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ENTERED

March 27, 2006

Mr. David Cobrain
State of New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East
Building One
Santa Fe, New Mexico 87505-6303



Reference: Work Assignment No. 06110.270; State of New Mexico Environment Department, Santa Fe, New Mexico; Support for the LANL Order of Consent; Review of the Middle Mortandad/Ten Site Canyon Aggregate Investigation Report, Los Alamos National Laboratory, New Mexico, Task 3 Deliverable.

Dear Mr. Cobrain:

This letter serves as a deliverable addressing the review of the "Middle Mortandad/Ten Site Canyon Aggregate Investigation Report," Los Alamos National Laboratory, New Mexico (herein referred to as the Investigation Report).

As discussed between Ms. Neelam Dhawan (NMED) and Ms. Paige Walton (TechLaw), NMED wishes to address the issue of evaluating the Middle Mortandad/Ten Site Canyon Aggregate areas on a solid waste management unit (SWMU) or area of concern (AOC) basis, instead of lumping all SWMUs and AOCs into a single large unit. The concerns were that 1) there could be a possibility of dilution of higher levels of contamination, and 2) some SWMU and/or AOCs might meet residential standards if evaluated individually. Ms. Walton agreed, that these are realistic scenarios and agreed that if an area could be marked for no further action, this would benefit both NMED and Los Alamos National Laboratory (LANL). In response, some further evaluation of the risk assessment was conducted to evaluate these issues. The following summarizes this additional review.

1. An Excel spreadsheet has been provided as an attachment to this letter deliverable. The Ten Slope Site Areas A and B were broken into individual SWMUs and AOCs. For Ten Slope Site Area A, Figures F-4.2-4, F-4.2-6, and F-4.2-8 from the above-referenced investigation report were used to identify the specific units as well as to extract sampling data. The units were evaluated as three individual areas: AOC 35-016(j), AOC 35-014(g)3, and consolidated unit 35-014(g)-00. For Ten Site Slope Area B, Figures F-4.2-5, F-4.2-7, and F-4.2-9 were referenced. For Area B, only four of the units were evaluated: AOC 35-016(b), consolidated unit 35-004(g)-00, consolidated unit 35-016(c)-00, and consolidated unit 35-016(a)-00. While several other units are identified within the boundary of Area B, this was only an example exercise and not meant to be a



complete evaluation.

2. The evaluation was based upon the maximum detected values listed on the figures, and included organics, inorganics, and radionuclides. The industrial exposure level was assumed to be zero (0) to one (1) foot (ft) while the residential exposure interval was assumed to be 0 to 10 ft. As stated above, the maximum detected concentration for each constituent in these intervals was used as the exposure point concentration. This could be an overestimate of risk, as if sufficient data are available, the exposure point concentration would be more appropriately be the 95 percent upper confidence limit of the mean (95% UCL).
3. The industrial and residential soil screening levels provided in the investigation report (Tables 4.0-1 and 4.0-2) were used for estimating hazard and risk.
4. In reviewing the investigation report, it became clear that while data was collected for TPH-DRO (total petroleum hydrocarbons/diesel range organics), the data were not included in the risk assessment. For evaluating TPH-DRO, the industrial and residential screening levels for diesel#2 as listed in the *Final Updated Petroleum Hydrocarbon Fraction Toxicity Values for the VPH/EPH/APH Methodology* (November 2003 and as reviewed and updated by TechLaw in 2005) were applied. A more conservative assumption may have been to apply the screening levels for unknown waste oil.
5. For radionuclides, a similar approach was applied. However, the radionuclide screening action levels (SALs) for industrial and residential receptors as listed in the investigation report (Table 4.0-3) were applied.
6. A final step that was done was to evaluate the potential for migration to groundwater. This evaluation was conducted using the Tier 1 approach, which assumes applies the maximum detected concentration regardless of depth. These maximum concentrations were compared to the NMED soil-to-groundwater screening levels based on a dilution attenuation factor of 20. Data from the newly revised March 2006 version of the screening levels were used.

