State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous & Radioactive Materials Bureau
2044 Galisteo
P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-1557
Fax (505) 827-1544

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

September 11, 1997

Mr. Michael J. Zamorski
Acting Area Manager
Kirtland Area Office
US Department of Energy
P.O. Box 5400
Albuquerque, New Mexico 87185-5400

RE: Denial: Report of the Mixed Waste Landfill Phase 2 RCRA Facility Investigation, Sandia National Laboratories

Dear Mr. Zamorski:

The RCRA Permits Management Program (RPMP) has completed review of the US Department of Energy/Sandia National Laboratories/New Mexico (DOE/SNL) May 1996 submittal, **Report of the Mixed Waste Landfill Phase 2 RCRA Facility Investigation, Sandia National Laboratories, Albuquerque, New Mexico**. The Department of Energy Oversight Bureau, New Mexico Environment Department contributed technical comments which were considered in the staff review and have been combined into the attached eighty-five (85) comments which need to be addressed in the Closure Plan/Post-Closure Care Permit Application.

DOE/SNL proposes No Further Action for Operable Unit 1289, Environmental Restoration (ER) Site 76, the Mixed Waste Landfill (MWL), coupled with three years of groundwater monitoring for tritium only, as an indicator contaminant. The RPMP does not agree that the MWL is appropriate for NFA at this time.

The submitted report and request for No Further Action are denied and further requirements are imposed. The basis for these actions is explained below.

Basis for denial. In 1986, the US Environment Protection Agency (EPA) published a notice that the hazardous component of mixed waste was subject to the Resource Conservation and Recovery Act (RCRA). EPA issued a clarification on how facilities would qualify for interim status for their mixed waste activities on September 23, 1988. Although the MWL continued to receive low-level radioactive waste and mixed waste through December 1988, it was never included in a Part A or Part B permit application.

Under 20 NMAC 4.1, Subpart IX, 40 CFR 270.1(c), owners and operators of landfills that received waste after July 26, 1982 are required to obtain a post-closure permit for the facility, unless closure by removal is demonstrated. For facilities that did not receive an operating permit, and close under interim status standards, this closure plan/post-closure permit application serves to impose several critical statutory and regulatory requirements, including the requirements for corrective action (61 FR 19438, May 1, 1996).

In line with this requirement, DOE/SNL must submit a closure plan and stand-alone post-closure permit application for the MWL which meet the requirements of 20 NMAC 4.1, Subpart VI, 40 CFR 265.110-120, **Closure and Post-Closure**, and 265.310, **Landfills, Closure and post-closure care.** These documents should utilize the findings in the report for the Phase 2 RFI conducted at the MWL, as well as HRMB's comments on this report. The comments are enclosed for your information.

Under the provisions of 20 NMAC 4.1, Subpart IX, the required documents must be received within one hundred and eighty (180) calendar days after receipt of this Letter of Denial.

Please call myself or Stephanie Kruse of my staff at 827-1561 if you have any questions or comments regarding this action.

Sincerely,

Robert S. (Stu) Dinwiddie, Ph. D., Manager
RCRA Permits Management Program

Enclosure

xc: John Tymkowych, NMED/HRMB
Roger Kennett, NMED/DOE OB
John Parker, NMED/DOE OB
Mark Jackson, DOE
Warren Cox, SNL
David Neleigh, EPA
file: snl, 9/11/97, doe/kao, hrmb/sk, re, file
track: hswa, snl-ou 1289, 97

COMMENTS

REPORT OF THE MIXED WASTE LANDFILL PHASE 2 RCRA FACILITY INVESTIGATION SANDIA NATIONAL LABORATORIES ALBUQUERQUE, NEW MEXICO SEPTEMBER 1996

The Mixed Waste Landfill (MWL) received low-level radioactive waste and mixed waste through December 1988. The MWL is also designated for temporary, above-ground storage of containerized radioactive and mixed waste.

