, 85	Plume core, deep characterization
21	1543199	1475767	0, 15, 85	Plume core, deep characterization
22	1543068	1476494	0, 15, 85	Plume core, deep characterization
23	1541968	1474648	0, 15, 85	Plume core, deep characterization
24	1541682	1474703	15, 40*	Plume margin, deep characterization
25	1541025	1474360	15, 40*	Plume margin, deep characterization
26	1540407	1474016	15, 40*	Plume margin, deep characterization
27	1543712	1475683	15, 40*	Plume margin, deep characterization
28	1543364	1477684	0, 15, 40	Plume margin, deep characterization

* - water table well already exists

The Permittee shall revise the Groundwater Investigation Work Plan to incorporate the general comments and correct the deficiencies noted above.

Specific Comments on Groundwater Investigation Work Plan

1. Page 3-6, Section 3.3.4 and Figure 3-3 – Well construction details are missing, as the wrong figure was submitted for a well construction diagram in the Work Plan. The Permittee shall revise the Groundwater Investigation Work Plan to correct the deficiency noted above.

2. *Page 3-4, Section 3.3.2* – This section states that "NMED will be notified regarding any deviations in well constructions per Section 4.0." Aside from the fact that there is no Section 4.0, well construction and any changes thereto must be approved in advance by the NMED. E-mail or telephone approval may suffice to facilitate in-field decision-making. The Permittee shall revise the Groundwater Investigation Work Plan accordingly.

3. *Page 3-5, Section 3.3.3* – Soil samples shall be collected at well locations #11, 12, 17, and 18 listed in Table 4 from the deepest borehole at each location. The samples shall be collected at a frequency of at least one sample every 10 feet for the first 50 feet of the borehole, then at least one sample every 50 feet to the bottom of the borehole, and at total depth of the borehole. The soil samples must be analyzed in the laboratory for TPH, VOCs, SVOCs, and lead. The Permittee shall revise the Groundwater Investigation Work Plan accordingly.

4. *Page 3-7, Section 3.3.5* – This section indicates that wells screened below the water table will be considered by the Permittee to be "piezometers" (normally for measuring only hydraulic head). Groundwater samples must be collected from all wells, regardless if the wells are screened at the water table or deeper, and all samples must be analyzed for TPH and hazardous constituents. The Permittee shall revise the Groundwater Investigation Work Plan accordingly.

5. *Page 3-7, Section 3.3.5* – This section states that wells located within the area of the floating LNAPL will not be developed. All wells, including those within the LNAPL plume, shall be properly developed to provide representative water samples. The Permittee shall revise the Groundwater Investigation Work Plan accordingly.

6. *Page 3-7, Section 3.3.6* – This section states that groundwater at wells located within the area of the floating LNAPL will not be sampled. Groundwater in all wells will be sampled, including those within the LNAPL plume. The Permittee shall revise the Groundwater Investigation Work Plan accordingly.

7. *Page 3-7, Section 3.3.6* – For analysis of groundwater samples, add lead and substitute SVOCs for PAHs, and dissolved iron and dissolved manganese for iron and manganese, respectively. Samples must not be filtered, except for sample fractions for dissolved iron and dissolved manganese.

Add alkalinity and pH to the list of field parameters.

The Permittee shall revise the Groundwater Investigation Work Plan accordingly.

8. *Page 3-6, Section 3.3.4* - It is not clear how many wells are actually proposed because wells KAFB-10629, KAFB-10630, and KAFB-10638 are not listed on Table 3-2 of the Groundwater Investigation Work Plan. The Permittee must clarify or resolve this discrepancy in a revision to the Groundwater Investigation Work Plan.

9. *Page 3-1, Section 3.1.1* - Indicate what geophysical logs will be run and at what stage of the borehole/well installation process. The discussion should be included in Section 3.3 instead of Section 3.1.1. The Permittee shall revise the Groundwater Investigation Work Plan accordingly.

10. *Page 3-2, Section 3.3.1* - See specific Comments #2 and 3 for the Vadose Zone Work Plan regarding surface geophysical surveys.

PART 2

A. Direction to Conduct Interim Measures and Other Actions

In NMED's letter of April 2, 2010, the Permittee was informed that the NMED has determined that the Bulk Fuel Facility Spill poses a threat to human health and the environment, and furthermore, endangers the groundwater resource – including water supply wells – relied upon by the WUA for delivery of safe drinking water to its customers. The contamination also threatens KAFB and the Veterans Administration ("VA") Hospital water-supply wells. The large extent of this contamination and its proximity to water supply wells requires that urgent action be taken.

The NMED has estimated that nearly 8 million gallons of fuel have been released at the Bulk Fuels Facility. The Permittee is operating four SVE units on the Permittee's property; however, these soil-vapor extraction units will not clean up the contamination thus far known to occur from the Bulk Fuels Facility Spill in a reasonable time frame. Because the Permittee's Interim Measures Work Plan does not contain any interim measures that could be implemented immediately, the NMED herein is directing the Permittee to:

1. conduct additional soil vapor extraction,
2. improve the Operation and Maintenance Plan for the SVE units,
3. begin immediate excavation of contaminated soil at the Fuel Offloading Rack,
4. provide an estimate of the contaminant migration rate,
5. install sentry wells,
6. log existing wells, including using geophysical methods,
7. submit critical data to the NMED, and
8. provide adequate funding to the WUA for sampling and analysis of well water.

SVE and these other actions must be initiated or completed, as appropriate, by the deadlines indicated in this letter and in the Compliance Schedule in Table 5. Additionally, this letter specifies minimum requirements that the Permittee must meet regarding well installations, well development, sampling, geophysical logging, preparing geologic logs, notification of activities, field and laboratory quality control, and reporting.

1. Soil Vapor Extraction

a. The Permittee has demonstrated that SVE has worked to remove contaminate vapors from the vadose zone. The Permittee shall install and operate additional SVE units at the following locations:

i. No later than **October 6, 2010** (Table 5) at existing groundwater monitoring wells KAFB-3411, KAFB-10614, and KAFB-10624, which are located in the core of the vadose zone contamination.
ii. No later than **November 8, 2010** (Table 5) at soil boring/soil-vapor monitoring well locations #4, 5, 9, 10, 11, 12, and 21 that are listed in Table 1 of this letter. These wells, to be located in the core of contamination, should be designed to serve both as vapor extraction wells and as soil-vapor monitoring wells. The Permittee must also conduct geologic logging and borehole geophysical logging at each location. The Permittee shall comply with the collection and analysis of soil samples as specified in Part 1 of this letter for well installations.
iii. No later than **October 6, 2010** (Table 5) or 60 days after required access is granted, which ever is later, at existing groundwater monitoring wells KAFB-10617 and 10618 which are located at the northern extent of the LNAPL plume.
iv. No later than **November 8, 2010** (Table 5) or 60 days after required access is granted, which ever is later, at existing groundwater monitoring wells KAFB-10610 which is located at the northern extent of the 1-foot thick layer of LNAPL plume.
v. No later than **November 8, 2010** (Table 5) or 60 days after required access is granted, which ever is later, locations #3, 8 and 9 on Table 2 of this letter shall be made ready for conducting future soil vapor extraction by completing soil-vapor monitoring/extraction wells at this location. The Permittee must conduct geologic logging and borehole geophysical logging at this location and shall comply with the collection and analysis of soil samples as specified in Part 1 of this letter for well installations.

b. The Permittee shall continue to operate SVE units at the locations of the four existing SVE units (located at the Fuel Offloading Rack, KAFB-1065, KAFB-1066, and KAFB-1068).

Until such time that the interim measures plan is approved by the NMED, the Permittee shall continue to operate all SVE units 24 hours per day, 7 days a week, except when necessary to perform maintenance or repairs. If maintenance or repairs are necessary, the maintenance or repairs shall be completed as quickly as practicable, and the unit returned to service immediately after maintenance or repairs are completed. Any maintenance or repairs that will take more than 3 calendar days shall be reported in writing to the NMED within 24 hours of discovery that the maintenance or repairs will take more than 3 days. The Permittee shall explain in the report why the maintenance or repairs will take more than 3 calendar days and why the delay is beyond the control of the Permittee.

The SVE units shall be similar to those currently in use for the Bulk Fuels Facility Spill and shall be capable of extracting soil vapor at a minimum flow rate of 27 SCFM. The SVE units shall also average over a period of 12 months an operating efficiency (operating time relative to down time) of no less than 85%. The SVE units shall meet the regulatory requirements for air emissions enforced by the City of Albuquerque Environmental Health Department. The Permittee is responsible for obtaining all necessary permissions and permits to construct and operate the SVE units.

If the City of Albuquerque Environmental Health Department will not issue an air permit to operate the SVE units specified by this letter, the Permittee shall immediately notify the NMED in writing and shall substitute a different technology for conducting SVE and treating emissions that will meet the regulatory requirements enforced by the City of Albuquerque Environmental Health Department and the deadlines set forth in this letter in the Compliance Schedule shown in Table 5.

2. Operation and Maintenance (O&M) Plan

The Permittee shall modify its O&M Plan to reduce down time of SVE units by maintaining in inventory commonly-needed spare parts for maintenance and repairs, and keeping a spare engine available for SVE units that suffer catastrophic engine failures. The spare parts and engine shall be maintained by the Permittee in inventory by **September 7, 2010**. The Permittee shall provide NMED with a written list of the spare parts and spare engine kept in inventory by **October 6, 2010** (Table 5).

3. Excavation of Soil and Removal of Fuel Offloading Rack

The Permittee shall by **October 6, 2010** (Table 5) begin removal of the remaining components of the Fuel Offloading Rack and excavation of contaminated soil to 20 feet. The excavation of soil and removal of the Fuel Offloading Rack shall be completed by **October 6, 2011** (Table 5), and a report on completion of the work submitted to the NMED by **January 15, 2012** (Table 5). Any soil contamination left in place must meet NMED's requirements for clean up (see Comment # 8 of Section A of Part 1 of this letter). The Permittee may use direct push sampling and field analysis to help determine which soils require excavation. However, laboratory analysis shall be conducted to determine the concentrations of hazardous constituents in soil for the purpose of defining the final extent of excavation, for risk assessment, and for waste determinations.

Soil shall be sampled to determine whether all contaminated soil that poses an unacceptable risk to human health or the environment has been removed to a depth of at least 20 feet. Soil samples shall be analyzed in the laboratory for TPH, VOCs, SVOCs, and lead, and collected on all sides and the bottom of the excavation at a spacing not to exceed 25 feet.

4. Estimates of Contaminant Migration Rate

The Permittee must provide NMED by **September 7, 2010** (Table 5) with calculations showing the estimated velocity of and the travel time for the dissolved-phase contaminant plume to first reach the closest well in the Ridgecrest well field, the Veteran Administration (VA) Hospital Well, and KAFB production wells KAFB-3, KAFB-15, and KAFB-16. The calculations shall consider the direction and gradient of groundwater flow, and the geologic and hydrologic properties of the aquifer under a worse-case scenario. The Permittee shall provide the source of all information used to support the required calculations.

5. Installation of Sentry Wells

a. The Permittee must install groundwater monitoring wells (water table, intermediate, and deep wells referred to as A, B, and C wells) at location #28 of Table 4 of this letter, north of the leading edge of the dissolved-phase contaminant plume, by no later than **November 8, 2010** (Table 5) or 90 days after required access is granted, which ever is later. These wells will serve as sentry wells for the northern extent of the dissolved-phase plume.
b. The Permittee must install B and C groundwater monitoring wells at existing well locations KAFB-10613 and KAFB-1064, near the V.A. Hospital, by no later than **November 8, 2010** (Table 5) or 90 days after required access is granted, which ever is later. These wells will serve as sentry wells for the V.A. Hospital.
c. The Permittee must install A, B, and C groundwater monitoring wells at location #3 listed in Table 4 of this letter, on the east edge of the dissolved-phase contaminant plume, by no later than **November 8, 2010** (Table 5) or 90 days after required access is granted, which ever is later. These wells will serve as sentry wells for the northeastern extent of the dissolved-phase plume.
d. The Permittee must install A, B, and C groundwater monitoring wells at location #1 listed in Table 4 of this letter, on the west edge of the dissolved-phase contaminant plume no later than **November 8, 2010** (Table 5) or 90 days after required access is granted, which ever is later. These wells will serve as sentry wells for the northwestern extent of the dissolved-phase plume.
e. The Permittee must also conduct geologic and borehole geophysical logging of each well discussed in paragraphs a-d of this section. Geologic logging must be completed during the drilling of the boreholes; geophysical logging must be completed within 30 days of well completion (Table 5). Copies of the geologic and geophysical logs must be provided to the NMED by the submittal dates for quarterly reports specified in NMED's letter of June 4, 2010.

Wells constructed in cluster or nested configuration must meet the requirements set forth in Comment # 5 of Section D of Part 1 of this letter. Groundwater samples shall be collected and analyzed in a laboratory at a quarterly frequency from each sentry well in accordance with the direction in NMED's letter of June 4, 2010, and directions under this letter.

6. Geophysical logging of Existing Wells

The Permittee must conduct borehole geophysical logging (medium and deep induction, gamma, and neutron) at all existing groundwater monitoring wells. Copies of the geophysical logs must be provided to the NMED by **October 6, 2010** (Table 5).

7. Submitting Critical Data to NMED

The Permittee failed to provide certain critical information required in NMED's April 2, 2010 letter. The Permittee must provide the following information to the NMED by **September 7, 2010** (Table 5):

i. tables in electronic format (Excel™) showing the locations (x, y, z), sampling points, and maximum depths of all soil borings and vapor and groundwater monitoring wells;
ii. Survey plats for all wells.
iii. tabulated data in electronic format (Excel™) and graphs showing hydrocarbons (HC) and trends of major hazardous constituent (such as benzene, toluene, ethylene dibromide, xylenes, naphthalene, ethylbenzene, and lead) concentrations versus time for soil vapor for each extraction and each soil-vapor and groundwater monitoring well, as applicable.
iv. tabulated data in electronic format (Excel™) and graphs showing trends of TPH and major hazardous constituent (such as benzene, toluene, ethylene dibromide, xylenes, naphthalene, ethylbenzene, and lead) concentrations versus time for groundwater for each groundwater monitoring well.
v. Cross-sections showing the geology of the site drawn to a horizontal scale of 1 inch equals 50 feet, a vertical scale of 1 inch = 50 feet, and along the orientations A-A', B-B', C-C', and D-D' as shown on Figure 3 enclosed with this letter.
vi. Cross-sections showing the geology of the site drawn to a horizontal scale of 1 inch equals 300 feet, a vertical scale of 1 inch = 50 feet, and along the orientations A-A', B-B', C-C', and D-D' as shown on Figure 4 enclosed with this letter.
vii. Cross-sections showing concentrations of major hazardous constituents in soil, drawn to a horizontal scale of 1 inch equals 50 feet, a vertical scale of 1 inch = 50 feet, and along the orientations A-A', B-B', C-C', and D-D' as shown on Figure 3 enclosed with this letter.
viii. Cross-sections showing concentrations of major hazardous constituents in soil vapor, drawn to a horizontal scale of 1 inch equals 50 feet, a vertical scale of 1 inch = 50 feet, and along the orientations A-A', B-B', C-C', and D-D' as shown on Figure 3 enclosed with this letter.
ix. Cross-sections showing concentrations of major hazardous constituents in groundwater, drawn to a horizontal scale of 1 inch equals 300 feet, a vertical scale of 1 inch = 50 feet, and along the orientations A-A', B-B', C-C', and D-D' as shown on Figure 4 enclosed with this letter.

8. Sampling and Analysis of Water Production Wells

NMED understands that the Permittee is providing funding to the WUA to analyze groundwater samples from WUA water-supply wells threatened by contamination originating from the Bulk Fuels Facility Spill. NMED has also become aware that the analytical method used by the WUA to test for ethylene dibromide (EDB) is 524.2 rather than Method 504.1, the latter which is normally used for purposes of determining compliance with Safe Drinking Water Act.

NMED does not consider analysis by Method 524.2 to be sufficiently sensitive to provide adequate early-warning protection for the WUA wells. The Permittee shall continue to collaborate with the WUA to ensure that water quality is safe for human consumption, but will also ensure the samples are analyzed by Method 504.1. The Permittee shall provide copies of the laboratory results to the NMED in quarterly reports in accordance with the reporting requirements of NMED's letter of June 4, 2010.