The following tables summarize the results of the risk analysis for each of the SWMUs/AOCs evaluated using the above process. Table 1 provides a summary of chemical risk/hazard while Table 2 summarizes radiological dose.

Table 1 – Summary of Chemical Hazard and Risks, Ten Site Slope Areas A and B

Ten Site Slope Area A				
SWMU/AOC	Industrial HI	Industrial Risk	Residential HI	Residential Risk
AOC 35-016(j)	1.07E-03	7.52E-06	8.60E-03	3.61E-05
AOC 35-014(g3)	13.1	1.95E-05	5.25	7.44E-05
HI assuming TPH removal:	3.85E-03		1.93E-02	

Consolidated Unit 35-014(g)-00	6.72E-01	8.41E-07	4.03E-01	3.17E-06
Ten Site Slope Area B				
AOC 35-016(b)	N/A	N/A	N/A	N/A
Consolidated Unit 35-004(g)-00	1.14E-03	2.96E-09	9.57E-03	6.87E-07
Consolidated Unit 35-016(c)-00	2.97E-02	7.06E-08	4.22E-01	2.66E-07
Consolidated Unit 35-016(a)-00	6.80E-03	4.88E-06	5.33E-02	2.02E-05

As shown in Table 1, most of the sites could meet residential closure. For AOC 35-016(j), the risk is slightly above the target risk level of 1E-05. Benzo(a)pyrene contributes most to the risk. Localized removal of some soil could result in clean closure for this site.

For AOC 35-014(g3), the hazard index (HI) is above the acceptable target level of one (1). However, the sole driver for the elevated hazard is TPH-DRO. If removal of soil contaminated with TPH-DRO is conducted, the site easily meets residential levels.

For Consolidated Unit 35-016(a)-00, arsenic is the driver for the elevated risk. The concentration of arsenic was not significantly above background, and most likely a site attribution analysis would drop arsenic as a constituent of concern.

Table 2 shows the associated doses due to exposure to radiological constituents for each of the units in Areas A and B.

Table 2 – Summary of Radiological Dose, Ten Site Slope Areas A and B

SWMU/AOC	Industrial Dose (mrem/yr)	Residential Dose (mrem/yr)
Ten Site Slope Area A		
AOC 35-016(j)	5.71E-03	3.64E-02
AOC 35-014(g3)	0.00E+00	3.59E+00
Consolidated Unit 35-014(g)-00	1.97E+00	1.06E+01
Ten Site Slope Area B		
AOC 35-016(b)	0.00E+00	0.00E+00
Consolidated Unit 35-004(g)-00	0.00E+00	1.51E+01
Consolidated Unit 35-016(c)-00	1.13E+00	4.65E+00
Consolidated Unit 35-016(a)-00	3.12E-01	5.07E+00

The dose for both industrial and residential receptors is either at or below the target dose limit of 15 mrem/yr. Thus, radiological contamination does not appear to drive a restriction of land use.

The final analysis was to evaluate the potential to migration to groundwater. Table 3 summarizes the results of this analysis for each area.

Table 3. Evaluation of Migration to Groundwater

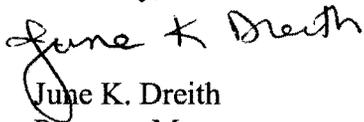
Ten Site Slope Area A		
SWMU/AOC	Constituent Exceeding SSL DAF 20	Comments
AOC 35-016(j)	Arsenic	Similar to background, may drop out with site attribution analysis
AOC 35-014(g3)	Benzo(a)pyrene	
Consolidated Unit 35-014(g)-00	None	
Ten Site Slope Area B		
AOC 35-016(b)	None	
Consolidated Unit 35-004(g)-00	None	
Consolidated Unit 35-016(c)-00	Chromium	Applied a value for hexavalent chrome instead of total chrome. Would most likely not exceed a SSL for total chromium
Consolidated Unit 35-016(a)-00	Arsenic	Similar to background, may drop out with site attribution analysis

Based upon the above analyses, TechLaw proposes the following recommendations.