General Comments

1. Only sparse information on caps for landfill cells is provided in the report. The text states, " Once pits were filled with waste, they were backfilled with soil then capped with concrete...Trenches were *reportedly* backfilled on a quarterly basis (emphasis added) and, once filled with waste, capped with originally excavated soils which had been stockpiled locally." (Section 1.1, *MWL Background*, 3rd paragraph.)

Not all the pits have been capped, as shown in a photograph taken in 1997.

A landfill cover which meets the requirements of 20 NMAC 4.1, Subpart VI, 40 CFR 265.310 is necessary.

2. The New Mexico Environment Department (NMED) is aware that records of waste disposed at the landfill are not complete. A table summarizing the complete known inventory of mixed, hazardous, and radioactive wastes disposed at the MWL must be included in the report. Insofar as possible, the inventory must include each chemical and radiological Constituent of Concern (COC) the volume (or mass), waste form (solid, liquid, gas), EPA Identification Number, cell location, containerization (if any), and date of receipt of the waste. A map identifying each cell must accompany this table. As precisely as possible, information on information gaps must also be provided.

3.a. A 10,000-pound Cs-137-contaminated semi-truck trailer and its contents were apparently buried in Trench E. Sandia National Laboratories (SNL) must explain what is contained within the trailer (waste type, quantity, and form), and where the trailer came from.

3.b. Maps of sampling locations and summaries of surface and subsurface soil data from earlier investigations need to be included in the report. This information may be presented in an addendum.

Specific Comments

4. **Page 3-6, Table 3.4-1; Pages 3-8 and 3-9, Table 3.4-3; and Pages 3-10 and 3-11, Table 3.4-4**
For clarity, these tables must be revised to show units of measurement for all COCs.

5. **Pages 3-10 and 3-11, Table 3.4-4**
Maximum background concentrations (95th UTLs or 95th percentiles) are not included in this table for Hg, Se, Ag, and Tl. The appropriate maximum background concentrations for these COCs should be substituted for the "NA" ("Not Applicable") notations found in this table. For information purposes, the site-wide maximum background concentrations (subsurface soil) are:

COC	Maximum Background (mg/kg)
Hg	<0.1
Se	<1
Ag	<1
Tl	<1.1

Although soil data for tritium were also acquired by SNL, a maximum background concentration was not included in Table 3.4-4. SNL must revise Table 3.4-4 to include the appropriate background information for tritium. Additionally, a note should be added that indicates that background data for tritium are listed in Table 4.6-9.

6. **Page 3-13, Section 3.4.8, *Comparison Tests***
For the purpose of determining whether an ER site is contaminated, the only screening test that should be used is the "Hot Measurement Comparison". Any sample collected at an SNL ER site having a concentration exceeding the 95th UTL (or 95th percentile, where applicable) is considered representative of contamination, unless

A. the analytical result is shown to be an error, or

B. an acceptable site-specific background investigation is conducted and shows that the background level is naturally elevated above the level originally expected for the site.

On a case-by-case basis, sample analyses considered representative of contamination may trigger a regulatory requirement for additional site characterization or site remediation.

NMED recognizes that high concentrations of COCs representative of the upper 5% of a natural background population or high concentrations representative of unidentified laboratory or human error could falsely trigger additional regulatory actions. Thus, where data exceed the background level for a COC, the spatial distribution of the data is one of several factors which will be considered when deciding whether additional work is needed.

7. **Page 4-1, Section 4.1, *Radioactive Survey***
Surface contact readings of 0.5, 50, and 6 mrem/hr were measured for Pits SP-4, SP-35, and SP-36, respectively. These levels of radioactivity are high enough to be a concern. For example, 0.5 mrem/hr is equivalent to 960 mrem/yr; this exceeds background radiation levels of approximately 350 mrem/yr in the Albuquerque area. The surface contact readings must be reduced to background levels by additional shielding at Pits SP-4, SP-35, and SP-36. Alternatively, the radioactive/mixed waste in these pits could be removed and disposed of elsewhere, in accordance with applicable regulatory requirements.