B. Technical Requirements for Conducting Interim Measures

1. Notification of Sampling and other Field Activities

The Permittee shall notify the NMED in writing of field sampling or other field activities undertaken in accordance with the requirements of this letter, and shall provide the NMED the opportunity to collect split samples upon request by the NMED. For such sampling or other field activities, the Permittee shall provide the NMED with as much advance notice as is practicable, but no less than 15 days prior to the conduct of such sampling. The Permittee shall notify the NMED in writing a minimum of 15 days prior to the implementation of the Interim Measures, Groundwater Investigation and Vadose Zone Work Plans. Notification of sampling or other field activities may be made by email, fax, or letter.

2. Soil-Vapor Well Construction

Soil-vapor monitoring wells shall be designed and constructed in a manner that will yield high-quality samples. Soil vapor wells shall not be installed with the use of any fluids. Soil vapor wells may be completed by backfilling with native materials. The Permittee shall not sample the well before the expiration of the 24-hour equilibration period following completion of installation. Information on the design and construction of soil-vapor monitoring wells shall be recorded as for groundwater monitoring wells.

3. Groundwater Monitoring Well Construction

Groundwater monitoring wells shall be designed and constructed in a manner that will yield high quality samples, ensure that the well will last the duration of the project, and ensure that the well will not serve as a conduit for hazardous constituents to migrate between different stratigraphic

units or aquifers. The design and construction of groundwater monitoring wells shall comply with the guidelines established in various RCRA guidance, including, but not limited to:

EPA, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1, September, 1986; and

Aller, L., Bennett, T.W., Hackett, G., Petty, R.J., Lehr, J.H., Sedoris, H., Nielsen, D.M., and Denne, J.E., *Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells*, EPA 600/4-89/034, 1989.

1. Drilling Methods

The Permittee shall abide by the following conditions:

1. Drilling shall be performed in a manner that minimizes impacts to the natural properties of the subsurface materials;
2. Drilling shall be performed in a manner that contamination and cross-contamination of groundwater and aquifer materials is avoided;

1. The drilling method shall allow for the collection of representative samples of rock, unconsolidated sediment, and soil;
2. The drilling method shall allow the Permittee to determine when the appropriate location for the screened interval(s) has been encountered;
3. The drilling method shall allow for the proper placement of a filter pack and annular sealant for each monitored zone, and the borehole diameter shall be at least four inches larger in diameter than the nominal diameter of the well casing and screen to allow adequate space for emplacement of the filter pack and annular sealants;
4. The drilling method shall also allow for the collection of representative groundwater samples; and
5. Drilling fluids, including air, shall be used only when minimal impact to the surrounding formation and groundwater can be ensured.

All drilling equipment shall be in good working condition and capable of performing the planned tasks. Drilling rigs and equipment shall be operated by properly trained crews. Drilling equipment shall be properly decontaminated before initiation of drilling for each boring. Precautions shall be taken to prevent the migration of contaminants between geologic, hydrologic, or other identifiable zones during drilling and well installation activities.
The drilling and sampling shall be conducted under the direction of a qualified engineer or geologist. Known site features and/or site survey grid markers shall be used as references to locate each boring prior to surveying the location.

2. Well Construction Materials

When selecting construction materials, the primary concern shall be selecting well construction materials that will not contribute to or remove hazardous waste or constituents from groundwater

samples. Other factors to be considered include the tensile strength, compressive strength, and collapse strength of the materials; the length of time the monitoring well will be in service; and the material's resistance to chemical and microbiological corrosion.

3. Design and Construction of Screens and Filter Packs

Screens and filter packs shall be designed to allow accurate sampling of the saturated zone that the well is intended to sample, minimize the passage of formation materials (turbidity) into the well, and ensure sufficient structural integrity to prevent the collapse of the intake structure. The filter pack shall be installed in a manner that prevents bridging and particle-size segregation. Filter packs shall be installed by the tremie pipe method. At least two inches of filter pack material shall be installed between the screen and the borehole wall, and two feet of filter pack material shall extend above the top of the screen. A minimum of six inches and a maximum of two feet of filter pack material shall also be placed under the bottom of the screen. The precise volume of filter pack material required shall be calculated and recorded before placement, and the actual volume used shall be determined and recorded during construction. Any significant discrepancy between the calculated and actual volume shall be explained. Prior to installing the filter pack annular seal, a one to two-foot layer of chemically inert fine sand shall be placed over the filter pack to prevent the intrusion of annular sealants into the filter pack.

4. Design and Construction of Annular Seals

The annular space between the casing and the borehole wall shall be properly sealed to prevent cross-contamination. The materials used for annular sealants shall be chemically inert with respect to the highest anticipated concentration of chemical constituents expected in the groundwater. The precise volume of annular sealant required shall be calculated and recorded before placement, and the actual volume shall be determined and recorded during construction. Any significant discrepancy between the calculated volume and the actual volume shall be explained.

During construction, an annular seal shall be placed on top of the filter pack. This seal shall normally consist of a high solids (10 to 30 percent) bentonite material in the form of bentonite pellets, granular bentonite, or bentonite chips. The seal shall be placed in the annulus through a tremie pipe. A tamping device shall be used to ensure that the seal is emplaced at the proper depth. The bentonite seal shall be placed above the filter pack with a minimum of two-foot vertical thickness. The bentonite seal shall be allowed to completely hydrate in conformance with the manufacturer's specifications prior to installing the overlying annular grout seal. A grout seal shall be installed on top of the filter pack seal. The grout shall be placed into the annular space by the tremie pipe method, from the top of the filter pack annular seal to within a few feet of the ground surface; however, the grout shall be installed at intervals necessary to allow it time to cure and not damage the filter pack or filter pack annular seal during installation of the grout. The grout seal shall be allowed to cure for a minimum of 24 hours before the concrete surface pad is installed. All grouts shall be prepared in accordance with the manufacturer's specifications.

5. Surface Completion Methods

Monitoring wells may be completed either as flush-mounted wells, or as above-ground completions. A surface seal shall be installed over the grout seal and extended vertically up the well annulus to the land surface. The lower end of the surface seal shall extend a minimum of one foot below the frost line to prevent damage from frost heaving. The composition of the surface seal shall be neat cement or concrete. In above-ground completions wherein the well casing rises or sticks up above ground level, a three-foot square by four-inch thick concrete surface pad shall be installed around the well immediately after the protective casing is installed. The surface pad shall be sloped so that drainage will be off the pad and away from the protective casing. In addition, a minimum of one inch of the finished pad shall be below grade or ground elevation to prevent washing and undermining by soil erosion.

Protective casing with a locking cover shall be installed around the well casing (stickup or riser) to prevent damage or unauthorized entry. The protective casing shall be anchored in the concrete surface pad below the frost line and extend at least several inches above the casing stickup. A weep hole shall be drilled into the protective casing just above the top of the concrete surface pad to prevent water from accumulating and freezing inside the protective casing. A cap shall be placed on the well riser to prevent the entry of foreign materials into the well, and a lock shall be installed on the cover of the protective casing to provide security against tampering. If a well is located in an area that receives vehicular traffic, a minimum of three bumper guards consisting of steel pipes three to four inches in diameter and a minimum of five-feet in length shall be installed next to the concrete surface pad. The bumper guards shall be installed to a minimum depth of two feet below the ground surface in a concrete footing and extend a minimum of three feet above ground surface. The pipes that form the bumper guards shall be filled with concrete to provide additional strength, and shall be painted a bright color to make them readily visible.
If flush-mounted completions are required (e.g., in active roadway areas), a protective structure such as a traffic-rated utility vault or meter box shall be installed around the casing. In addition, measures should be taken to prevent the accumulation of surface water in the protective structure and around the well intake. These measures shall include outfitting the protective structure with a steel lid or manhole cover that has a rubber seal or gasket, and ensuring that the bond between the cement surface seal and the protective structure is watertight. A lock shall be installed on the lid or cover of the protective structure to prevent unauthorized access to the well.

6. Well Development Methods

All monitoring wells shall be developed to create an effective filter pack around the screen, correct damage to the formation caused by drilling, remove residual drilling mud or other drilling additives, if present, and fine particles from the formation near the borehole, and assist in restoring the original water quality of the aquifer in the vicinity of the well. Monitoring wells shall be developed until the column of water in each well is free of visible sediment, and the pH, temperature, turbidity, and specific conductance have stabilized to within 10%. If a well is pumped dry, the water level shall be allowed to sufficiently recover before the next development period is initiated.

If water is introduced to a borehole during drilling and completion, then at minimum the same volume of water shall be removed from the well during development. In addition, the volume of water withdrawn from or introduced into a well during development shall be recorded. Well development must be completed within 30 days of installation.

4. Surveying Requirements for Groundwater Monitoring and Soil-Vapor Wells

The horizontal and vertical coordinates of the measuring point at the top of each monitoring well casing and the ground surface elevation at each monitoring well location shall be determined by a registered New Mexico professional land surveyor or licensed Professional Engineer. Horizontal coordinates shall be measured in accordance with the State Plane Coordinate System. Horizontal positions shall be measured to the nearest 0.1 foot, and vertical elevations shall be measured to the nearest 0.01 foot.

5. Well Completion Reports

For each monitoring well, the Permittee shall submit to the NMED a completion summary report which shall include a well construction log and diagram, a geologic log, and a well development log. The report for each well shall be submitted in accordance with the quarterly schedule set forth in NMED's letter of June 4, 2010.

6. Well Construction Diagrams and Logs

Information on the design, construction, and development of each monitoring well shall be recorded. Construction diagrams and logs shall include the following information:

1. Well, boring name/number;
2. Date/time of construction;
3. Borehole diameter and casing diameter;
4. Surveyed location coordinates;
5. Total depth, expressed both as depth below ground surface and elevation above sea level;
6. Name of drilling contractor;
7. Casing length;
8. Casing materials;
9. Casing and screen joint type;
10. Screened intervals, expressed both as depth(s) below ground surface and elevation(s) above sea level;
11. Screen materials;
12. Screen slot size and design;
13. Filter-pack material and size;
14. Filter-pack volume (calculated and actual);
15. Filter-pack placement method;

16. Filter-pack interval(s), expressed both as depth(s) below ground surface and elevation(s) above sea level;
17. Annular sealant composition;
18. Annular sealant placement method;
19. Annular sealant volume (calculated and actual);
20. Annular sealant interval, expressed both as depth below ground surface and elevation above sea level;
21. Surface sealant composition;
22. Surface seal placement method;
23. Surface sealant volume (calculated and actual);
24. Surface sealant interval, expressed both as depth below ground surface and elevation above sea level;
25. Surface seal and well apron design and construction;
26. Development procedure and turbidity measurements;
27. Well development purge volume(s) and stabilization parameter measurements;
28. Type, design, and construction of protective casing;
29. Type of cap and lock;
30. Ground surface elevation above sea level;
31. Survey reference point elevation above sea level on well casing;
32. Top of casing elevation above sea level;
33. Top of protective steel casing elevation above sea level;
34. Drilling method(s); and
35. Types, quantities, and dates/times that additives were introduced, if any.

7. Measurement of Groundwater Levels

Groundwater levels shall be measured in all monitoring wells associated with the Bulk Fuels Facility Spill within 72 hours from the start of monitoring the water level in the first well. Groundwater levels shall be obtained prior to purging for any sampling event. Measurement data and the date and time of each measurement shall be recorded on a field log. The depth to groundwater shall be measured to the nearest 0.01 foot. The depth to groundwater shall be recorded relative to the surveyed well casing rim.

8. Sampling of Environmental Media

Sampling of environmental media (groundwater, soil, and soil vapor) shall comply with the requirements set forth in NMED's letter of June 4, 2010, and in accordance with the additional requirements provided herein.

1. Soil Sampling Requirements

Relatively undisturbed discrete soil and rock samples shall be obtained during the advancement of each boring for the purpose of logging and analytical testing. A split-barrel sampler lined with brass sleeves, a coring device, or other method approved in advance by the NMED shall be used to obtain samples during the drilling of each boring.

Soil samples are subject to the same field quality assurance, laboratory quality assurance, data validation, and reporting requirements as for groundwater and soil-vapor samples; including requirements to collect or prepare, as appropriate, and analyze field quality control samples. Soil samples collected for the purpose of analyzing for VOCs and SVOCs shall not be mixed to homogenize samples for any reason.

2. Groundwater Sample Collection

Groundwater samples shall be obtained within eight hours of the completion of well purging. Groundwater in monitoring wells with low recharge rates and that purge dry shall be sampled when the water level in the well has recovered sufficiently to collect the required samples. Sample collection methods shall be documented in field monitoring logs. Samples shall be placed into appropriate clean containers. Decontamination procedures shall be established and, implemented, for nondedicated water sampling equipment.

The Permittee shall obtain groundwater samples for dissolved metals analysis using disposable in-line filters with a 0.45 micron mesh size.

9. Field Quality Control

Field duplicates shall consist of two samples collected sequentially. Field duplicate samples shall be collected and analyzed at a frequency of at least 10 percent of the total number of environmental samples submitted for analysis. At a minimum, one duplicate sample per sampling event shall always be collected and analyzed.

Field blanks shall be prepared and analyzed at a frequency of no less than one per day. Field blanks shall be generated by filling sample containers in the field with deionized water and submitting the field blank, along with the groundwater samples, to an analytical laboratory.

Equipment blanks shall be prepared and analyzed at a rate of at least five percent of the total number of environmental samples submitted for analysis, but no less than one equipment blank per sampling day. Equipment blanks shall be generated by rinsing decontaminated sampling equipment with deionized water, and capturing the rinsate water in an appropriate clean container. The equipment blank then shall be submitted with the groundwater samples to the analytical laboratory for the same analyses as the environmental samples.

Trip blanks shall be prepared using deionized water. Trip blanks shall be managed exactly the same as environmental samples. Trip blanks shall accompany sampling personnel into the field

throughout sampling activities, and then shall be placed into a shipping container with environmental samples for shipment to the analytical laboratory. Trip blanks shall be analyzed at a frequency of one for each shipping container holding samples for VOC analysis.

10. Laboratory Quality Assurance

The Permittee shall ensure that contract analytical laboratories maintain internal quality assurance programs in accordance with EPA and industry-accepted practices and procedures. At a minimum, the laboratories shall use a combination of standards, blanks, surrogates, duplicates, matrix spike/matrix spike duplicates (MS/MSD), and other laboratory control samples to assess data quality. The laboratories shall establish control limits for individual chemicals or groups of chemicals based on the long-term performance of the test methods. In addition, the laboratories shall establish internal QA/QC procedures that meet EPA's laboratory certification requirements. Specific procedures to be completed are identified in the following sections. If a laboratory is unable or unwilling to meet the requirements of this Permit, the Permittee shall select a different laboratory that can and will meet the requirements.

1. Laboratory Equipment Calibration Procedures

The laboratories' equipment calibration procedures, calibration frequency, and calibration standards shall be in accordance with the EPA test method requirements and documented in quality assurance and standard operating procedures manuals. All instruments and equipment used by laboratories shall be operated, calibrated, and maintained according to manufacturers' guidelines and recommendations. Operation, calibration, and maintenance shall be performed by personnel who have been properly trained in these procedures. A routine schedule and record of instrument calibration and maintenance shall be kept on file at the laboratories.

2. Laboratory QC Samples

Analytical procedures shall be evaluated for quality by analyzing reagent blanks or method blanks, surrogates, MS/MSDs, and laboratory duplicates, as appropriate for each method. At a minimum, laboratories shall analyze laboratory blanks, MS/MSDs, and laboratory duplicates at a frequency of at least one in 20 for all batch runs requiring EPA test methods and at a frequency of at least one in 10 for non-EPA test methods. All laboratory quality control data reported with the Facility's sample analysis results must be related to the analysis of the Facility's samples.

11. Data Validation

The Permittee shall evaluate all sample data, and all field and laboratory QC results for acceptability. Each group of samples shall be evaluated using data validation guidelines contained in EPA guidance documents, the latest version of SW-846, and industry-accepted methods and procedures. Additionally, the Permittee shall evaluate all data for compliance with the following parameters:

1. Representativeness -- The Permittee shall implement procedures to assure representative samples are collected and analyzed, such as repeated measurements of the same parameter at the same location over several distinct sampling events. The Permittee shall note any procedures or variations that may affect the collection or analysis of representative samples and shall qualify the data accordingly;

2. Comparability -- To assure comparability of data, the Permittee shall implement standard collection and analytical procedures, and shall report analytical results in appropriate units for comparison with other data (e.g., past studies, comparable sites, screening levels, and cleanup standards). Any procedure or variation that may affect comparability shall be noted, and the data shall be qualified appropriately;

3. Completeness -- The Permittee shall evaluate all laboratory data for completeness with respect to data quality objectives. The degree of completeness shall be reported with the data in any reports in which the data are referenced;

4. Accuracy -- The Permittee shall evaluate all data for accuracy with respect to percent recovered of spiked samples. Results shall be reported for each analyte in any report in which the data are cited; and

5. Precision -- The Permittee shall evaluate all data for precision with respect to RPDs of duplicate samples. Results shall be reported for each analyte in any report in which the data are cited.