1. LANL conduct a risk assessment on a SWMU/AOC bases for each area identified in the Middle Mortandad Canyon/Ten Site Aggregate report. Individual risk assessments were conducted for the Mesa Top and Mortandad Slope areas, so a similar approach should be taken for the Ten Site Slope, Pratt Canyon, Ten Site Canyon, East Ten Site Slope, and Sigma Mesa.
2. TPH-DRO data was collected but not included in the risk analyses. LANL must revise the risk assessments to address this constituent. The results of the assessment may indicate that some soil removal may be warranted, even to meet industrial closure standards.
3. LANL did not conduct an analysis of the potential for migration to groundwater. While it is noted that depth to groundwater is approximately 1000 feet, additional lines of evidence are required to support the conclusion that constituents of concern are not present at levels above the NMED SSLs based upon a DAF of 20.

This deliverable was emailed to you on March 27, 2006 at David.Cobrain@state.nm.us to Ms. Neelam Dhawan at Neelam.Dhawan@state.nm.us. A formalized hard (paper) copy of this letter deliverable will be sent via mail. If you have any questions, please call me at (303) 763-7188 or Ms. Paige Walton at (801) 451-2978.

Sincerely,

A handwritten signature in black ink that reads "June K. Dreith". The signature is written in a cursive style with a large, looping initial "J".

June K. Dreith
Program Manager

Enclosure

cc: Neelam Dhawan, NMED
Ms. Paige Walton, TechLaw

SSLs from Table 4.0-2

Industrial risk based on 0-1 foot (ft) interval

Residential risk based on 0-10 ft interval

Migration to Groundwater (dilution attenuation factor, DAF of 20) based upon maximum detected at site

SSL DAF20 from NMED SSL table, March 2006

Lead is not included in calculations, but rather concentrations should be compared to a residential level of 400 mg/kg and industrial

All results in concentration of mg/kg unless otherwise noted.

Ten Site Slope Area B

AOC 35-016(b)

Organics and Inorganics	Max Detect 0-1 ft	Location	Max Detect 0-10 ft	Location	NC Industrial SSL	HQ	Carcin. Industrial SSL	Risk
lead			67.1	35-02190				

Consolidated Unit 35-004(g)-00

Organics and Inorganics	Max Detect 0-1 ft	Location	Max Detect 0-10 ft	Location	NC Industrial SSL	HQ	Carcin. Industrial SSL	Risk
copper								
silver	2.58	35-32205	2.58	35-32205	5680	0.000454		
zinc	68.5	35-02102	68.5	35-02102	1.00E+05	0.000685		
acenaphthene	0.0109	35-23205	0.0109	35-23205	3.48E+04	3.13E-07		
arochlor-1254								
arochlor-1260			0.15	35-02100				
bis(2-ethylhexyl)phthalate	0.385	35-23207	0.385	35-23207			1370	2.81E-09
butylbenzylphthalate	0.0427	35-23205	0.0427	35-23205				
chrysene	0.036	35-23205	0.036	35-23205			2340	1.54E-10
fluoranthene	0.0392	35-23207	0.0392	35-23207	2.44E+04	1.61E-06		
fluorene	0.0128	35-23205	0.0128	35-23205	2.94E+04	4.35E-07		
phenanthrene	0.0265	35-23205	0.0265	35-23205	2.05E+04	1.29E-06		
pyrene	0.0436	35-23205	0.0436	35-23205	3.13E+04	1.39E-06		

Total Indust. Risk	1.14E-03	2.96E-09
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Radionuclides	Max Detect 0-1 ft	Location	Max Detect 0-10 ft	Location	Industrial SAL	Total Dose mrem/yr	Residential SAL	Total Dose mrem/yr
europium-152			0.93	35-02545	11		3	4.81E+00
plutonium-238			0.03	35-02041	240		37	1.22E-02
uranium-234			5.10	35-02042	1500		170	4.50E-01
uranium-235			0.21	35-02042	87		17	1.85E-01
uranium-238			55.05	35-05042	430		86	9.60E+00
								<u>1.51E+01</u>