8. **Page 4-4, Table 4.2-1**
The table must be revised to show the detection limits for the values listed as nondetects.

9. **Page 4-5, 3rd paragraph: The text states, "This is approximately 21 months of continuous exposure..."**
A "Derived Air Concentration" (DAC) must be defined and the significance of an inhaled DAC for tritium of 20 $\mu Ci/m^3$ discussed. For a DAC of 20 $\mu Ci/m^3$, what would be the yearly dose of an individual in mrem, assuming continuous exposure (please show calculations)?

Because of the text font, the unit of tritium flux is unclear in the text and Table 4.2-2. Assuming that $pCi/m^2/hr$ is equivalent to pCi/m^2-hr, calculations by the NMED Department of Energy Oversight Bureau show that, if trapped, the concentration would reach a DAC of 20 $\mu Ci/m^3$ in 139 days (about 4.6 months, not 21 months). In regard to data listed in Table 4.2-3 (1993 tritium flux), based on a flux of 166,000 pCi/m^2-hr, a DAC of 20 $\mu Ci/m^3$ would be reached in only 5 days. The text should indicate what the yearly dose of an individual in mrem would be, assuming continuous exposure for this latter scenario (please show calculations).

10. **Page 4-11, Section 4.2.1, *1993 MWL Radiological Release***
A release of 0.294 Ci of tritium per year is a fairly large amount of radioactivity.

11. **Page 4-29, Section 4.4, *Surface Soil Sampling for Tritium***
The term "surface soil" must be defined.

12. **Page 4-39, 1st paragraph: The text states, "78% of the total tritium disposed of at the MWL was disposed of in the classified area...."**
SNL's estimate of the amount of tritium waste buried at the MWL should be considered a minimum. On page 4-29, last paragraph, SNL states, "... The remaining 410 Ci of the tritium disposed of at the MWL were probably disposed of in unclassified area Trenches A through D...*No information has been found* (emphasis added) to date on the quantity of tritium disposed of in Trenches A through D".

The latter statement suggests that historical records are incomplete. Based on historical records, it is only known that *at least* 1861 Ci of tritium were disposed of at the MWL. This is a very large amount of radioactivity, and tritium is only one of a number of radionuclides apparently disposed of at the MWL.

The text must discuss what other radionuclides and chemical species, in addition to tritium, were or might have been present in the 271,000 gal of coolant wastewater discharged to Trench D. Did this coolant wastewater contain Co-60, Sr-90, or Cs-137?

13. **Pages 4-36 and 4-37, Figures 4.4-2 and 4.4-3**
To facilitate interpretation, contours representing a given concentration should be drawn with the same color on both figures. Because the 1 pCi/g isopleth (contour) exceeds background conditions, this isopleth must also be shown on Figure 4.4-2. The figures must be revised accordingly.

14. **Page 4-39, 1st paragraph: The text states, "1993 tritium activities are one order of magnitude lower than 1982 tritium activities".**
Although the maximum values appear to differ by an order of magnitude, the areas encompassed by the 50, 100, and 1000 pCi/g contours shown in Figures 4.4-2 and 4.4-3 indicate that tritium contamination at the MWL has spread over a larger area since 1982. This must be discussed in the text.

15. **Page 4-43,** ***Toluene, Ethylbenzene, Xylene***
Toluene may have been used in scintillation vials or as a solvent.

16. **Pages 4-58 and 4-59, Figures 4.5-11 and 4.5-12**
Results of sample #10 (2nd round soil-gas survey) were lost. The nondetect notations (NDs) shown at the location of this sample should be deleted from the two figures. Alternatively, the NDs could be replaced by "Not Analyzed" ("NA").

17. **Page 4-61, Section 4.5.2,** ***Active Soil Gas Sampling***
Soil gas measurements obtained during the 1989 field investigation at the MWL encountered volatile organic compounds ranging from 22 to 650 ppm at depths ranging from 10 to 128 ft (using a photoionization detector). The text must explain why these field measurements differ so much from the active soil gas sampling results obtained in 1994.