12. Waste Management

Waste management of investigation derived waste shall be in accordance with that set forth in Part 1 of this letter.

13. Geophysical Logs

Geophysical logging shall be conducted using induction (deep, medium), neutron, and gamma (large crystal) tools. Geophysical logging at cluster/nested well locations is required in only the well at each location that has the deepest screened interval.

Geophysical logs submitted to the NMED must show results of the induction logging (medium and deep) in millimhos per meter, neutron logging in American Petroleum Institute (API) neutron units, and gamma logging in API calibrated counts per second, the results of each method plotted versus depth from the surface to total depth of the borehole for which the log represents. The name of the borehole, location of the borehole, the date(s) that the borehole was completed, the drilling method, and the elevation of the top of the borehole shall also be noted on the boring log. The data must be provided to the NMED in hard copy and in digital format.

14. Field and Geologic Logs

The physical characteristics of soil and rock samples, such as mineralogy and lithic content, ASTM soil classification, moisture content, texture, color, presence of stains or odors, field screening results, depth, location, method of sample collection, the presence of any water-bearing zones and any unusual or notable conditions encountered during drilling shall be recorded in a field log. Field logs shall be completed by a qualified geologist.

The Permittee shall prepare geologic logs for each borehole showing relative to borehole depth the rock types, thickness of rock units, and water bearing zones (including that at and below the water table). The name of the borehole, location of the borehole, the date(s) that the borehole was completed, the drilling method, and the elevation of the top of the borehole shall also be noted on the boring log. The data must be provided to the NMED in hard copy and in digital format.

15. Reporting

Unless specified otherwise in this letter, the Permittee shall report to the NMED the information that is required by NMED's letter of June 4, 2010, and by the indicated schedules in that letter. Reporting for the additional SVE units required to be installed under Part 2 of this letter shall also be in accordance with NMED's letter of June 4, 2010.

Final Direction

The Permittee shall meet the deadlines specified in the Compliance Schedule of Table 5 of this letter. The Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans must be completely revised and resubmitted. The Permittee shall submit to NMED by **September 7, 2010** (Table 5) revisions of the Vadose Zone, Interim Measures, and Groundwater Investigation Work Plans that correct the deficiencies noted herein and incorporate the requirements set forth in this letter. The Permittee shall also implement the interim measures and other actions as directed under Part 2 of this letter by the dates indicated and in accordance with the schedule in Table 5.

The investigation plans required under this letter shall include relevant maps and cross-sections that show concentration data for contaminants and other relevant information with supporting data posted on the maps and cross-sections in a legible manner, and clearly showing which borings/wells contributed data towards construction of the maps and cross-sections and which did not. Tables including all existing soil borings, soil-gas monitoring wells, and groundwater monitoring wells, listing their surveyed location, sampling points and maximum depth of exploration shall also be included in the reports and plans. For soil-gas monitoring wells, tables and graphs shall also be included providing trends of TPH concentrations versus time for the depths below ground surface of 25, 50, 150, 250, 350, and 450 feet.

To the extent any requirement of this letter requires access to property not owned or controlled by the Permittee, the Permittee shall use its best efforts to obtain access from the present owners of such property to conduct the required activities. In the event that access is not obtained when necessary, the Permittee shall immediately notify the NMED in writing regarding its best efforts and its failure to obtain such access.

Table 5. Compliance Schedule.

Revisions to Work Plans	
Submittal	Due Date
Interim Measures Work Plan	September 7, 2010
Vadose Zone Work Plan	September 7, 2010
Groundwater Investigation Work Plan	September 7, 2010
Other Document Submittals	
Indoor Air Quality Report	October 6, 2010
Interim Measures and other Actions	
Install and operate SVE units at KAFB-3411, KAFB-10614, and KAFB-10624	October 6, 2010
Install and operate SVE units at soil boring/monitoring well locations #4, 5, 9, 10, 11, and 12 (see Table 1)	November 8, 2010 or 60 days after required access is granted, which ever is later
Install and operate SVE units at KAFB-10617 and KAFB-10618	October 6, 2010
Install and operate SVE units at soil boring/monitoring well location KAFB-10610	November 8, 2010 or 60 days after required access is granted, which ever is later
Prepare for SVE operation at soil boring/monitoring well locations #3, 8, and 9 (see Table 2)	November 8, 2010 or 60 days after required access is granted, which ever is later
Operate SVE units at Fuel Offloading Rack and KAFB-1065, KAFB-1066, and KAFB-1068	Immediately, except operation of SVE Unit at Fuel Offloading Rack may be temporarily suspended while excavating soil and removing remaining components of the Fuel Offloading Rack.
Maintain spare parts and spare engine for SVE units in inventory	September 7, 2010
Report that spare parts and spare engine for SVE units is in inventory	October 6, 2010
Begin excavation of contaminated soil and removing remaining components of the Fuel Offloading Rack.	October 6, 2010
Complete excavation of contaminated soil and	October 6, 2011

removing remaining components of the Fuel Offloading Rack.	
Report on completion of excavation of contaminated soil and removing remaining components of the Fuel Offloading Rack.	January 15, 2012
Submit estimate of contaminant migration rate to NMED	September 7, 2010
Complete A, B, and C sentry wells at location #28 (see Table 4)	November 8, 2010 or 90 days after required access is granted, which ever is later
Complete B and C sentry wells at KAFB-10613 and KAFB-1064	November 8, 2010 or 90 days after required access is granted, which ever is later
Complete A, B, and C sentry wells at location #3 (see Table 4)	November 8, 2010 or 90 days after required access is granted, which ever is later
Complete A, B, and C sentry wells at location #1 (see Table 4)	November 8, 2010 or 90 days after required access is granted, which ever is later
Complete geologic logs of new wells at locations #1, 3, 28, KAFB-10613 and KAFB-1064	During drilling of each well
Complete geophysical logs of new wells at locations #1, 3, 28, KAFB-10613 and KAFB-1064	Within 30 days of well completion
Submit copies of geologic and geophysical logs for locations #1, 3, 28, KAFB-10613 and KAFB-1064	In accordance with NMED letter of June 4, 2010
Submit copies of geophysical logs of existing wells	October 6, 2010
Submit critical data to NMED (Section A.7 of Part 2).	September 7, 2010
Notification of sampling and other field activities (Section B.1 of Part 2)	No less than 15 days prior to implementation
Submit geologic and geophysical logs for sentry wells	In accordance with NMED letter of June 4, 2010
Submit water quality data for WUA wells	In accordance with NMED letter of June 4, 2010
Submit well completion reports	In accordance with NMED letter of June 4, 2010
Submit report on all SVE units	In accordance with NMED letter of June 4, 2010
Report to NMED if any SVE units will not receive an air emissions permit to operate	Immediately
Report to NMED down time of SVE units that will exceed a duration of 72 hours	Within 24 hours of discovery that repairs or maintenance will take more than 72 hours to complete

The Permittee shall respond directly to my attention, with copy to Mr. Bill Olson of the NMED's Ground Water Quality Bureau, and Mr. William Moats (NMED HWB, 5500 San Antonio NE, Albuquerque, NM 87109), on all correspondence and required plans and reports related to the Bulk Fuels Facility Spill, unless otherwise directed by NMED. All submittals and correspondence must be submitted in hardcopy and electronic format.

If you have any questions regarding the technical aspects of this letter, please contact Mr. William Moats of my staff at (505) 222-9551. Any other questions should be directed to me at 505-476-6016.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

Enclosures: Figures 1-4

cc: J. Kieling, NMED HWB
W. Moats, NMED HWB
W. McDonald, NMED HWB
S. Brandwein, NMED HWB
B. Olsen, HWB GWQB
A. Puglisi, HWB GWQB
B. Swanson, HWB GWQB
L. Barnhart, NMED OGC
B. Gallegos, AEHD
B. Gastian, ABCWUA
L. King, EPA-Region 6 (6PD-N)
File: Reading and KAFB 2010