Consolidated Unit 35-016(c)-00

Organics and Inorganics	Max Detect 0-1 ft	Location	Max Detect 0-10 ft	Location	NC Industrial SSL	HQ	Carcin. Industrial SSL	Risk
antimony	8.2	35-02398	8.2	35-02398	454	0.018062		
chromium	56.6	35-02398	56.6	35-02398				
copper	36	35-02398	36	35-02398	4.54E+04	0.000793		
lead	58.6	35-02398	58.6	35-02398				
mercury	2.7	35-02398	2.7	35-02398	340	0.007941		
nickel	27.9	35-02398	27.9	35-02398	2.25E+04	0.00124		
selenium	0.355	35-23288	0.355	35-23288	5680	6.25E-05		
silver	2.72	35-23207	3.1	35-02111	5680	0.000479		
zinc	110	35-02399	110	35-02399	1.00E+05	0.0011		
acetone	0.0139	35-23291	0.0139	35-23291	1.00E+05	1.39E-07		

arochlor-1260	0.0055	35-23284	0.0055	35-23284			8.26	6.66E-09
arochlor-1254	0.006	35-23284	0.006	35-23284			8.26	7.26E-09
benzo(a)anthracene	0.066	35-02401	0.066	35-02401			23.4	2.82E-08
benzo(b)fluoranthene	0.066	35-02401	0.066	35-02401			23.4	2.82E-08
butylbenzylphthalate	0.27	35-02401	0.27	35-02401				
chrysene	0.066	35-02401	0.066	35-02401			2340	2.82E-10
dichloroethene, 1,1-	0.0015	35-23291	0.0015	35-23291	686	2.19E-06		
fluoranthene	0.066	35-02401	0.066	35-02401	2.44E+04	2.7E-06		
isopropyltoluene, 4-	0.00092	35-23291	0.0016	35-23290	2730	3.37E-07		
phenanthrene	0.13	35-02398	0.13	35-02398	2.05E+04	6.34E-06		
pyrene	0.069	35-02399	0.069	35-02399	3.13E+04	2.2E-06		
styrene	0.00068	35-23291	0.00068	35-23291	419	1.62E-06		
toluene	0.00059	35-23291	0.00059	35-23291	248	2.38E-06		

Total	
Indust. HI	2.97E-02

Total	
Indust. Risk	7.06E-08

Radionuclides	Max Detect 0-1 ft		Max Detect 0-10 ft		Total Industrial Dose		Total Residenti al Dose	
	1 ft	Location	10 ft	Location	SAL	mrem/yr	al SAL	mrem/yr
cesium-137	0.52	35-02396	0.52	35-02396	23	3.39E-01	6	1.39E+00
europium-152	0.47	35-02108	0.47	35-02108	11	6.41E-01	3	2.43E+00
plutonium-238	0.14	35-23291	0.14	35-23291	240	8.75E-03	37	5.68E-02
plutonium-239	0.59	35-23291	0.59	35-23291	210	4.21E-02	33	2.68E-01
uranium-238	2.86	35-23291	2.86	35-23291	430	9.98E-02	86	4.99E-01
					total:	1.13E+00	total:	4.65E+00