18. **Page 4-81, Figure 4.5-25**
Data derived from the glass-bulb and the Summa-canister methods do not appear to always be in good agreement. It is not clear in this figure (and Figures 4.5-26, 4.5-27, and 4.5-29) which data were derived from the Summa-canister method and which were obtained from the glass-bulb technique. All three figures must be revised in a way that clearly differentiates between Summa-canister-derived and glass-bulb-derived data.

Assuming that the data derived by the Summa-canister method are always listed above the triangles representing sample locations, the Summa-canister data appear to be generally lower than that derived from the glass-bulb technique. If this is the case, the text must discuss what might cause this.

19. **Page 4-87, Section 4.6.4,** ***Borehole Drilling Analytical Procedures*****: The text states, "A total of 532 samples were collected during borehole drilling".**
This statement implies that 532 different locations were sampled. Because some samples were duplicates, fewer than 532 locations were sampled (perhaps about 60 less). The text must be revised to reflect the number of different sample locations.

20. **Page 4-88, Figure 4.6-1**
The figure must be revised to show the orientation and horizontal extent of the angled boreholes. Sample locations for each borehole must also be shown on this figure.

21. **Page 4-92, Section 4.6.4.2,** ***VOCs***
Additional information has been requested regarding VOC data (see Comments No. 17, No. 18, and No. 66). If no other concerns are raised upon review of this requested information, NMED considers that the MWL has been adequately characterized with respect to VOCs.

22. **Page 4-94, Section 4.6.4.3,** ***SVOCs***
Additional information has been requested regarding SVOC data in Appendix C. If no other concerns are raised upon review of the requested information, NMED considers that the MWL has been adequately characterized with respect to SVOCs.

23. **Page 4-94, Section 4.6.4.4,** ***TAL Metals***
Analytical results for some soil samples exceed maximum background concentrations for some metals:

Borehole	COCs	Borehole	COCs
BH-1	Cu	BH-9	As, Cr, Tl
BH-2	Cd, Cr, Cu, Ni	BH-10	Hg, As, Ba, Co, Cr, Ni, Tl, V
BH-3	Ag, Cd, Co, Cu, Ni, Zn	BH-11	Ba, V
BH-4	Hg, Cd, Cu	BH-12	As
BH-5	Ba, Cd	BH-13	Ba, Tl, Zn
BH-6	Cd, Cr, Ni, Pb	BH-14	As, Ba, Tl, V
BH-7	Ba, Cr	BH-15	Hg, Cr, Tl
BH-8	As, Co, Cr, Tl, V		

Because cross-sections showing metal concentrations in the boreholes were not provided, it is not possible to determine if adequate site characterization has been achieved with respect to metals. SNL can expedite this review by providing the following nine cross-sections:

#	Boreholes Shown on East-West Cross-Sections
1	BH-13, BH-2
2	BH-11, SB-5[1], BH-12, BH-3
3	BH-8, BH-7, BH-6, BH-5, MWL-MW4
4	BH-15, BH-10, BH-4
5	BH-15, SB-4, BH-9, BH-4

#	Boreholes Shown on North-South Cross-Sections
6	BH-8, BH-9, BH-10, BH-11, SB-5
7	BH-14, BH-15
8	BH-7, MWL-MW4, BH-12, BH-13
9	BH-5, BH-4, BH-3, BH-2

(1) Borehole numbers preceded by "SB" (for example SB-5) are soil borings from the 1989 drilling program.

Individual cross-sections must be generated for each metal for which some samples have **exceeded maximum background concentrations**: Ag, As, Ba, Cd, Cu, Co, Cr, Hg, Ni, Pb, Tl, V, and Zn. The geology, if available, and trench/pit boundaries on these cross-sections must also be shown.