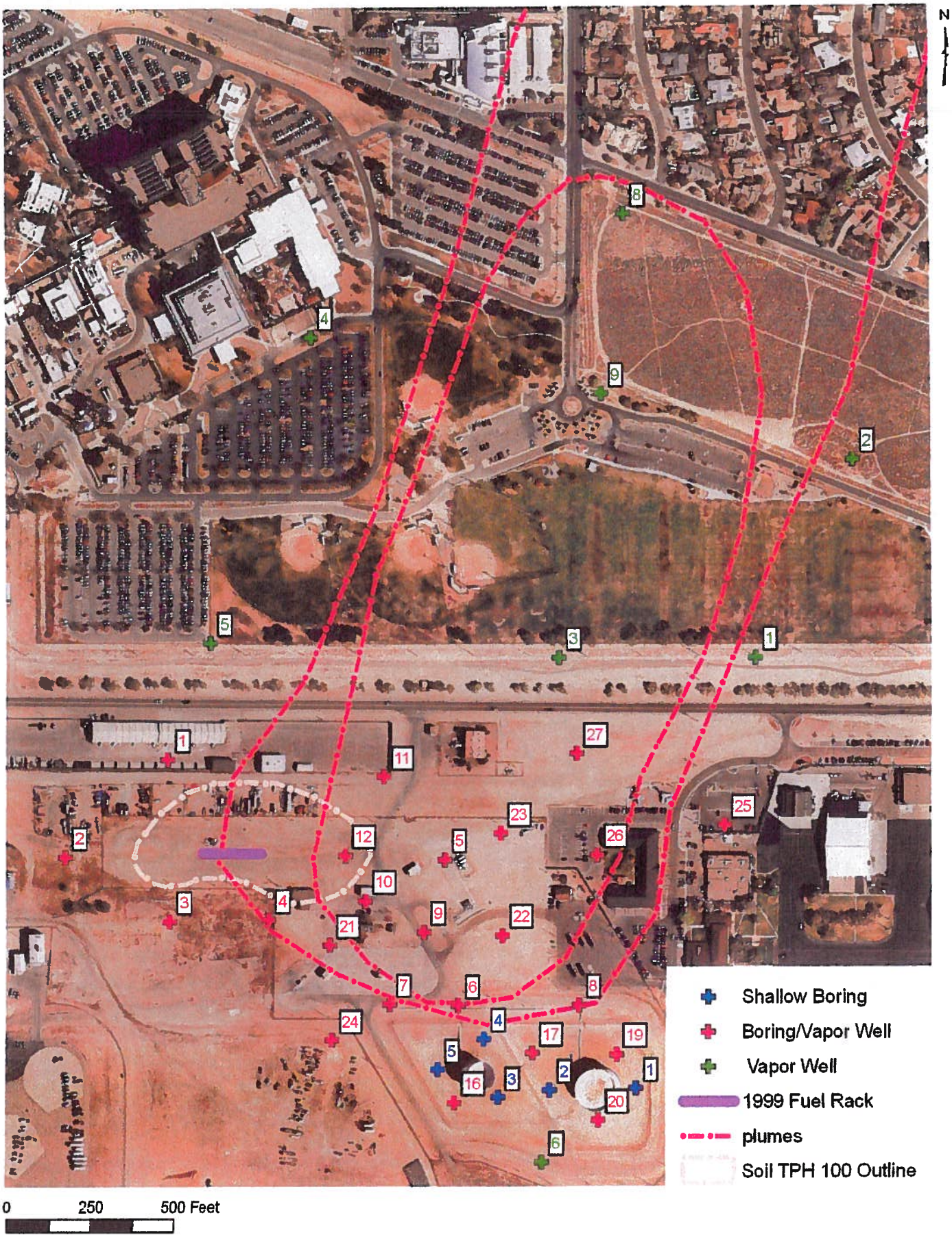

Figure 1. Soil Boring and
Soil-Vapor Monitoring Well Locations

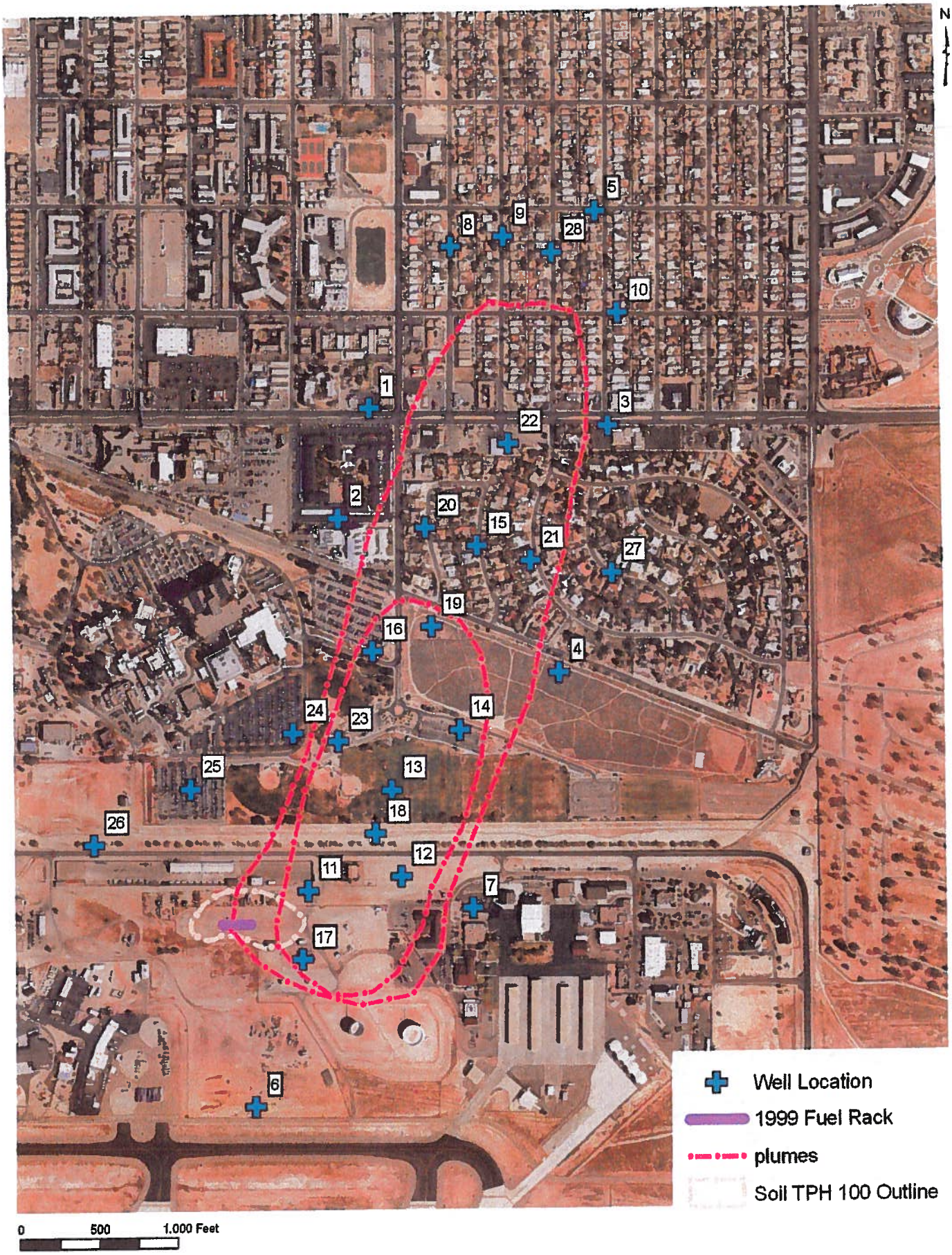

Figure 2. Groundwater Monitoring Well Locations

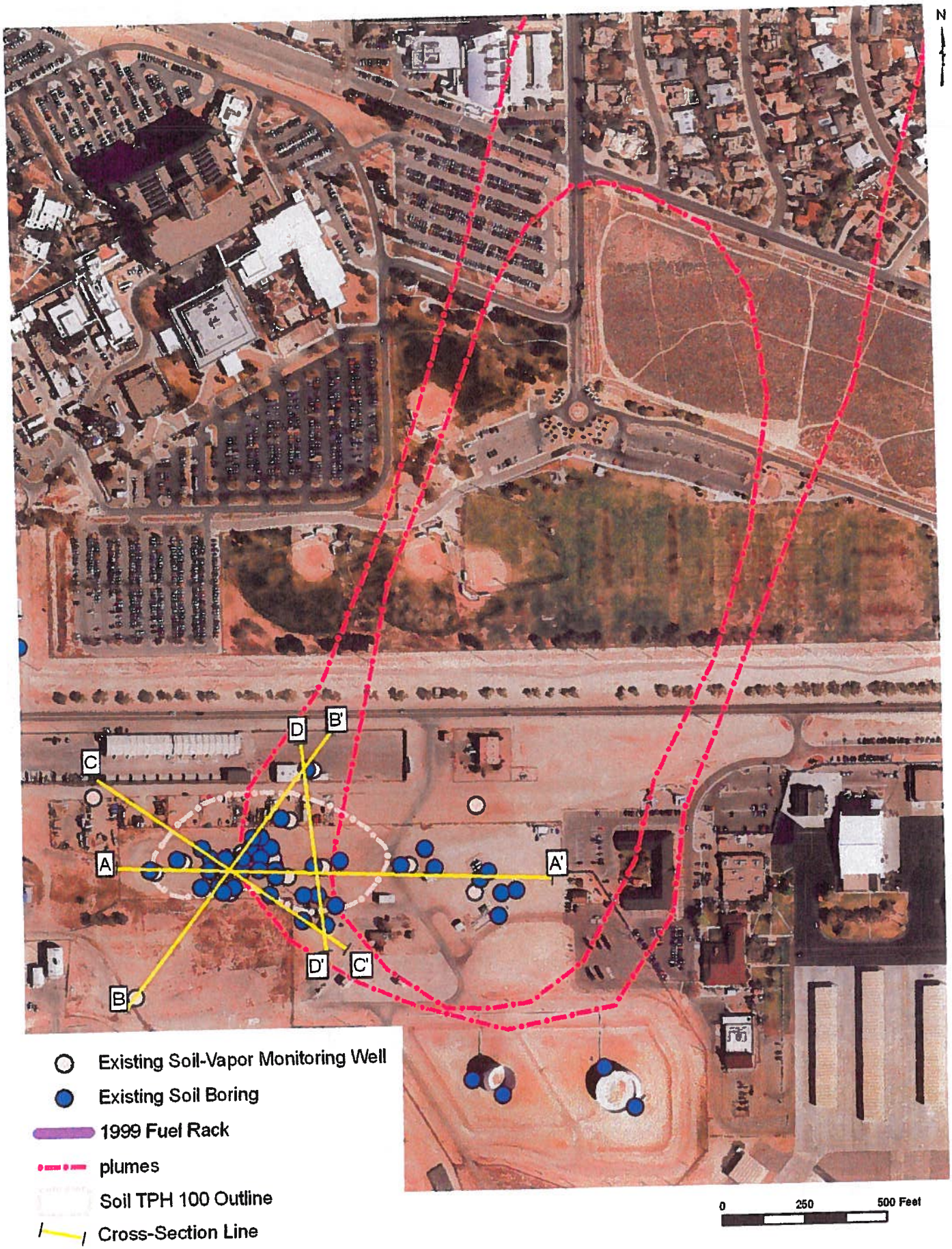

Figure 3 Existing Soil Boring, Soil-Vapor Monitoring Well and Cross-Section Locations

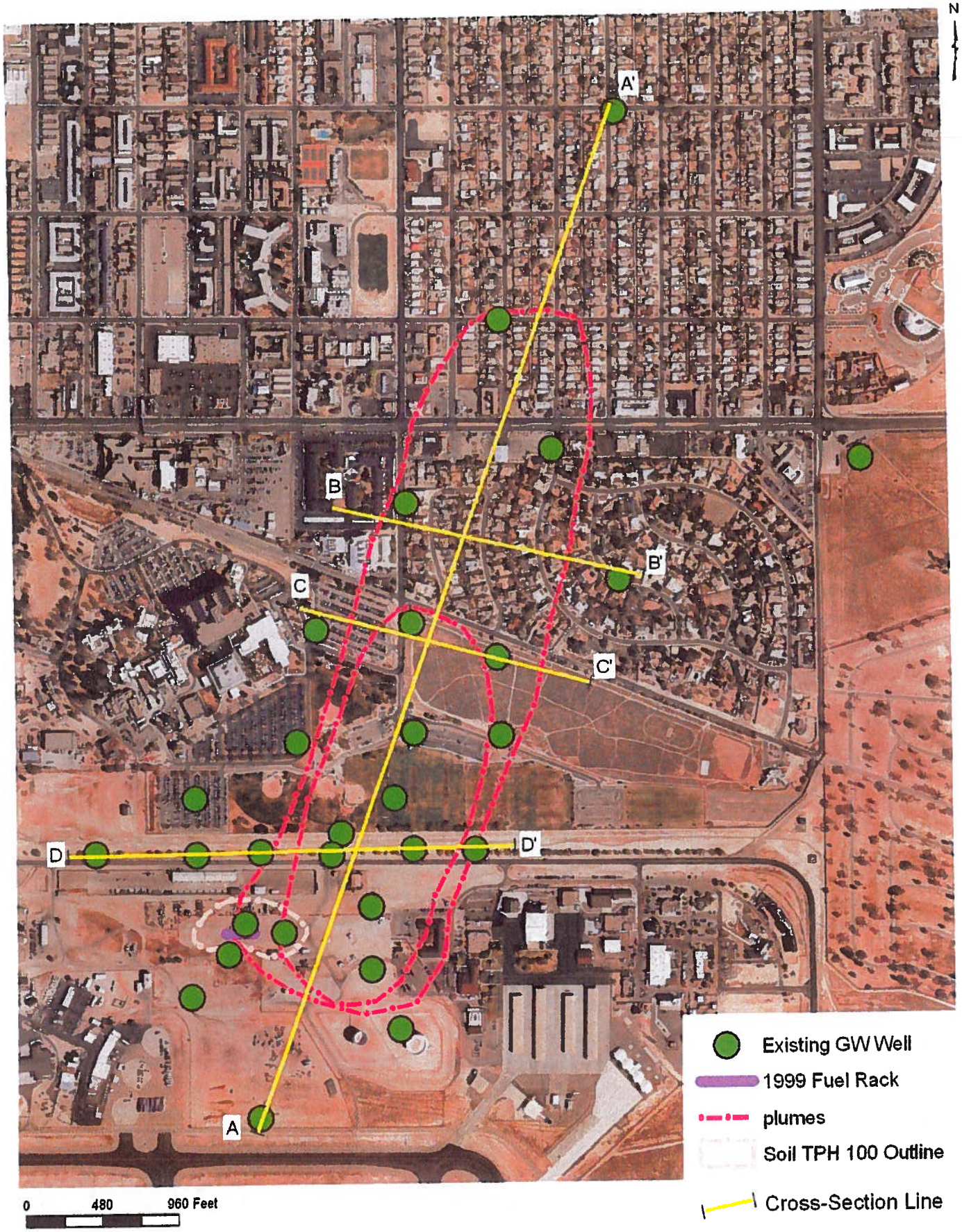

Figure 4. Existing Well and Cross-Section Locations

ATTACHMENT 3

December 10, 2010 Correspondence from the NMED HWB to Colonel Robert L. Maness, Base Commander, 377 ABW/CC and Mr. John Pike, Director, Environmental Management Section, 377 MSG/CEANR

Re: Bulk Fuels Facility Spill (SWMUs ST-106 and SS-111), Notice of Partial Approval with Modification and Notice of Disapproval, Interim Measures, Vadose Zone, and Groundwater Investigation Work Plans, HWB-KAFB-10-015, HWB-KAFB-10-016, HWB-KAFB-10-019

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NEW MEXICO ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

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BILL RICHARDSON
Governor

DIANE DENISH
Lieutenant Governor

RON CURRY
Secretary

SARAH COTTRELL
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

December 10, 2010

Colonel Robert L. Maness
Base Commander
377 ABW/CC
2000 Wyoming Blvd. SE
Kirtland AFB, NM 87117-5606

Mr. John Pike
Director, Environmental Management Section
377 MSG/CEANR
2050 Wyoming Blvd., Suite 116
Kirtland AFB, NM 87117-5270

RE: BULK FUELS FACILITY SPILL (SWMUS ST-106 AND SS-111)
NOTICE OF PARTIAL APPROVAL WITH MODIFICATIONS AND NOTICE OF DISAPPROVAL
INTERIM MEASURES, VADOSE ZONE, AND GROUNDWATER INVESTIGATION WORK PLANS, NOVEMBER 2010
KIRTLAND AIR FORCE BASE, EPA ID# NM9570024423
HWB-KAFB-10-015, HWB-KAFB-10-016, HWB-KAFB-10-019

Dear Col. Maness and Mr. Pike:

The New Mexico Environment Department (NMED) has reviewed the revised Interim Measures, Vadose Zone, and Groundwater Investigation Work Plans, concerning the Kirtland Air Force Base (KAFB) Bulk Fuels Facility Spill, Solid Waste Management Units (SWMUs) ST-106 and SS-111. The revised plans were submitted November 4, 2010, in response to the NMED's Notice of Disapproval (NOD) issued August 6, 2010.

NMED finds the plans to be deficient, and provides the following comments. However, NMED must also ensure that commencement of the vadose zone and groundwater investigations and interim measures not be further delayed. NMED is therefore partially approving with modifications the Work Plans in accordance with Permit Part 1.38 of the Permittee's Hazardous Waste Operating Permit (Permit), issued July 15, 2010. Those aspects of the Work Plans that are approved with modifications are addressed in Part 1 of this letter. Under Part 1 of this letter, the Permittee must conduct certain activities to

begin the investigation of the vadose zone and groundwater at the Bulk Fuels Facility immediately, and to conduct interim measures at the former Fuel Offloading Rack, prior to approval of the remainder of the Work Plans. These activities are to be conducted as described in this letter, and without delay. The work to be conducted under Part 1 must also be included in the revised Work Plans even if the Permittee believes that such work has been completed when it submits the revised Work Plans for approval. NMED reserves the right to require the Permittee to correct work completed under Part 1 that does not meet the corrective action requirements of Permit Part 6 or the modifications specified in this letter for such work.

Part 2 of this letter concerns those aspects of the Work Plans that are disapproved. The Permittee is further directed, in Part 2 of this letter, to make additional revisions to the three Work Plans, which are necessary before NMED can approve the plans.

PART 1
PARTIAL APPROVAL WITH MODIFICATIONS

The Permittee must begin immediate investigation of the vadose zone and groundwater in accordance with the corrective action requirements of Permit Part 6, and with the modifications to the three Work Plans that are specified in this letter. The Permittee shall also complete the removal of the former Fuel Offloading Rack and the excavation of contaminated soil exceeding NMED Soil Screening Levels (SSLs).

A. Installation of New Groundwater Monitoring Wells

NMED approves the well installations as described in the revised Groundwater Investigation Work Plan submitted November 4, 2010 with the following modifications. The Permittee shall therefore immediately commence installation of the 78 groundwater monitoring wells provided for in Section 5.2.4 of the revised Groundwater Investigation Work Plan. The installation of the wells shall be completed by **April 28, 2011** (Appendix B of the Groundwater Investigation Work Plan).

Because steel well screens and casing would render most of the geophysical logs useless the Permittee must use polyvinyl chloride (PVC) screens and casing for the deep wells. The Permittee may substitute PVC screens and casing for the intermediate-depth wells, and may use PVC screens and casing for wells screened across the water table at locations where LNAPL is not present.

Section 5.2.4.1 of the Groundwater Investigation Work Plan, *Monitoring Well Installation Procedures*, item #6 states that three PVC centralizers would be used in well construction, one installed directly above and one below the well screen and one installed at the midpoint of the well. In lieu of a centralizer installed at the midpoint, the Permittees shall install PVC centralizers approximately every 100 feet between the top of screen and the ground surface.

The borehole of each well shall be logged in accordance with Permit Part 6.5.15 by a registered professional geologist.

Screen lengths for wells shall not exceed 15 feet, with the exception that wells screened across the water table shall have screens 20 feet long, with no more than 15 feet of screen length situated below the water table.

Each of the new wells shall be developed pursuant to Permit Part 6.5.17.10.6. Pursuant to Permit Part 6.5.17.3, initial groundwater samples shall be obtained from newly-installed monitoring wells within 30 days after completion of well development. Groundwater sampling and reporting requirements shall be conducted as directed in NMED's letter of June 4, 2010, and as specified in Permit Part 6.5.17.5.

B. Development of Existing Wells

In NMED's letter of April 2, 2010, the Permittee was directed to develop all existing wells located within the LNAPL plume, and to make such wells available to sample groundwater below the floating LNAPL so that concentrations of dissolved-phase contaminants can be assessed in this area. This work was to be completed by July 6, 2010. The Permittee failed to complete this work. Furthermore, the revised Groundwater Investigation Work Plan does not contain any provisions for developing the existing wells within the LNAPL plume.

NMED is again directing the Permittee to develop all existing wells located within the LNAPL plume, and to make such wells available to sample groundwater. Well development shall be conducted in accordance with Permit Part 6.5.17.10.6. The work must be completed no later than **February 15, 2011**.

C. Geophysical Logging of Existing Wells

In the August 6, 2010, NOD, the Permittee was directed to conduct borehole geophysical logging (medium and deep induction, gamma, and neutron) at all existing groundwater monitoring wells, and to submit copies of the geophysical logs to the NMED by October 6, 2010. The Permittee failed to complete this work on time, but provides for the geophysical logging of existing wells in the revised Groundwater Investigation Work Plan.

NMED approves the Permittee's proposal to conduct borehole geophysical logging (medium and deep induction, gamma, and neutron) at all existing groundwater monitoring wells. Copies of the logs must be submitted to the NMED by no later than **February 15, 2011**.

D. Completion of Soil Borings

NMED approves the projects in Sections D and E of this letter as described in the revised Vadose Zone Investigation Work Plan submitted November 4, 2010 with the following modifications The Permittee shall immediately complete the 35 deep and 5 shallow soil borings provided for in Section 5.2.10 of the revised Vadose Zone Investigation Work Plan. The work shall be completed by **February 11, 2011**(Appendix B of the Vadose Zone Investigation Work Plan). Each deep boring at each location shall be drilled from the surface to the water table.

Soil samples from the deep borings shall be collected at a frequency of at least one sample every 10 feet for the first 50 feet, and at least one sample thereafter every 50 feet to total depth, and at least one sample at total depth in each boring. The soil samples shall be analyzed for TPH, VOCs, SVOCs, and lead.

Soil samples from shallow borings shall be collected at depths of 0, 5, 10, 15, and 20 feet and shall be analyzed for TPH, VOCs, SVOCs, and lead.

Each soil boring shall be logged in accordance with Permit Part 6.5.15 by a registered professional geologist.

E. Installation of New Soil-Gas Monitoring Wells

The Permittee shall immediately install the 35 soil-gas monitoring wells provided for in Section 5.2.11 of the revised Vadose Zone Investigation Work Plan submitted November 4, 2010. The well installations shall be completed by **February 11, 2011** (Appendix B of the Vadose Zone Investigation Work Plan).

The soil-gas monitoring wells shall be capable of yielding discrete samples of soil gas recovered from depths of 25, 50, 150, 250, 350, and 450 feet below the ground surface.

The borehole of each well shall be logged in accordance with Permit Part 6.5.15 by a professional geologist.

Vapor sampling and reporting requirements shall be conducted as directed in NMED's letter of June 4, 2010.

F. Geophysical Logging of New Groundwater and Soil-Vapor Wells

NMED approves the Permittee's proposal to conduct borehole geophysical logging (medium and deep induction, gamma, and neutron) at all new groundwater and soil-vapor monitoring wells. Copies of the logs must be submitted to the NMED by no later than **June 1, 2011**.

G. Interim Measures at Former Fuel Offloading Rack

The NOD issued August 6, 2010, specified that the Permittee begin removal of the remaining components of the former Fuel Offloading Rack and excavation of contaminated soil exceeding NMED SSLs to 20 feet (SSLs shall be those based on residential land use) by October 6, 2010. The Permittee was also instructed that laboratory analysis of soil samples shall be conducted to determine the concentrations of hazardous constituents for the purpose of defining the final extent of excavation, for risk assessment, and for waste determination. NMED approves the Permittee's proposal for sample analysis, with the following modification: Soil samples shall be analyzed in the laboratory for TPH, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and lead, and collected on all sides and the bottom of the excavation at a spacing not to exceed 25 feet. Additionally, the excavation of soil and removal of the former Fuel Offloading Rack shall be completed by October 6, 2011, and a report on completion of the work submitted to the NMED by January 15, 2012.