Consolidated Unit 35-016(a)-00

Organics and Inorganics	Max Detect 0-1 ft		Max Detect 0-10 ft		NC Industrial		Carcin. Industrial Risk	
	1 ft	Location	10 ft	Location	SSL	HQ	SSL	Risk
arsenic	4.41	35-22970	4.41	35-22970			17.7	2.49E-06
cadmium	0.976	35-22970	0.976	35-22970	8600	0.000113		
chromium	23.8	35-02394	23.8	35-02394				
copper	84.1	35-02394	84.1	35-02394	4.54E+04	0.001852		
lead	36.5	35-22970	36.5	35-22970				
nickel	13.1	35-02394	13.1	35-02394	2.25E+04	0.000582		
zinc	387	35-02394	387	35-02394	1.00E+05	0.00387		
acenaphthene	0.024	35-23292	0.024	35-23292	3.48E+04	6.9E-07		
acetone	0.112	35-23280	0.112	35-23280	1.00E+05	1.12E-06		
anthracene	0.055	35-23292	0.055	35-23292	2.64E+05	2.08E-07		
arochlor-1254	0.393	35-23280	0.393	35-23280			8.26	4.76E-07
arochlor-1260	1.26	35-23280	1.26	35-23280			8.26	1.53E-06
benzo(a)pyrene	0.0758	35-23292	0.0758	35-23292			2.34	3.24E-07
benzo(b)fluoranthene	0.12	35-23292	0.12	35-23292			23.4	5.13E-08
benzo(k)fluoranthene	0.0363	35-23292	0.0363	35-23292			234	1.55E-09
bis(2-ethylhexyl)phthalate	0.98	35-02107	0.98	35-02107			1370	7.15E-09
chrysene	0.0855	35-23292	0.0855	35-23292				
DDE	0.000223	35-23282	0.000223	35-23282			78.1	2.86E-11
dibenzofuran	0.0242	35-23292	0.0242	35-23292	3170	7.63E-06		
dichloroethene, 1,1-	0.0012	35-23292	0.0025	35-23280	686	1.75E-06		
di-n-butyl phthalate	0.223	35-23280	0.0856	35-23280	6.80E+04	3.28E-06		
fluoranthene	0.217	35-23292	0.217	35-23292	2.44E+04	8.89E-06		
fluorene	0.0471	35-23292	0.0471	35-23292	2.94E+04	1.6E-06		
isopropyltoluene, 4-	0.0937	35-23280	0.0937	35-23280	2730	3.43E-05		
naphthalene	0.0285	35-23292	0.0285	35-23292	98.3	0.00029		
phenanthrene	0.239	35-23292	0.239	35-23292	2.05E+04	1.17E-05		
pyrene	0.193	35-23292	0.193	35-23292	3.13E+04	6.17E-06		
toluene	0.0028	35-23280	0.0028	35-23280	248	1.13E-05		

Total	
Indust. HI	6.80E-03

Total	
Indust. Risk	4.88E-06

Radionuclides	Max Detect 0-		Max Detect 0-		Industrial	Total Dose	Residenti	Total Dose
	1 ft	Location	10 ft	Location	SAL	mrem/yr	al SAL	mrem/yr
plutonium-238	0.03	35-23282	0.03	35-23282	240	1.88E-03	37	1.22E-02
plutonium-239	0.93	35-23280	0.93	35-23280	210	6.64E-02	33	4.23E-01
strontium-90	1.25	35-02544	1.25	35-02544	1900	9.87E-03	5.7	3.29E+00
tritium	0.07	35-02080	0.07	35-02080	4.40E+05	2.32E-06	750	1.36E-03
uranium-234	4.41	35-02080	4.41	35-02080	1500	4.41E-02	170	3.89E-01
uranium-235	0.21	35-23282	0.21	35-23282	87	3.62E-02	17	1.85E-01
uranium-238	4.41	35-23282	4.41	35-23282	430	1.54E-01	86	7.69E-01
					TOTAL:	<u>3.12E-01</u>	TOTAL:	<u>5.07E+00</u>