NMED assumes that, for metals, no other subsurface data are available from previous studies at the MWL (conducted in 1969, 1979, 1981, 1982, and 1989). If this assumption is erroneous, any additional sampling results for metals (subsurface) must be provided for review and possible inclusion in the above cross-sections.

24. **Page 4-104, 3rd paragraph: The text states, "Aluminum, cobalt, copper, manganese, vanadium, and zinc are not listed as RCRA metals in 40 CFR 261 Appendix VIII; therefore they were not considered as contaminants of concern".**
Some of the soil sample results for cobalt, copper, vanadium, and zinc exceed maximum background concentrations; all four metals may have been disposed of at the MWL. NMED considers that ground water is threatened by waste disposal activities at the MWL. Cobalt, copper, vanadium, and zinc are listed as hazardous constituents in ground water in 20 NMAD 4.1, Subpart V, 40 CFR Part 264, Appendix IX. Therefore, cobalt, copper, vanadium, and zinc are COCs at the MWL and can not be automatically ruled out.

25. **Page 4-106, Section 4.6.4.5, *Radiochemistry***
See Comment No. 69.

26. **Page 4-106, Section 4.6.4.6, *Tritium***
Based on data presented in Table 4.6-9, the 95th percentile for background tritium is 0.034 pCi/g. All of the boreholes yielded at least some sediment samples containing tritium at activities which exceed the local 95th percentile for tritium.

The two cross-sections (Figures 4.6-2 and 4.6-3) showing tritium activities in selected boreholes are not constructed across the area of major interest. Thus, it can not be determined if adequate site-characterization has been achieved at the MWL with respect to tritium. SNL can expedite this review by providing the following nine cross-sections:

#	Boreholes Shown on East-West Cross-Sections
1	BH-13, BH-2
2	BH-11, BH-12, BH-3
3	BH-15, BH-10, BH-4
4	BH-15, BH-9, BH-4
5	BH-8, MWL-MW4, BH-7, BH-6, BH-5

#	Boreholes Shown on North-South Cross-Sections
6	BH-8, BH-9, BH-10, BH-11
7	BH-14, BH-15
8	BH-7, MWL-MW4, BH-12, BH-13
9	BH-5, BH-4, BH-3, BH-2

The geology, if available, and trench/pit boundaries must also be shown on these cross-sections.

27. **Pages 4-114 through 4-122, Table 4.6-10**
See Comment No. 6.

28. **Section 4.7.2, Page 4-125: The text states, "All analyses, chemical and radiochemical, were performed by Quanterra, Inc., Arvada, Colorado".**
The last paragraph of page 4-123 and note (a) at the bottom of Table 4.7-2 states that Enseco Rocky Mountain Analytical Laboratory did the analyses of MWL-MW4 soil samples. Only later in the text is it mentioned that Enseco Rocky Mountain Analytical Laboratory has changed its name to Quanterra, Inc. The text should be revised to indicate this change.

29. **Page 4-134, Section 4.7.2.4, *TAL Metals*, first paragraph, last sentence**
Because UTLs were calculated only when a normal distribution was assumed, UTLs were not calculated by SNL for *all* TAL metals.

30. **Page 4-136, Section 4.7.2.4, 4th paragraph: The text states, "Aluminum, cobalt, copper, manganese, vanadium, and zinc are not listed as RCRA metals in 40CFR 261 Appendix VIII; therefore they were not considered as contaminants of concern".**
See Comment No. 24.

31. **Page 4-139, 1st paragraph**
Just because an archived sample has a lower concentration of some COC the second time it is analyzed does not mean that the second, more favorable result, is the more accurate. If the two results differ significantly, additional analytical work is necessary to resolve the difference.

32. **Page 4-142, Table 4.7-10**
All of the reported tritium values exceed the 95th% of the background data shown in Table 4.6-9. The data suggest that low levels of tritium may be present in saturated sediments at depths below the water table.