NMED approves the Permittee's soil sampling plan except as modified below. Section 4.5.2 of the Interim Measures Work Plan, *FFOR Soil Investigation and Sampling*, indicates that the direct-push technology (DPT) samples are to be collected at the former Fuel Offloading Rack (FFOR) and along the remaining aboveground and underground piping on 25-ft centers. The Permittee does not adequately describe the locations of the samples nor are the locations individually depicted on Figure 4-2. No additional sampling is proposed for the known three locations of pipeline leaks, which occurred approximately 18 ft, 150 ft, and 200 ft from the west end of FFOR.

For underground piping from Building 1033 (Pump House) to its terminus at the west end of the FFOR, the Permittee shall instead collect soil samples on 10-ft centers along a line oriented directly over what was once the centerline of the now-excavated pipeline (hereafter referred to as the former pipe centerline). Soil samples shall also be collected at locations spaced no further than 10 ft apart along two lines oriented parallel to the former pipe centerline, with the two lines situated no further than 5 ft from and on opposite sides of the former pipe centerline. Sampling shall also be conducted directly beneath each of the three known leak locations.

At each of the three known leak locations, sampling shall be increased by collecting soil samples at 5 ft by 5 ft grid nodes.

At each sampling location, soil samples shall be collected at depths of 0, 5, 10, 15, and 20 feet.

If lead, VOCs, or SVOCs are detected in soil at concentrations exceeding the NMED SSLs at a given location, the soil at the location shall be excavated, removed from the site, and properly disposed of. The Permittee shall also increase the sampling grid at the location by using the same method as directed above for sampling the three known leak locations, and collect and analyze the additional samples. Expansion of sampling and the collection and analysis of additional samples shall continue until all soil containing VOCs, SVOCs, or lead at concentrations exceeding the NMED SSLs have been excavated.

Section 4.5.2.1, Bullet 4, of the Work Plan states "The field Geologist will collect samples for laboratory analysis that appear to contain the greatest degree of contamination based on visual observation and headspace VOC screening...", suggesting that not all samples will be submitted to the laboratory for analysis. Because headspace analysis will not detect lead and may not detect SVOCs, all soil samples must be submitted to the laboratory for analysis.

Confirmation samples are samples collected to verify that all contaminated soil with concentrations of hazardous constituents exceeding the NMED SSLs has been excavated and removed. In Section 4.5.3.6, *Confirmation Sampling*, the Interim Measures Work Plan indicates that confirmation samples will not be collected from the sidewalls of the excavation. In contrast, the Interim Measures Work Plan in Section 4.5.1 indicates that sidewalls will be sampled for confirmation.

Confirmation samples must be collected from the bottom and sides of all excavations at intervals not to exceed 25 feet. This includes any areas excavated to depths of 20 ft. The Permittee can collect sidewall conformation samples ahead of, behind, or through shoring via portholes cut through the shoring.

Excavation of contaminated soil at the former Fuel Offloading Rack must be completed by **October 6, 2011**.

H. Piping From Building 1033 to Tanks

NMED approves the Permittee's soil sampling plan, except as modified below. The Permittee must excavate to a depth of up to 20 feet any contaminated soil exceeding NMED SSLs that occurs along the piping from Building 1033 to the jet-fuel fuel storage tanks. In lieu of what the Permittee proposed, for the underground and aboveground piping from Building 1033 to the jet-fuel storage tanks, the Permittee shall collect soil samples at locations spaced no further than 20 ft apart along two lines oriented parallel to the pipe centerline, with the two lines situated no further than 5 ft from and on opposite sides of the pipeline. Soil samples shall be collected at depths of 0, 5, 10, 15, and 20 feet and shall be analyzed in the laboratory for TPH, VOCs, SVOCs, and lead.

If lead, VOCs, or SVOCs are detected in soil at concentrations exceeding the NMED SSLs at a given location, the soil at the location shall be excavated and removed from the site for proper disposal. The Permittee shall also increase sampling at the location by using the same method as directed above for sampling the three known leak locations at the former Fuel Offloading Rack, and collect and analyze the additional samples. Expansion of the sampling and the collection and analysis of additional samples shall continue until all soil containing VOCs, SVOCs, or lead at concentrations exceeding the NMED SSLs are excavated and removed from the site for disposal.

Section 4.5.2.1, Bullet 4, of the Work Plan states "The field Geologist will collect samples for laboratory analysis that appear to contain the greatest degree of contamination based on visual

observation and headspace VOC screening...", suggesting that not all samples will be submitted to the laboratory for analysis. Because headspace analysis will not detect lead and may not detect SVOCs, all soil samples shall be submitted to the laboratory for analysis.

Confirmation samples must be collected from the bottom and sides of all excavations at intervals not to exceed 25 feet. This includes any areas excavated to depths of 20 ft. The Permittee can collect sidewall conformation samples ahead of, behind, or through shoring via portholes cut through the shoring.

Sampling along the pipeline from Building 1033 to the storage tanks shall be completed by **March 7, 2011**.

I. Soil-Vapor Extraction

In the August 6, 2010, NOD, the Permittee was directed to install and operate additional SVE units, or prepare for SVE operations at the following 16 locations: existing groundwater monitoring wells KAFB-3411, KAFB-10614, KAFB-10624, KAFB-10617, KAFB-10618, and KAFB-10610, at soil boring/soil-vapor monitoring well locations # 4, 5, 9, 10, 11, 12, and 21 listed in Table 1 of the NOD, and soil-vapor monitoring well locations #3, 8 and 9 on Table 2 of the NOD. The Permittee did not accomplish this work, and did not propose any alterative work for NMED to consider. Furthermore, the Permittee has not done anything in the past four months to accelerate the reduction of the soil-vapor mass in the vadose zone at the Bulk Fuels Facility.

Nevertheless, NMED has reconsidered its earlier position to expand the number of SVE Units. Instead of expanding the number of operating SVE Units, the Permittee is directed to prepare the locations of existing groundwater monitoring wells KAFB-3411, KAFB-10614, KAFB-10624, KAFB-10617, KAFB-10618, and KAFB-10610 for conducting SVE by no later than **February 15, 2011**. The Permittee is also directed to prepare an SVE Optimization Plan for the four existing SVE Units, with the concept that the four SVE units will be moved periodically between the six aforementioned locations and the four locations where SVE is currently conducted to maximize the removal of contaminants (by mass) via vapor extraction. Furthermore, the Permittee must propose in the SVE Optimization Plan alternative technologies for the removal and treatment of soil-vapor contamination that do not rely on the use of internal combustion engines. The SVE Optimization Plan must be submitted to NMED by **March 31, 2011**.

J. Special Tests under Interim Measures Work Plan

NMED approves the ROI, hydrocarbon baildown, and Pneulog tests. The Permittee shall conduct the Radius of Influence, the Hydrocarbon Baildown, and PneuLog tests by **April 6, 2011**; **March 2, 2011;** and **December 21, 2011**, respectively.

K. Collection of LNAPL Sample

The Permittee shall collect a sample of LNAPL from one of the groundwater monitoring wells within the LNAPL plume and provide the sample to the Scientific Laboratory Division (SLD) of the New Mexico Department of Health by no later than **March 31, 2011**. The Permittee shall notify the NMED in writing of the delivery of the LNAPL sample to the SLD no later than **1 business day** following delivery of the sample.

The Permittee is directed to conduct all activities required in Part 1 of this letter in accordance with the terms described in each section of this letter and to resubmit the Work Plans with the required revisions along with the changes required by Part 2 of this letter. Any portion of a Work Plan that was not specifically approved and modified as described above is disapproved and must be corrected as described in Part 2.

PART 2
PORTIONS OF WORK PLANS THAT ARE DISAPPROVED

A. Deficiencies Common to All Three Plans

1. Part 1, A.7 of the NOD issued on August 6, 2010, required that the Permittee list the data gaps that apply to each of the three plans, as appropriate for the topic of a plan. The Permittee was also instructed to revise the Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans to include a description of at least the data gaps identified by the NMED and point specifically to where in each of the documents the data gaps are addressed.

This deficiency was not corrected in any of the revised Work Plans submitted on November 4, 2010. The NMED is directing the Permittee again to revise the Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans to include a description of the data gaps identified by the NMED and point specifically to where the data gaps are addressed in each of the documents.

2. Part 1, A.9 of the NOD issued on August 6, 2010, required that the Permittee include a site conceptual model encompassing the source area(s), the fuel percolation area, the light non-aqueous phased liquid (LNAPL) plume floating on groundwater, and the dissolved-phase contaminant plume in groundwater in each of the plans. However, none of the revised Work Plans contains a site conceptual model. Instead, the issue was addressed under the Work Plans by stating that a model will be provided later by the Permittee.

The NMED is directing the Permittee again to revise the Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans to include a site conceptual model encompassing the source area(s), the fuel percolation area, the light non-aqueous phased liquid (LNAPL) plume floating on groundwater, and the dissolved-phase contaminant plume in groundwater in each of the plans. The model should be illustrated through the liberal use of detailed, accurate, and scaled geologic cross-sections, maps in plan view, and any other necessary graphical

representations to clearly and accurately show geologic and hydrologic features, and contaminant levels. NMED invites the Permittee to meet to discuss NMED's expectations with respect to the conceptual model and graphic representation of data.

3. Part 1, A.10 of the NOD issued on August 6, 2010, required that the Permittee meet Section E of the NMED's letter of April 2, 2010, which directed that investigation plans are to include relevant maps and cross-sections that show concentration data for contaminants and other relevant information with supporting data posted on the maps and cross-sections, and clearly show which borings/wells contributed data towards construction of the maps and cross-sections and which did not. Additionally, tables including all existing soil borings, soil-gas monitoring wells, and groundwater monitoring wells, listing their surveyed location, sampling points and maximum depth of exploration were also to be included in the plans. For soil-gas monitoring wells, tables and graphs were also to be included providing trends of TPH concentration versus time for the depths below ground surface of 25, 50, 150, 250, 350, and 450 feet.

The required maps, cross-sections, tables, and graphs were not included in the Work Plans submitted November 4, 2010. Revise the Work Plans accordingly.

4. Appendix E, Uniform *Federal Policy-Quality Assurance Project Plan* – This plan is incorporated into the Vadose Zone Investigation, Groundwater Investigation, and Interim Measures Work Plans. The plan, as written, appears to be a combination of many types of plans, such as project management, training, data validation, quality assurance, and sampling and analysis plans. Additionally, much of the information presented appears to be overly burdensome and not particularly useful in the present format. For example, a tabulated listing of field quality control samples to be collected for every quarter/year is unnecessary as the types and frequencies of such samples are not likely to change every quarter or even every year. Listings of quality control targets (in particular, limits for laboratory control samples) from three different entities are also not useful – instead only those that will actually be used for this particular project should be listed.

The Permittee must revise Appendix E into multiple appendices to separate the various types of plans (e.g. project management, training, data validation, quality assurance, and sampling and analysis). The various listings of laboratory analytes per media (QAPP Worksheet # 18a-c), field quality control samples (QAPP Worksheet # 20a-c), quality control targets (Appendix A of Appendix E) should be revised to simplify the information presented and contain only the necessary information to support the Bulk Fuels Facility Spill project. Some tables, such as QAPP Worksheets # 3, 4, 9, 16, 24c, 25, 28a-d, do not provide useful information to the NMED and should be deleted.

NMED is expecting a Quality Assurance (QA) Plan that contains specific quality assurance and quality control activities for the Bulk Fuels Facility Spill project. The QA plan is to integrate all technical and quality aspects of the project to ensure that the necessary type and quality of data are obtained to adequately characterize the release, the contaminated media, and for conducting and verifying clean up. NMED invites the Permittee to meet and discuss NMED's expectation

with respect to what should be in the QA Plan, as well as project management, training, data validation, and sampling and analysis plans.

B. Groundwater Investigation Work Plan

1. The Permittee must describe in the first paragraph of Section 5.2.5 what geophysical logging has been previously conducted at existing wells.

2. The last paragraph on page 5-19, Section 5.2.5.1, states "The logs will be run from the groundwater table (approximately 500 ft bgs) to ground surface through the well casing." Correct the text to read "The logs will be run from the bottom of the well to the ground surface." Also, change all references to "groundwater table" in the Groundwater Investigation Work Plan to the correct term "water table".

3. The first sentence on page 5-20, Section 5.2.5.1, references a proposed seismic survey. Discuss the survey, or remove the reference to the seismic survey if such a survey will not be conducted.

4. Section 5.2.5.2, *Induction Logging*, on page 5-22, 3rd paragraph, 1st sentence states: "The borehole induction system can be used in boreholes that range from 2 to 8 inches diameter without significant borehole effects." Because the Permittee is proposing to drill boreholes with diameters of 9-5/8 and 11-3/4 inches, indicate whether the borehole induction system can be used properly in boreholes with diameters greater than 8 inches, or modify the plan to indicate that another, more appropriate tool will be used to log the boreholes.

5. Section 5.2.5.2, *Induction Logging*, page 5-22, the last sentence of the 3rd paragraph states; "The maximum depth of measurement for the most induction logging systems is 650 ft (200) meters)." Explain what this sentence means, as wells many thousands of feet deep are logged using induction logging. If the sentence is incorrect, correct the sentence or delete it from the Work Plan.

6. The last paragraph and bullets in Section 5.2.5.2, *Induction Logging*, discusses general procedures for all geophysical logging. This discussion needs to be moved to a more general section, such as Section 5.2.5 *Logging Requirements*. Also:

   a. Add total depth from the logger to the list of bullets.

   b. Add the same information to the list of bullets that is to be recorded in the first bullet of Section 5.2.3.2 of the Vadose Zone Investigation Work Plan (e.g., logging tool serial number, sensitivity range setting).

   c. The Permittee must include the measured deviation between the "zero point" of the tool at ground level at the start of the logging run and after completing the logging run.

7. Describe in Section 5.2.5.1 of the Work Plan if tools are to be run centralized, decentralized, or free in casing and describe where that information will be recorded.

8. Section 5.2.6.1, Logging System, p.5-25, last sentence, states "The logging system will be equipped with.... cable long enough to log 600-ft.depths." Because some of the groundwater monitoring wells may be 610-620 ft deep, the logging system must be capable of logging the full depth of all wells, even those in excess of 600 ft depth.

9. Table 4-1, Data Quality Objectives Summary Table, in the 3rd and 4th column in row 4, *Define the Study Boundary* states "Study boundaries are indicated on Figure 2-1". Many wells are outside the study boundary shown on the figure. Correct the statement or the figure as appropriate.

Revise Table 4-1 in accordance with the directives in this letter, or delete the table. Although the Permittee may use the EPA's DQO process to plan work, NMED prefers that Table 4-1 and Section 4 be deleted from the Work Plan, as they add little additional useful information. Items in the table should be included in the text of the Work Plan with additional details and as modified in accordance with the directives of this letter.

10. Table 4-1, Data Quality Objectives Summary Table, in the 3rd and 4th column in row 6, *Specify Limits on Decision Errors* states "Borehole geophysics measurements obtained is less than 1 ft." Explain what this sentence means, especially in light of the second sentence in Section 5.2.5.2 on page 5-22, which states "The intercoil spacing resolves conductivity layers 20 inches thick." See comment # 9 above about the deletion of Table 4-1 and Section 4.

11. Section 5.2.7, *Borehole Geophysics Equipment Decontamination* – Revise the Work Plan to indicate clearly that both the cable and probe will be decontaminated.

12. The 2nd paragraph, last sentence of the *Preface* states "Part II will consist of the evaluation of all existing and new data, and development of the risk assessment (including the conceptual site model), and the Groundwater Investigation Report (including cross sections and plan views)."

Revise the Work Plan to include a detailed description of what is to be included in the Part II Work Plan. NMED notes further that the inclusion of a "report" in a work plan is unusual and generally inappropriate. Information derived from newly completed work is normally submitted as a stand alone report, not as a section of a work plan.

Furthermore, the schedule in Appendix B lists the Part II Work Plans as being submitted by August 6, 2011. Because the contents of the Phase II plans are unknown to the NMED, the NMED can not agree to this submittal due date.

13. There are few details of reporting in the Work Plan, and most of those are aimed at the geophysical logging. Revise the Work Plan to include details for reporting on well installation, monitoring, and sampling results.

14. Section 3.5.3, *Identification of Contaminants of Potential Concern*, page 3-10 lists WQCC water quality standards from 20.6.2 NMAC. The cleanup levels for groundwater shall be the New Mexico Water Quality Control Commission (WQCC) water quality standards (20.6.2.3103 and 20.6.2.4103 NMAC) and the drinking water maximum contaminant levels (MCLs) adopted by EPA under the Federal Safe Drinking Water Act (42 U.S.C. §§ 300f to 300j-26). If both a WQCC standard and a MCL have been established for a contaminant, then the most stringent of the two levels shall be the cleanup level for that contaminant.