ial of 800 mg/kg

NC Residential		Carcin. Residential		Site	SSL	Exceed	
SSL	HQ	SSL	Risk	Maximum	Location	DAF20	SSL?
391	0.006598			12.8	35-22938	1030	N
2.35E+04	0.002915			2.58	35-32205	31.3	N
4690	2.32E-06			68.5	35-02102	1.36E+04	N
				0.0109	35-23205	54.9	N
				0.0021	35-22937	5.28	N
		2.22	6.76E-07	0.15	35-02100	5.28	N
		347	1.11E-08	0.385	35-23207	2.15E+04	N
				0.0427	35-23205		
		621	5.80E-10	0.036	35-23205	348	N
2250	1.74E-05			0.0392	35-23207	4690	N
3130	4.09E-06			0.0128	35-23205	58.5	N
1800	1.47E-05			0.0265	35-23205	464	N
2300	1.9E-05			0.0436	35-23205	373	N
Total Res. HI		Total Res. Risk					
9.57E-03		6.87E-07					

NC Residential		Carcin. Residential		Site	SSL	Exceed	
SSL	HQ	SSL	Risk	Maximum	Location	DAF20	SSL?
31.3	0.261981			8.2	35-02398	13.2	N
				56.6	35-02398	42	Y
3130	0.011502			36	35-02398	1030	N
				58.6	35-02398		
23	0.117391			2.7	35-02398		
1560	0.017885			27.9	35-02398	953	N
391	0.000908			0.355	35-23288	19	N
391	0.007928			3.1	35-02111	31.3	N
2.35E+04	0.004681			110	35-02399	1.36E+04	N
7.04E+04	1.97E-07			0.0139	35-23291	19.1	N

NOTE: USED HEX CHROMIUM, -

182	8.24E-06	2.2	2.5E-08	0.0055	35-23284	5.28	N
2250	2.93E-05	2.2	2.727E-08	0.006	35-23284	5.28	N
700	2.29E-06	6.21	1.063E-07	0.066	35-02401	10.9	N
1800	7.22E-05	6.21	1.063E-07	0.066	35-02401	33.5	N
2300	0.00003			0.27	35-02401		
419	1.62E-06	621	1.063E-09	0.066	35-02401	348	N
248	2.38E-06			0.0015	35-23291	2.68	N
				0.066	35-02401	4690	N
				0.0016	35-23290		
				0.13	35-02398	464	N
				0.069	35-02399	373	N
				0.00068	35-23291	10.5	N
				0.00059	35-23291	21.7	N

Total Res.	
HI	4.22E-01

Total Res.	
Risk	2.66E-07

NC Residential	HQ	Carcin. Residential	Risk	Site Maximum	Location	SSL DAF20	Exceed SSL?
74.1	0.013171	3.9	1.13E-05	4.41	35-22970	0.29	Y
3130	0.026869			0.976	35-22970	27.5	N
1560	0.008397			23.8	35-02394	42	N
1.00E+05	0.00387			84.1	35-02394	1030	N
4690	5.12E-06			36.5	35-22970		
7.04E+04	1.59E-06			13.1	35-02394	953	N
2.35E+04	2.34E-06			387	35-02394	1.36E+04	N
				0.024	35-23292	54.9	N
				0.112	35-23280	19.1	N
				0.055	35-23292	1620	N
		2.22	1.77E-06	0.393	35-23280	5.28	N
		2.22	5.68E-06	1.26	35-23280	5.28	N
		0.621	1.22E-06	0.0758	35-23292	2.78	N
		6.21	1.93E-07	0.12	35-23292	33.5	N
		62.1	5.85E-09	0.0363	35-23292	335	N
		347	2.82E-08	0.98	35-02107	2.15E+04	N
				0.0855	35-23292	348	N
		17.2	1.30E-10	0.000223	35-23282	262	N
				0.0242	35-23292	2.87	N
				0.0025	35-23280	2.68	N
				0.0856	35-23280	3720	N
				0.217	35-23292	4690	N
				0.0471	35-23292	58.5	N
				0.0937	35-23280		
				0.0285	35-23292	0.394	N
				0.239	35-23292	464	N
				0.193	35-23292	373	N
				0.0028	35-23280	21.7	N

Total Res.	
HI	5.33E-02

Total Res.	
Risk	2.02E-05

TOTAL CHROME WOULD NOT BE EXCEEDED