Given that 1 Ci of tritium was presumably disposed of in Trench D (in 1967), and that approximately 2.5 half-lives have passed, it is remarkable that only low levels of tritium were encountered in the upper 50 ft of the MWL-MW4 borehole. However, at an angled depth of 50 ft, the MWL-MW4 borehole reached a horizontal distance of only 5.2 ft from its collar location. Depending on how far the collar of the borehole was from the north edge of Trench D, none of the upper 50 ft of the borehole may have been directly under the trench. Given that no appreciable tritium was found where it was expected, the text must discuss why SNL ceased its characterization efforts for Trench D.

33. **Page 4-144, Section 4.7.2.7, *Plutonium-238 and Plutonium-239/240*, and Page 4-142, Table 4.7-10**
Plutonium is a man-made radionuclide and should not be generally detected at depth. See also Comment No. 36.

34. **Page 4-144, Section 4.7.3, *MW-4 Drilling Summary*, paragraph 2: The text states, "Three of the 26 samples contained concentrations of beryllium..."**
See Comment No. 31.

35. **Page 4-145, Table 4.7-12**
See Comment No. 6.

36. **Page 4-146: The text states, "Six reported values of plutonium were discounted based upon...problems associated with laboratory quality control data".**
No evidence was presented to support SNL's speculation that problems with laboratory contamination or accuracy had actually occurred. Therefore, the data must not be rejected on that basis.

37. **Page 5-1, Section 5, Groundwater Monitoring, last paragraph: The text states, "The adequacy of the MWL monitoring well network was evaluated using numerical contaminant transport modeling, and the network was found to be adequate for detecting potential groundwater contamination originating from the landfill...."**
The detection monitoring system at the MWL is inadequate because the hydraulic gradient and groundwater-flow direction are not known with reasonable certainty, as noted by Moats and Winn (1993). A site-specific water-level map should be provided. Also see Comment No. 64.

38. **Page 5-15, Figure 5.3-5**
The text should discuss why there is at least a 17-ft difference in water-level elevation between MWL-MW4 (upper zone) and the rest of the MWL monitoring wells.

One purpose of installing monitoring well MWL-MW4 was to resolve uncertainty as to the hydraulic gradient and groundwater flow direction. The text should explain how this work achieved the above objective.

39. **Page 5-16, Section 5.3.2.1, *Horizontal Potentiometric Gradient***
The text should identify which MWL monitoring wells were used to determine the horizontal hydraulic gradient of 0.01 ft/ft.

With regard to Comments No. 37 and No. 38, the text must indicate how any reliable gradient can be determined.

40. **Page 5-16, Section 5.3.2.2,** ***Vertical Potentiametric Gradient***
Well MWL-MW1 is located too far away (~ 150 ft) from MWL-MW4 to provide a proper estimate of the vertical hydraulic gradient.

41. **Page 5-21, Section 5.3.3.3,** ***Boundary Conditions***
The location and orientation of the flow net must be shown on a surface map. The text must explain why the particular flow-net orientation and location were chosen, given the uncertainty concerning the hydraulic gradient and groundwater flow direction.

42. **Page 5-21, Section 5.3.3.4,** ***Flow-Net Results***
The model does not match observed heads (see Figure 5.3-5, April 1995 data) in monitoring wells MWL-MW1 and especially MWL-MW4 (upper and lower). The text must explain how the total hydraulic heads were extrapolated for MWL-MW2 and MWL-MW4 (upper and lower).

43. **Page 5-26, Section 5.4.1.1,** ***Major Ion Chemistry***
Chloride concentrations in groundwater samples from MWL-MW4 are nearly twice as high as those in samples obtained from other MWL monitoring wells, and generally exceed the 95th UTL for chloride (53.0 mg/L) as determined for the low-TDS hydrochemical facies by Moats and Winn (1995). Groundwater contamination has been encountered at several areas within the low-TDS facies where chloride concentrations exceed the 95th UTL (for example: TA-2, TA-5, and the Burnsite). Thus, some unrecognized impact to ground water may have occurred at the MWL. See also Deficiency No. 64.