If a WQCC standard or MCL has not been established for a contaminant, the EPA Regional Screening Level (RSL) (EPA, 2009) for tap water shall be used as the cleanup level. If a RSL for tap water does not exist for a contaminant, and toxicological information is available, the Permittee shall propose a cleanup level based on a residential scenario, a total target human health excess cancer risk level of 10^{-5} and for non-carcinogenic contaminants a HQ of one (1.0). Revise the Work Plan accordingly.

See Permit Section 6.2.3.1.

15. Section 3.5.4, *Light Non-Aqueous Phase Liquid Distribution*, contains a list of wells where LNAPL has been detected. Add well KAFB-10628 to the list.

16. Section 5.2.3.1, page 5-6, 3rd bullet, discusses a scale of 1 inch =10 feet for drilling logs for wells shallower than 200 feet, but does not address a scale for wells greater than 200 feet. Because all wells are likely to be greater than 200 feet deep, identify the scale to be used.

17. Section 5.2.4, Groundwater Monitoring Wells, page 5-14, 2nd paragraph, last sentence states "A schematic showing a well construction detail is included in Appendix D, Forms 4, 5, 6, and 7." None of the four forms seems to fit the proposed construction details with a single cased, telescoped borehole, as shown on Figure 5-1. Revise the Work Plan to include appropriate well-construction field forms.

18. Section 5.2.4.3, *Well Development*, 2nd bullet discusses stabilization of groundwater field parameters during well development. Water stability indicators must be as described in the Permit, not as listed in this section, or as listed in Appendix D. Form 8, *Well Development Record and Water Quality Field Data Sheet (Continued 5 of 6).*

19. Appendix D. Form 8, *Well Development Record and Water Quality Field Data Sheet (Continued 5 of 6)* lists conversion factors to determine the volume of well water to be purged for development and sampling based upon the height of the water column in the well. A distinction is made between a dedicated and non-dedicated system. NMED does not recognize such a

distinction and requires that all well development meet Permit Part 6.5.17.10.6 and that well purging be conducted as directed in NMED's letter of June 4, 2010, and Permit Part 6.5.17.4.

20. Appendix C, *Waste Management Plan*, Table 2 implies that the preferred method of disposal of non-hazardous waste water, a form of investigation-derived waste (IDW), is to discharge it to the ground surface. NMED encourages the Permittee to dispose such non-hazardous waste water into the City of Albuquerque's Publically-Owned Treatment Works (POTW) sewer system. Furthermore, all such water must be containerized and tested prior to disposal in accordance with 20.4.1.300 NMAC incorporating 40 CFR § 262.11. Waste water from one well can not be commingled with that from any other well or wells unless demonstrated not to be a hazardous waste.

21. The Permittee shall address the following concerning Appendix E, *Uniform Federal Policy-Quality Assurance Project Plan.*

a) Appendix E is shown as "(Pending Review)". This suggests that Appendix E is a draft document. Revise the Work Plan to contain only finished products, ready for NMED review.

b) Appendix E, page 77, Section 17.2, first paragraph, correct "April 2009" to the appropriate date.

c) Appendix E, page 77, Section 17.2 must clearly state quarterly groundwater monitoring will occur until a change is approved by NMED.

d) Describe what risk evaluation the Permittee is expecting to do and why.

e) List the data quality objectives that the QAPP must address.

f) Describe the Quality Assurance for geophysical logging.

g) Appendix E, Section 17.5 (and elsewhere) – Samples must be analyzed at an EPA-certified laboratory. Also, the Permittee must indicate whether the referenced Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) laboratory is EPA-certified. Revise the Work Plan accordingly.

h) Appendix E, Section 17.8, *Investigation-Derived Waste* –This section needs to clearly state that no IDW water from individual wells will be comingled before appropriate testing.

i) Appendix E, Section 17.9.4 states that no trip blanks will be collected for soil samples for VOC analysis. Revise the Work Plan to indicate that trip blanks are required for soil samples that are to be analyzed for VOCs.

j) Appendix E, Section 17.9 must include percent frequency of field quality control samples in each subsection. The sampling frequency must be as described in Permit 6.5.17.6.

k) Appendix E, Section 17.9.5, states field (ambient) blanks will be collected for groundwater only. Revise the Work Plan to include field blanks for soil sampling.

l) Appendix E mainly addresses sampling only for laboratory and field analyses. Other field activities, such as surveying and geophysical logging need to be addressed.

m) Appendix E, Section 17.2.2, *MNA Groundwater Monitoring*, states "30 groundwater monitoring wells will be installed for the monitored natural attenuation (MNA) investigation effort." Specify which wells these are and the purpose of this monitoring given that NMED has not made any decision concerning MNA as a remedy. Additionally, Section 11.2 of Appendix E, indicates that there are 35 wells to be included in the study. Specify which number of wells is correct.

22. Revise the Work Plan to provide for the collection and maintenance of representative soil samples encountered during well installations and to indicate that said samples will be made available for NMED inspection upon request by the NMED. Additionally, Section 11.2 of Appendix E indicates that there are 35 wells to be included in the study. Specify which number of wells is correct.

23. Revise the Work Plan to specify the frequency that soil samples will be tested for grain size via sieve analysis. Indicate the specific sieve screen sizes that will be utilized for the testing.

24. Table 6-2 lists only two soil samples each to be collected for grain size, residual LNAPL saturation, Water/LNAPL Drainage Capillary Pressure and Water LNAPL Relative Permeability and only one LNAPL sample each for testing for viscosity, fluid density and surface and interfacial tension. Revise the Work Plan to describe why these few numbers of samples are sufficient for the range of conditions at the site. Also, clarify in the table if the column titled "No. of Field Samples" is correct, and if the column "Total No. of Samples to Laboratory" is correct.

25. Saturated hydraulic conductivity and porosity are important variables in groundwater flow considerations. Specify field or laboratory tests that will be conducted to arrive at a range of site specific values. Revise the Work Plan to indicate how values for saturated hydraulic conductivity and porosity will be assessed.

C. Vadose Zone Investigation Work Plan

1. Geophysics – Revise the Vadose Zone Investigation Work Plan in accordance with the above Comments 1-8 and 10-11 concerning Groundwater Investigation Work Plan.

2. Geophysical logging is proposed in soil-gas wells with 2-inch casing. Confirm that all tools fit in 2-inch casing, given the neutron probe is described as being 60 mm in diameter (2.36 inches, see page 5-24 of the Groundwater Investigation Work Plan, first paragraph, last sentence) or make an appropriate change in tool size or casing size.

3. For the soil vapor wells, describe where the 2-inch casing will be located in the borehole (e.g., in the center, closer to one side), and if so, how geophysical logging conducted in the 2-inch casing could be affected by the other soil-vapor monitoring points attached to 0.75-inch diameter casing in the same nested borehole.

4. The Work Plan does not include a detailed discussion of soil-vapor sampling. Revise the Vadose Zone Investigation Work Plan to include a section describing soil-vapor sampling in detail, with discussion of sampling methods, analytical methods, sampling frequency, laboratory and field quality control, handling, shipping and packaging, and reporting of results.

5. Section 5.2, top line on page 5-3 references Table 4 of the August 6, 2010, NOD for number, location, and depths of soil borings/soil-vapor wells. The table number is incorrect. The correct reference is Tables 1, 2 and 3.

6. Table 5-2 of the Work Plan does not show an exact correspondence to the August 6 letter. However, NMED will accept the locations as described in Table 5-2.

7. Section 5.2.10, *Soil Borings/Drilling*, page 5-18, last sentence, 1st paragraph, mentions "10 ¾" O.D. casing whereas Figure 5-2 shows "11 ¾" casing. Correct, as appropriate, the figure or the text.

8. Section 5.2.10, *Soil Borings/Drilling*, page 5-18, last sentence, 1st paragraph, mentions telescoping to a smaller diameter borehole at 200 feet, while Figure 5-2 shows telescoping to a smaller diameter borehole at 150 feet. Correct, as appropriate, the figure or the text.

9. Revise the Work Plan to add total depth from the logger to the first bullet of Section 5.2.3.2.

10. In the bullets of Section 5.2.3.2, define what "Assemble the downhole logging tool" means as a type of information recorded, or remove the bullet.

11. Section 6.1, *Soil Sampling*, Revise the Work Plan to indicate that additional samples will be collected and analyzed, beyond those obtained at the planned sampling intervals, if field evidence suggests contamination may be present as required in Permit Part 6.5.11.

12. Describe what will be submitted in Part 2 Vadose Zone Investigation Work Plan, indicate when the information will it be submitted, and explain why any of the information that was required by November 8, 2010, was not included in Part 1.

13. Appendix E, Section 17.3, *Pre-remedy Quarterly Monitoring Program – Soil Vapor*, discusses soil-vapor monitoring. Describe the risk evaluation the Permittee is proposing to conduct and the purpose of the evaluation. Revise the Work Plan to state that soil-gas

monitoring will be conducted quarterly until a change in frequency or termination of soil-gas monitoring is approved by the NMED.

14. Table 5-2 – Correct the date of the "August 8" letter to "August 6" in the title and last column heading.

15. Table 5-2 – Correct the locations listed in the last column under Shallow Borings. The same location is given for the five separate borings. Revise the Work Plan to correct the location numbers.

16. There are few details of reporting in the Work Plan, and most of those are aimed at the geophysical logging. Revise the Work Plan to include details for reporting on well installation, monitoring, and sampling results.

17. Section 5.2.11, Soil Vapor Monitoring Wells, p.5-27, 1st paragraph, discusses movement of the monitoring point by up to 20 feet if the point lies in a fine-grained layer. This is acceptable for the four deepest points (150, 250, 350, 450) but not for the two shallow points (25, 50). Movement of up to +/-5 feet for the shallow points will be acceptable. Screen depths can only be changed if the adjustment sets the screen in a more permeable geologic unit.

18. Section 5.2.11, Soil Vapor Monitoring Wells, p.5-27, 1st paragraph, states "If a large deviation is required, the NMED will be notified in writing of the deviation." All deviations must have prior written approval from NMED.

D. Interim Measures Work Plan

1. Section 2. 4.5.3.2, Waste Profiling – The Work Plan states that soil will be characterized in place by sampling waste, but is unclear how sample locations will be selected and at what frequency that samples will be collected. Revise the Work Plan accordingly.

2. Section 4.6.11, Radius of Influence (ROI) Testing – The Work Plan does not indicate which existing wells will be used for the testing. Revise the Work Plan to list the wells to be used in the ROI tests.

3. Section 4.6.2.4 states that soil-gas wells will be constructed with 2-inch casing. Figure 4-4 indicates that the deepest monitoring point will be constructed using 3-inch casing. Revise the Work Plan to indicate the correct casing diameter. If 2-inch casing is correct, confirm that all geophysical tools will fit in 2-inch casing, given the neutron probe is described as being 60 mm in diameter (2.36 inches, see p.5-24 of the Groundwater Investigation Work Plan, first paragraph, last sentence) or make an appropriate change in tool size or casing size.

If 2-inch casing is correct, describe where the 2-inch casing will be located in the borehole (e.g., in the center, closer to one side), and if so, how geophysical logging conducted in the 2-inch

casing could be affected by the other soil-vapor monitoring points attached to 0.75-inch diameter casing in the same nested borehole.

Final Direction

The Permittee must meet the deadlines specified in the Compliance Schedule at the end of this letter. The Interim Measures, Groundwater Investigation, and Vadose Zone Work Plans must be revised and resubmitted by the Permittee to the NMED for its review and approval by **March 31, 2011**. The revisions of the Vadose Zone, Interim Measures, and Groundwater Investigation Work Plans must address the comments noted herein and incorporate the requirements set forth in this letter. The Permittee shall also implement the interim measures and other actions as directed under Part 1 of this letter by the dates indicated and in accordance with the Compliance Schedule.

To the extent any requirement of this letter requires access to property not owned or controlled by the Permittee, the Permittee shall use its best efforts to obtain access from the present owners of such property to conduct the required activities. In the event that access is not obtained when necessary, the Permittee shall immediately notify the Department in writing regarding its best efforts and its failure to obtain such access.

The Permittee must document all field activities in accordance with Permit Part 6.5.2. All equipment that is not disposable must be decontaminated pursuant to Permit Part 6.5.3. All equipment that requires calibration must be calibrated as required under Permit Part 6.5.4. Sample handing, shipping, and custody procedures must comply with Permit Part 6.5.5. The collection and management of investigation-derived waste must conform to Permit Part 6.5.7. Well and boring locations must be surveyed in accordance with Permit Part 6.5.8. Field quality control samples must be collected and analyzed for all environmental media pursuant to Permit Parts 6.5.14 and 6.5.17.6. Laboratory analyses, including laboratory quality control samples, must be conducted as required under Permit Part 6.5.18. Field and laboratory quality control data must be reviewed and validated in accordance with Permit Part 6.5.18.3. Reporting of field activities, including sampling and analysis results, completion of soil borings, geologic and geophysical logging, and well installations, must be as directed by NMED's letter of June 4, 2010, for quarterly reporting.

The requirement under Permit Part 6.1.2 that the Permittee is to notify the NMED a minimum of 15 days in advance of field activities is waived for the work to be completed in the following sections of Part 1 of this letter: *A. Installation of New Groundwater Monitoring Wells, B. Development of Existing Wells, C. Geophysical Logging of Existing Wells, D. Completion of Soil Borings, Installation of New Soil-Gas Monitoring Wells, and I. Soil-Vapor Extraction.* The Permittee shall instead notify the NMED of these field activities by e-mail or letter by no later than the date that each of the activities begins.

Compliance Schedule

Revisions to Work Plans	
Submittal	**Due Date**
Interim Measures Work Plan	March 31, 2011
Vadose Zone Work Plan	March 31, 2011
Groundwater Investigation Work Plan	March 31, 2011
Well Installations, Soil Borings, Interim Measures, and other Actions	
Activity	**Completion Due Date**
Complete installation of new groundwater monitoring wells	April 28, 2011
Complete development of existing wells	February 15, 2011
Complete geophysical logging of existing wells	February 15, 2011
Complete soil borings	February 11, 2011
Complete installation of new soil-gas monitoring wells	February 11, 2011
Complete geophysical logging of new groundwater and soil-gas wells	June 1, 2011
Complete excavation of soil at former Fuel Offloading Rack	October 6, 2011
Complete investigation of piping from Building 1033 to storage tanks	March 7, 2011
Complete preparation of locations for soil-vapor extraction	February 15, 2011
Submit SVE Optimization Plan to NMED	March 31, 2011
Complete Radius of Influence tests	April 6, 2011
Complete Hydrocarbon Baildown tests	March 2, 2011
Complete PneuLog tests	December 21, 2011
Provide LNAPL sample to Scientific Laboratory Division of NM Department of Health	March 31, 2011
Notify NMED that LNAPL sample has been delivered to Scientific Laboratory Division of NM Department of Health	No later than 1 business day following delivery of the sample.

LNAPL Plume

NMED's directives as expressed in its April 2, 2010, letter and the August 6, 2010, NOD required the Permittee to provide an Interim Measures Work Plan to conduct interim measures to remediate the LNAPL plume within five years. The revised Interim Measures Work Plan submitted November 4, 2010, does not contain such a plan. Rather than complying with NMED's direction to take immediate action to conduct LNAPL remediation, the Permittee proposes in the revised Interim Measures Work

Plan to conduct various tests. This same approach was proposed in the Permittee's June 18, 2010 version of the Work Plan, and was found unacceptable by NMED (*see* August 6, 2010 NOD).

On December 1, 2010, the Permittee submitted a separate plan to contain the LNAPL plume by proposing to pump and treat contaminated groundwater at the leading edge of the LNAPL plume. NMED will review this plan to determine whether it meets NMED's directives of April 2, 2010, and the NOD issued August 6, 2010, and otherwise proposes a sound technical approach. NMED's action on that plan will be provided under separate cover.

The Permittee must respond to this letter to my attention, with copy to Mr. Bill Olson of the NMED Ground Water Quality Bureau, and Mr. William Moats (NMED HWB, 5500 San Antonio NE, Albuquerque, NM 87109), on all correspondence and required plans and reports related to the Bulk Fuels Facility Spill, unless otherwise directed by NMED. All submittals and correspondence must be submitted in hardcopy and electronic format.

Please contact me directly at 505-476-6016 should you have any questions. Questions of a technical nature may also be directed to William Moats of my staff at (505) 222-9551.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

cc: J. Kieling, NMED HWB
W. Moats, NMED HWB
W. McDonald, NMED HWB
S. Brandwein, NMED HWB
B. Olson, NMED GWQB
B. Swanson, NMED GWQB
L. Barnhart, NMED OGC
B. Gallegos, AEHD
B. Gastian, ABCWUA
L. King, EPA-Region 6 (6PD-N)
T. Chapman, DOH SLD
File: Reading and KAFB 2010

ATTACHMENT 4

May 31, 2011 Correspondence from the NMED HWB to Colonel Robert L. Maness, Base Commander, 377 ABW/CC and Mr. John Pike, Director, Environmental Management Section, 377 MSG/CEANR

Re: LNAPL Containment Interim Measure Work Plan, Bulk Fuels Facility Spill, Kirtland Air Force Base, HWB-KAFB-10-037

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NEW MEXICO ENVIRONMENT DEPARTMENT

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SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

DAVE MARTIN
Secretary

RAJ SOLOMON, P.E.
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

March 31, 2011

Colonel Robert L. Maness
Base Commander
377 ABW/CC
2000 Wyoming Blvd. SE
Kirtland AFB, NM 87117-5606

Mr. John Pike
Director, Environmental Management Section
377 MSG/CEANR
2050 Wyoming Blvd., Suite 116
Kirtland AFB, NM 87117-5270

RE: LNAPL CONTAINMENT INTERIM MEASURE WORK PLAN
BULK FUELS FACILITY SPILL
KIRTLAND AIR FORCE BASE
EPA ID# NM9570024423, HWB-KAFB-10-037

Dear Col. Maness and Mr. Pike:

The New Mexico Environment Department (NMED) received on December 1, 2010 the *Light Non-Aqueous Phase Liquid (LNAPL) Containment Interim Measure Work Plan* for Kirtland Air Force Base's (KAFB, or the Permittee) Bulk Fuels Facility Spill (Solid Waste Management Units (SWMUs) ST-106 and SS-111), dated November 2010, hereafter referred to as the Work Plan. In NMED's letter of April 2, 2010, the Permittee was directed to propose interim measures to stop the migration of the light nonaqueous phase liquid (LNAPL, or NAPL) plume and complete remediation of the plume within five years. The Work Plan has merit in that it presents a conceptual design for a pump-and-treat system to arrest migration of the LNAPL plume. Even though it does not have as a primary objective clean up of the bulk of the LNAPL that has been released, if successful, it could provide interim protection to allow for more time to develop and implement other remedial alternatives to clean up the vadose zone, LNAPL, and dissolved-phase groundwater contamination.

The Work Plan emphasizes that many details of the pump-and-treat system cannot be developed at this time because of the need to first obtain the requisite characterization information described

in the Work Plan primarily in Sections 1 through 6. The NMED concurs with the Permittee that collection of characterization data is a necessary precursor to the proposed interim measure, hence the need for a separate characterization plan. The revised Work Plan to be submitted in response to this letter, on the other hand, needs to focus on the design and operations aspects of the pump-and-treat system, and be developed after the characterization data has been obtained. Separating characterization work from the pump-and-treat system design will simplify the objectives of each plan, which is needed due to the complexity of the proposed pump-and-treat system.

The characterization plan must include proposed work to conduct the pumping tests and installation of the extraction and injection wells in addition to the other characterization activities proposed in Sections 1 through 6 of the Work Plan. Comments concerning characterization are addressed chiefly in Part 1 of this letter and primarily pertain to Sections 1 through 6 of the Work Plan.

Part 2 of this letter pertains chiefly to the design of the pump-and-treat system, found primarily in Sections 5 and 7 of the Work Plan. The design of the pump-and-treat system in the Work Plan must be revised to take advantage of the information obtained through implementation of the characterization plan, the Vadose Zone and Groundwater Investigation Plans, and the Interim Measures Work Plan.

PART 1 – COMMENTS ON CHARACTERIZATION

The following comments must be addressed in the characterization plan, and where directed in this Part, in both the characterization plan and the revised Work Plan.

1. Table 1-1 – Prepare the characterization plan to discuss the type of analyses that are intended for the parameter "NAPL cleaning." Identify the analytical laboratory that will be performing the analysis for hydrocarbon degrading bacteria.

2. Section 2.3 – NMED approval must be obtained for any changes to previously-approved work plans

3. Section 2.3 – Prepare the characterization plan to indicate where the Field Change Request form is to be found.

4. Section 4.4.1 – Prepare the characterization plan to indicate where Building 2405, the JP-8 offloading rack, is located on Figure 3-2.

5. Section 4.7 – Specific receptor points must be identified, such as the WUA, KAFB, and the Veterans Administration water supply wells.

6. Figure 5-2 – It is difficult to review data on Figure 5-2 due to the background aerial photograph. Provide an additional figure that leaves only major streets and/or other major features for reference to improve readability of the presented data.

7. Section 5.2.1 – Slug tests are proposed for wells KAFB-1065, KAFB-1066, KAFB-1068, KAFB-1069, KAFB-10610, and KAFB-10614. Additional hydraulic conductivity data for locations closer to the proposed extraction and injection wells are needed to better define the magnitude and spatial variability of hydraulic conductivity within the proposed containment area. At a minimum, conduct additional slug tests at wells KAFB-10613, KAFB-10617, KAFB-10618, KAFB-10619, KAFB-10620, KAFB-10628, and as appropriate, at new wells installed under the Groundwater Investigation Work Plan.

8. Section 5.2.1 – There is a high likelihood that the presence of LNAPL will affect the outcome of the slug tests. It is therefore critical that the thickness of the LNAPL be measured immediately prior to and after the slug tests are performed, and the results recorded. Specify how the presence of LNAPL will be addressed during field data collection and how it may affect the slug test results.

9. Section 5.2.1 – Indicate and explain the method that will be used to evaluate slug test data.

10. Section 5.2.1 – Specify the size of slug or slugs that will be used.

11. Section 5.2.2 – In addition to the locations specified in Section 5.2.2, collect and analyze LNAPL and groundwater samples from well KAFB-10628, the extraction and injection wells, and any additional observation wells (see Comments #21 and 22 of Part 1 of this letter) installed for conducting the pumping tests.

All wells must be properly developed and purged before groundwater samples are collected for analysis in accordance with the KAFB Hazardous Waste Facility Permit (Permit) Parts 6.5.17.10.6 and 6.5.17.4.

12. Section 1.2, Item #2 – This section discusses various analytes for testing but is not consistent with worksheet 18g in Appendix B, UFB-QAPP. Correct the work sheet as appropriate.

13. Section 5.2.3 – Indicate whether the 3D model incorporates the potential for transient flow from KAFB and Veterans Administration water-supply wells.

14. Section 5.2.3 – NMED assumes the Permittee has a conceptual geologic model for the capture-zone modeling. It was therefore surprising that a RockWorks™ model for the Bulk Fuels Facility Spill was not provided in the Work Plan. Such a geologic model must be included in both the characterization plan and the revised Work Plan. Update the geologic model for each

of the plans to include newly collected geological and geophysical data, as applicable, obtained through implementation of the Vadose Zone and Groundwater Investigation Plans.

15. Section 5.3.1 – Clarify if the definition for residual saturation only applies to nonwetting liquids (as indicated in the first sentence), given that annotations for both wetting fluid and nonwetting fluid (S_{rw} and S_{rnw}) are provided in the second sentence.

16. The Permittee's analysis indicates that two extraction wells will capture the LNAPL plume, assuming the hydraulic parameters used in the analysis are reasonably accurate. However, there is considerable uncertainty regarding these parameters. The last three bullets of Section 5.1 indicate that a feasibility analysis was performed that resulted in the selection of a two-well hydraulic extraction system. NMED agrees that a system with two vertical extraction wells is better than one vertical well for the reasons described. However, the same logic can be used to validate the efficiency of three vertical extraction wells or more. While the Permittee has demonstrated that one extraction well is inadequate, the optimum number is still in question. The proposed two-well system may in fact not provide adequate capture of the LNAPL plume. At least one additional extraction well should be considered to provide system redundancy, enhance system flexibility, and facilitate monitoring during system performance and pumping tests. The suggested location for the well is midway between proposed wells KAFB-106108-NAPL and KAFB-106109-NAPL (see Figure 1 of this letter).

This additional extraction well would provide additional benefits, including system back-up for the proposed primary extraction wells during down times, and (if not being pumped) water-level measurements within the capture zone between the active extraction wells. Even if not brought online immediately, it could be activated as a primary extraction in the future well to facilitate adequate capture.

17. NMED does not approve of a cross-gradient location of the injection well, as specified in Section 6.2 and as shown on Figures 5-1, 5-2, and 6-1 of the Work Plan. This objection was first expressed by the NMED in its public meeting held on January 12, 2011, where representatives of KAFB were present. The injection well must be located upgradient of the LNAPL plume within the area shown on Figure 1 of this letter such that any contaminated water for which treatment fails to achieve clean up goals will be recaptured by the containment system or other future remedial system. The proposed injection well location is not acceptable because detectable levels of contaminants would be introduced into a portion of the aquifer near a water supply well where contamination is not known to exist. Also, this area would not be subject to capture and subsequent treatment, putting the water supply unnecessarily at risk.

The combination of a pump-and-treat system with an upgradient injection area provides a circulation cell whereby treated water is drawn into the upgradient portions of the plume in the capture zone. This imparts a flushing effect and serves to enhance hydraulic movement of the plume toward the extraction location, which should accelerate cleanup of the LNAPL and dissolved phase plume. NMED acknowledges the Permittee's March 24, 2011 letter and attachment to the Albuquerque Bernalillo County Water Utility Authority (WUA), in which Dr.

Gary Hecox opines that upgradient injection would "lead to spreading of the dissolved-phase contaminant plume outside containment area" due to influx of regional groundwater into the capture zone. NMED has not noted this phenomenon at other pump-and-treat systems with upgradient injection in New Mexico, and without supporting data, is not persuaded by this argument.

18. Collect samples for lab measurements of grain size distribution, hydraulic conductivity, specific yield, and porosity at the injection well, extraction wells, and any additional observation wells (see Comments #21 and 22 of Part 1 of this letter).

19. Sections 6.2.1.3 and 6.2.1.5 and Figures 6.2 and 6.3 – The text of these sections do not agree in all cases with what is shown on Figures 6-2 and 6-3.

a) Section 6.2.1.5 states that the thickness of bentonite seal will be a minimum of 5 feet but Figures 6-1 and 6-2 show the thickness as 10 ft.

b) Sections 6.2.1.3 and 6.2.1.5 state the estimated depth of the extraction wells as 550 feet, but Figure 6-2 shows the bottom of each well's filter pack to be 600 feet.

c) Section 6.2.1.3 states "the injection well boring will be drilled to 100 ft below the first encountered groundwater (approximately 550 feet)." It is unclear if the 550 feet refers to groundwater or well depth, but in any case, the water level is shown on Figure 6.3 at 500 feet and the bottom of the well at 600 feet.

d) Figure 6-3 shows 6-inch inside diameter (ID) casing as having an 8-5/8- inch outside diameter (OD). Correct these specifications as applicable.

e) Clarify if the 13-3/8-inch surface casing shown on Figures 6-2 and 6-3 extends down to approximately 200 feet (the approximate depth of the 13-¾-inch drive casing mentioned in Section 6.2.1.3). If the latter is true, clarify also in the well installation procedure in Section 6.2.1.5, which does not mention a 13-¾-inch borehole diameter.

20. Section 6.2.1.4 – Prepare geologic logs for all wells, including any observation wells (see Comments #21 and 22 of Permit Part 1 of this letter).

21. Section 6.2.2 –

a) The expected drawdowns at wells that are to serve as observation wells for the pumping tests are not discussed. It is unclear which wells are to be used as observation wells, and the closest monitoring well (which has yet to be installed) would be about 200 feet from the nearest extraction well. A pumping test conducted at approximately 50 gpm in nearby well KAFB ST-105 achieved drawdown of only about 0.3 feet in an observation well only 70 feet away. NMED is therefore concerned that the distances between possible observation wells and

the extraction/injection wells may be too large for the observation wells to serve effectively for pumping tests. To resolve this, an extraction/injection well can be moved closer to an existing well to increase the likelihood of achieving a predicted drawdown scenario, provided the well can still adequately serve its intended purpose for the pump and treat system.

b) At a minimum, initially model drawdown for each pumping well at 50, 100, and 250 feet, or the distance between the pumping well and the intended observation wells, using hydraulic conductivities of 131 and 246 ft/day for 24 and 72 hour tests, the hydraulic conductivities reported in Table 3-2 of Appendix B of the *Stage 2 Abatement Plan for Nitrate Contaminated Groundwater at Kirtland Air Force Base*, dated December 2009. Site-specific gradients and other hydraulic parameters must be used in the modeling to the extent that they are known. All modeling parameters and assumptions must be discussed in detail. Additional monitoring wells may be required for the pumping tests based on initial modeling.

c) Specify which wells will be used for observation wells for each of the well pumping tests and their distances from the pumping well, which wells will undergo pumping tests for 24 hours and which for 72 hours, and the minimum drawdown that the Permittee believes can be measured in the field with reasonable certainty that the measurements are accurate. Discuss the potential error in the drawdown measurements and demonstrate that the expected minimum drawdown value can be distinguished from water-level decreases caused by changes in barometric pressure or other possible sources of error.

d) Propose a plan to determine specific yield from the pumping tests.

e) The NMED recommends that the Permittee consider using at least two observation wells for each pumping test, and also to consider using observation wells oriented parallel to and perpendicular to the major axis of the LNAPL plume. Horizontal anisotropy may be present with greater hydraulic conductivity in a north-south direction compared to that in the east-west direction (see U. S. Geological Survey Water-Resources Investigations Report 02-4200, page 19).

22. If appreciable drawdown is not observed for at least one observation well for a given pumping test, and taking other actions fail to produce appreciable drawdown, at least one observation well closer to the pumping well must be installed, and the pumping test for the well repeated. The location of new observation wells must be approved by NMED prior to their installation.

23. The volume of wastewater expected from the pumping tests could exceed 200,000 gallons. According to Table 2 of Appendix C, the proposed method for treatment/disposal of investigation-derived wastewater is "Discharge to ground surface per approval." Discharge of pumping-test water to the ground may not be acceptable given the expected contaminated nature

of the water from the extraction wells, which potentially may be a hazardous waste because of the toxicity of benzene. Even if treated, the wastewater from the pumping tests must be contained, sampled, and disposed of in accordance with Permit Part 6.5.7. Discharge to the ground surface must be approved in advance by NMED's Ground Water Quality Bureau. Discuss in detail in the characterization plan the means by which investigation-derived wastewater and other investigation-derived waste will be managed and disposed of.

24. Section 6.3 – This section implies that geophysical logging for the extraction and injection wells will be performed within steel-drive casing after total depth has been reached and before well construction. EM induction logging is generally used for uncased boreholes or polyvinyl chloride (PVC) cased wells, and therefore may not be effective under these circumstances. Describe the effectiveness of each logging tool when employed in steel-drive casing if this is indeed the plan.

25. Section 6.3.1 – Prepare geophysical logs for all wells, including any observation wells (see Comments #21 and 22 of Permit Part 1 of this letter).

26. Section 6.3.1 – This section discusses the use of a caliper tool. Because geophysical logging is presumably planned to be conducted within drive casing having a constant inside diameter, the purpose of the caliper logging in this application is unclear and its use potentially unnecessary.

27. Section 6.3.2 – This section states "The borehole induction system can be used in boreholes that range from 2 to 8 inches in diameter without significant borehole effects." Because the proposed boreholes are larger than 8-inches in diameter, explain what the significant borehole effects are or could be expected, and how these effects will be mitigated or taken into account.

28. Section 6.3.2 – Prepare the characterization plan to indicate whether the induction logging tool will be centralized. Provide the focusing radii of the medium and deep dual induction tool.

29. Section 6.3.5.1 – The Work Plan states that the cable to be used to conduct geophysical logging tool is long enough to log to depths of 600 ft. Section 6.3.2 says "the depth of measurement ...will be 650 ft." Correct the text of these sections to be consistent in that logging must be conducted from surface to total depth of each well.

30. Section 6.4 – Include a proposal to submit quarterly reports to the NMED.

31. The thickness of the aquifer is likely greater than 60 ft, and thus, the pumping wells will likely not fully penetrate the aquifer. Provide a detailed discussion in the characterization plan on how the true thickness of the aquifer may affect the results of pumping-test drawdown and how the modeling of drawdown has taken this into account.

32. Include a water-level map in the characterization plan (see Comment #2 in Part 2 of this letter).

PART 2 – COMMENTS ON DESIGN OF PUMP-AND-TREAT SYSTEM

The following comments must be addressed in the revised Work Plan, and where directed in this Part, in both the characterization plan and the revised Work Plan.

1. The thickness of the aquifer is likely greater than 60 ft. It is therefore likely that the extraction wells will probably not fully penetrate the aquifer. The revised Work Plan must contain a detailed discussion on how the true thickness of the aquifer may affect the results of drawdown, and thus, the extent of the capture zone and how the modeling of the capture zone has taken this into account.

2. Figure 5-2 – Prepare an additional figure showing the water table utilizing data from the wells shown on this figure, new monitoring wells to be installed under the Groundwater Investigation Work Plan, and the following wells: KAFB-0508, KAFB-0510, KAFB-0118, KAFB–0119, KAFB-0121, KAFB-0524, KAFB-3, KAFB-14, KAFB-15 and KAFB-16.

3. Section 5.2.3 – As indicated in Comment #14 in Part 1 of this letter, include a geologic model in the characterization plan and the revised Work Plan.

4. Section 5.2.4 – Clarify in the revised Work Plan if the vertical capture of contaminants is an objective of this interim action.

5. Section 7 – This section of the Work Plan does not provide an adequate discussion of the sampling and analysis of groundwater after it has been treated. Provide in the revised Work Plan details concerning:

a) a sampling port for effluent;

b) parameters to be tested for;

c) laboratory testing methods and detection limits;

d) frequency of analysis of effluent; and

e) quality assurance/quality control.

NMED's Ground Water Quality Bureau may direct further sampling and analysis requirements through any permits it may issue regarding reinjection of treated water.

6. Explain in the revised Work Plan the corrective action procedures that will be conducted if a sample of effluent fails any clean up goals.

7. Figure 7-1 – Explain in the revised Work Plan with notes added to the figure all acronyms used on the figure.

8. Section 7.2.2 – This section discusses discharge limits established under 20.6.2.3103 NMAC. The Permittee must also abide by the clean up goals established in Permit Part 6.2.3.

9. Section 7.3.1 –Indicate in the revised Work Plan what pre-design data will be collected to refine the design of the treatment process.

10. Section 7.4 – This section does not discuss the vapor GAC unit seen on Figure7-1. Discuss in the revised Work Plan if there are any air emissions from this GAC unit (or anywhere else in the system) and discuss if an air quality permit will be or may be necessary. Discuss if there will be a sampling port for vapor at the unit.

11. Section 7.4 – Indicate in the revised Work Plan if the piping to and from the treatment building is to be located above ground or below ground. Indicate also if cathodic protection or freeze protection is necessary.

12. Appendix B: Uniform Federal Policy – Quality Assurance Project Plan (UFP-QAPP) (labeled as Pending Review) – The plan appears to be a combination of many types of plans, such as project management, training, data validation, quality assurance, and sampling and analysis plans. Much of the information presented appears to be overly burdensome and not particularly useful in the present format.

Revise Appendix E into multiple appendices to separate the various types of plans (e.g. project management, training, data validation, quality assurance, and sampling and analysis). As expressed in our meeting on January 6, 2011, NMED is expecting a Quality Assurance (QA) Plan that contains quality assurance and quality control activities specific to the project. The QA plan is to integrate all technical and quality aspects of the project to ensure that the necessary type and quality of data are obtained.

Explain also what is meant by "Pending Review." If the document is considered a draft document because it is labeled "Pending Review," it must be finalized before re-submitting it to the NMED.

13. Provide more detail and clarification of the criteria to be used to demonstrate adequate capture of the LNAPL plume by the extraction wells. Refer to the "Six Steps for Systematic Evaluation of Capture Zones" provided in Environmental Protection Agency (EPA), 2008a, available at http://www.epa.gov/nrmrl/pubs/600R08003/600R08003.pdf. The approach must include, but not be limited to:

a) Documentation of pumping performance over time (e.g., were there any down times);

b) Water-level measurements and interpreted flow paths that demonstrate drawdown at or near the extraction wells, and reverse gradients north of the extraction wells;

c) Modeled water-level contours, particle tracks, and drawdown/buildup contours; and

d) Analytical monitoring data from downgradient wells.

Adequate capture of the plume must be demonstrated with empirical data derived from water-level measurements showing the presence of a groundwater divide at or beyond the leading edge of the LNAPL plume. Additional groundwater monitoring wells may be necessary to make this demonstration.

14. Section 5.2.4 lists the hydraulic gradient used as input for the capture zone model as 0.004 ft/ft. Because gradient has a significant influence on the predicted capture zone, explain why measured hydraulic gradient ranges from about 0.001 to 0.0015 ft/ft (based on water levels observed at existing wells) were not used.

15. In both the revised Work Plan and the characterization plan, evaluate and discuss the results of the existing step drawdown tests of nearby WUA or KAFB wells as they may relate to the capture zone model results and the proposed pumping tests. For example, the specific capacity of Ridgecrest #3 (on the order of 75 gpm/ft) and the specific capacities of wells KAFB-3, KAFB-15, KAFB-16 (60-80 gpm/ft) imply that a pumping rate of 50-100 gpm at the extraction wells may not yield the 5 ft of predicted drawdown shown on Figure 5-2 of the Work Plan. The pumping test conducted at ST-105 also suggests that the expected drawdown may not be achieved.

16. Section 5.2.4 does not seem to use representative site-specific water-level elevations. The fifth bullet of in Section 5.2.4 indicates "groundwater elevation 4900 used as reference head from measured water table elevations." However, the document *Kirtland Air Force Base, New Mexico, Quarterly Remediation and Site Investigation Report for the Bulk Fuels Facility Spill, July 2010 through September 2010* (dated November 2010) presents actual measured water-level elevations ranging from approximately 4,852 to 4,857 ft amsl, which are approximately 20 to 40 ft lower than those used in the model (see Figure 5-2, which shows groundwater elevations of 4,874 to 4,894). Explain the differences in water-level elevations or correct as appropriate, using site-specific data when available.

17. Section 5.2.4 – In the second full paragraph, first sentence, indicate whether the intent is to span the entire width of the dissolved plume for the target capture zone or just the width of the LNAPL plume.

18. Section 5.2.4 – This section contains the sentence: "The actual hydraulic capture zone will be determined using conventional capture-zone methods, including the Darcy Flow GIS

[geographic information system] method (e.g., EPA, 2008a)." The "Darcy Flow GIS method" is not discussed in the reference given. Include in the revised Work Plan the Six Steps for Systematic Evaluation of Capture Zones, as discussed in Exhibit 1, Section A of the given reference and as included below.

Step 1: Review site data, site conceptual model, and remedy objectives;

Step 2: Define site-specific target capture zone(s);

Step 3: Interpret water levels (from potentiometric surface maps and water level pairs);

Step 4: Perform calculations (capture zone width calculations, and numerical modeling);

Step 5: Evaluate concentration trends; and

Step 6: Interpret actual capture based on Steps 1-5.

See also Comment #13 of Part 2 of this letter.

19. Section 5.4 – Provide a description of the pump system planned for the extraction wells to recover LNAPL. Although the proposed extraction wells are to be located in an area with thin LNAPL, it is reasonable to expect that LNAPL will eventually accumulate in the resulting cone(s) of depression. LNAPL removal and inducing the formation of a cone of depression appear to be contradictory goals for a single pump in an extraction well. Indicate if a two pump system will be used, and if not, explain how the accumulated LNAPL will be removed and total fluids treated.

20. Section 5.4, Bullet 7 – Indicate specifically which wells are to be used to assess the performance of the remediation system. Also, define the term "liquid level measurement."

21. Section 6.1 – This section discusses permitting, which does not clearly indicate that a discharge permit for the injection well must be obtained from the NMED Ground Water Quality Bureau, which typically takes a minimum of four to six months to obtain (or more time if a public hearing is held). Furthermore, Section 6.1 does not mention if a treatment permit is or may be required under the New Mexico Hazardous Waste Management Regulations, 20.4.1 NMAC. Indicate in the revised Work Plan and the characterization plan that a discharge permit will be acquired from the NMED Ground Water Quality Bureau, and evaluate the need for a treatment permit under the New Mexico Hazardous Waste Act.

Additionally, permits may be required from the Office of the State Engineer. Indicate in the characterization plan and the revised Work Plan if permits must be obtained from the Office of the State Engineer to conduct the pumping tests or to operate the pump-and-treat system. Also indicate if water rights will need to be procured to conduct any of the proposed extraction.

The schedule in Appendix E implies a discharge permit would be obtained in about 3 months. The schedule should be revised to include a more realistic time frame for the acquisition of a discharge and any other required permits.

22. Section 6.2.1.5 – This section discusses a 60-feet length of screen for the extraction wells. Describe in the revised Work Plan the expected depths at which the pumps will be set in the extraction wells.

23. Quarterly reports must be prepared and combined with other quarterly reporting as specified in NMED's letter of June 4, 2010. The quarterly reports must document the construction, maintenance, and operation of the pump and treat system, and must summarize the analytical water-quality data for both treated and untreated groundwater.

25. Final Report (Interim Measures Report) – Appendix E, *Project Schedule*, indicates that an Interim Measures Report will be submitted after construction of the pump and treatment system. Provide additional details of the planned content of this report. At a minimum this report must meet the requirements of Permit Parts 6.2.2.2.12.5 and 6.2.4.10.

Final Direction

The Permittee's letter of December 3, 2010 states that the certification that accompanies documents like the revised Work Plan and the characterization plan must be signed by the commander of KAFB (currently Col. Maness). NMED notes that the certification that was submitted with the Work Plan was signed by Mr. Wayne Bitner, who does not appear to be authorized to sign for the Permittee in these matters. Submit the certification with the appropriate signature for the characterization plan and the revised Work Plan.

The characterization plan and the revised Work Plan must address the comments noted herein and incorporate the requirements set forth in this letter as they apply to each plan. The characterization plan must be submitted to the NMED no later than **June 15, 2011**. The characterization plan must also contain a schedule of the work to be completed under the plan, including the submittal of a report of the results to the NMED. The report must be submitted to the NMED by no later than **February 1, 2012**. The revised Work Plan must include sufficient detail that the pump-and-treat system could be constructed and operated under provisions of the plan with a reasonable expectation that its operation will be successful in stopping the migration of the LNAPL plume. The revised Work Plan must be submitted to the NMED no later than **April 1, 2012**. A certification must be included in the revised Work Plan, signed and stamped by a professional engineer registered in New Mexico, stating that the design and specifications of the pump and treat system have been reviewed by him/her, and a reasonable standard of care was used in designing the pump-and-treat system to meet the stated goal of stopping the migration of the LNAPL plume. The Permittee cannot construct or operate the pump-and-treat system until such time that it obtains NMED approval.

This corrective action is being conducted under the aegis of the Permit. Specifically, all field activities must be completed in accordance with Permit Part 6.5.2. All equipment that is not disposable must be decontaminated pursuant to Permit Part 6.5.3. All equipment that requires calibration must be calibrated as required under Permit Part 6.5.4. Sample handing, shipping, and custody procedures must comply with Permit Part 6.5.5. The collection and management of investigation-derived waste must conform to Permit Part 6.5.7. Well locations must be surveyed in accordance with Permit Part 6.5.8. Field quality control samples must be collected and analyzed for all environmental media pursuant to Permit Parts 6.5.14 and 6.5.17.6. Laboratory analyses, including laboratory quality control samples, must be conducted as required under Permit Part 6.5.18. Field and laboratory quality control data must be reviewed and validated in accordance with Permit Part 6.5.18.3. Reporting of field activities, including sampling and analysis results, completion of geologic and geophysical logging, and well installations, must be as directed by NMED's letter of June 4, 2010, for quarterly reporting.

NMED also notes that the WUA has submitted comments on the Work Plan to the Permittee, and urges the Permittee's thoughtful consideration of the WUA's comments in development of the characterization plan and the revised Work Plan.

As part of the response letters that accompany the characterization plan and the revised Work Plan, include a table that details where all revisions have been made to the plans and that cross-references NMED's numbered comments. Submittals (including maps and tables) must be in the form of two paper copies and one electronic copy in accordance with Permit Part 1.36.

Respond to this letter to my attention, with copy to Mr. Bill Olson of the NMED Ground Water Quality Bureau, and Mr. William Moats of my staff (NMED HWB, 5500 San Antonio NE, Albuquerque, NM 87109). NMED invites the Permittee to meet regarding the issues raised in this letter. Please contact me to arrange such a meeting, or should you have any questions.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

Attachment: Figure 1

cc: R. Solomon, Deputy Cabinet Secretary, NMED
J. Kieling, NMED HWB
W. Moats, NMED HWB
W. McDonald, NMED HWB
S. Brandwein, NMED HWB

B. Olson, HWB GWQB
B. Swanson, HWB GWQB
L. Barnhart, NMED OGC
B. Gallegos, AEHD
R. Shean, ABCWUA
L. King, EPA-Region 6 (6PD-N)
File: Reading and KAFB 2010

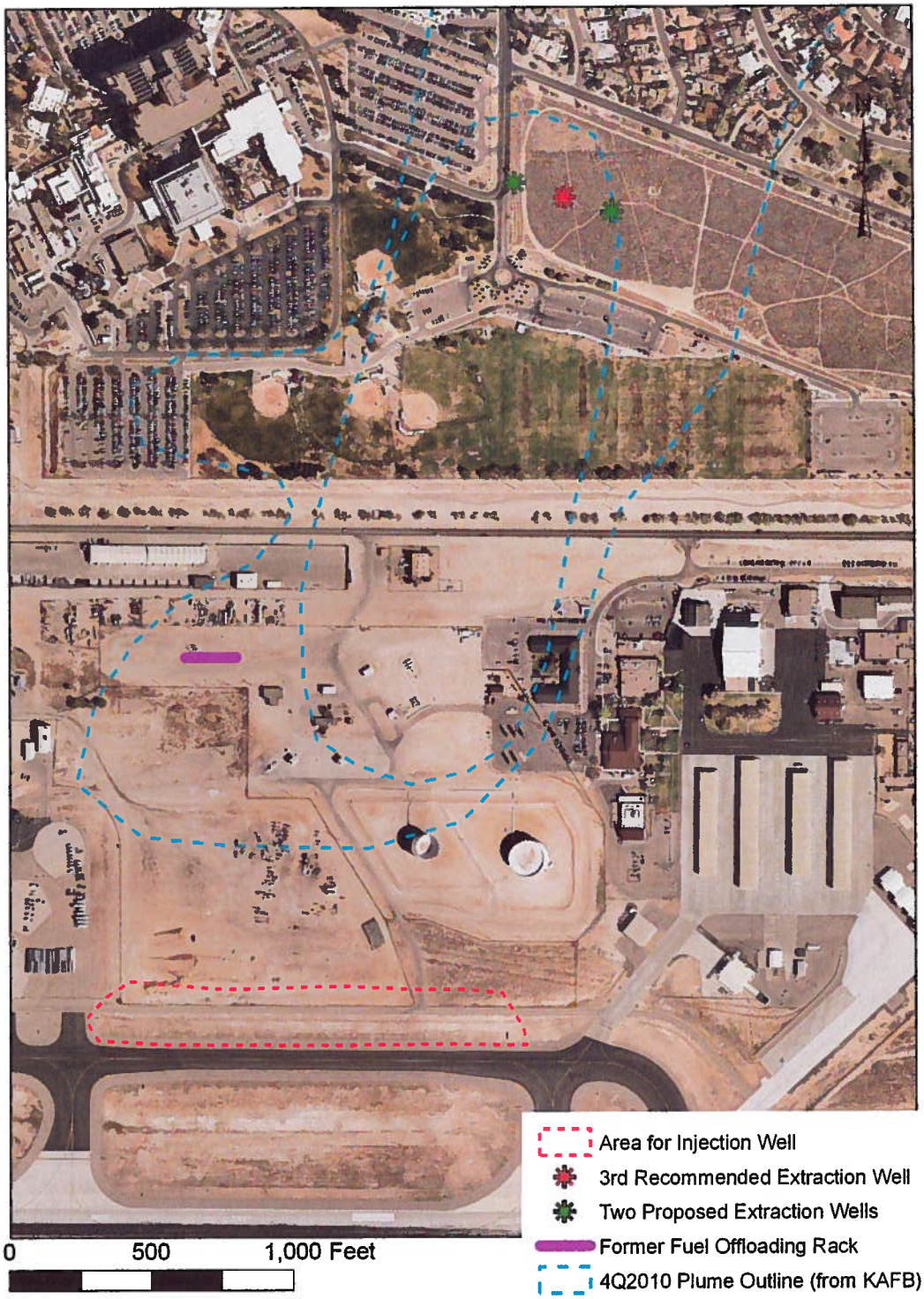

Figure 1. Locations for Extraction Wells and Injection Well