44. **Page 5-32, Table 5.4-5**
The quantitation limits for 2-butanone and acetone are both listed as 5.00 mg/L. Are these the correct units?

The unit of measurement for the rest of the data must be provided.

45. **Page 5-33, Table 5.4-6**
The acetone concentrations listed in the table are 7.83 mg/L and 3.71J mg/L. Are these the correct units?

The total uranium concentrations listed in the table are 4.9 and 4.8 mg/L. Are these the correct units?

46. **Page 5-44, Section 5.4.1.2,** ***TAL Metals and Nitrate***
The following observations were noted regarding groundwater quality. The observations are divided into two categories: those believed to be of no significant concern, and those that are of concern.

Observations believed to be of No Significant Concern:

- Many of the antimony data reported in Appendix J are nondetections associated with a relatively high detection limit of 0.060 mg/L. NMED's suggested maximum background concentration for antimony is 0.006 mg/L.

Many of the cadmium data reported in Appendix J are nondetections associated with a relatively high detection limit of 0.005 mg/L. SNL's proposed maximum background concentration for antimony is 0.00047 mg/L.

Some of the selenium data reported in Appendix J are nondetections associated with a relatively high detection limit of 0.010 mg/L. SNL's proposed maximum background concentration for selenium is 0.005 mg/L. April 1993 data for wells MWL-MW1, MWL-MW2, MWL-MW3, and MWL-MW4 are associated with detection limits reported as 2.5 mg/L or 5 mg/L; should these detection limits actually be 2.5 μg/L or 5 μg/L?

Some of the thallium data reported in Appendix J are nondetections associated with a relatively high detection limit of 0.010 mg/L. NMED's suggested maximum background concentration for thallium is 0.002 mg/L. In addition to the one detection of thallium cited in the text for a MWL-BW1 sample, several data (J-coded) exceed 0.002 mg/L 0for MWL-MW2 ground-water samples.

In groundwater samples collected from monitoring wells MWL-MW1, MWL-MW2, MWL-MW3, and MWL-MW4, some of the total uranium data reported in Appendix J slightly exceed SNL's maximum background concentration for uranium of 0.0052 mg/L.

Observations believed to be of Concern :

In groundwater samples collected from monitoring well MWL-MW1 (and occasionally in samples from MWL-MW3), nickel exceeds the 95th percentile for nickel (0.028 mg/L) in the Kirtland Air Force Base area as determined by Moats and Winn (1995). At the MWL, nickel appears to be the only metal (nonradioactive) which occurs in ground water at concentrations elevated above background.

Nitrate typically occurs in MWL ground water at about 4-6 mg/L. Such concentrations of nitrate are not typical of natural ground waters. SNL must provide information on the occurrence of any nitrate sources at the MWL or in the MWL area.

47. **Page 5-55, Section 5.4.1.3, *Radionuclides***
Uranium -- Even if suspect, the anomalous value of 2.69 mg/L should have been included in Appendix K.

Strontium-90 -- Even if suspect, the April 1993 data should have been reported in Appendix K.

Tritium -- Even if suspect, the 1991 data should have been reported in Appendix K. See Comment No. 75.

No sampling results are provided for gamma spectrum, including Co-60 or Cs-137. There has not been enough sampling for tritium and radionuclides in ground water. See last paragraph of Comment No. 64.

48. **Page 5-57, Table 5.4-9**
Thorium is listed as the sixth radionuclide, but the specific radioisotope is not given.

49. **Page 5-57, Table 5.4-9, Note (e): The text states, "Radionuclide is not considered to be present, because the 2-sigma value equals or exceeds the laboratory-measured activity"; see also similar text of Note (d).**

Just because a 2-sigma value equals or exceeds the measured activity of a sample does not mean that the measured value is zero. Different factors must be considered, such as other data and the sensitivity of the analytical method. A better way of dealing with this issue is to estimate the probability of getting some value (or a higher value) when the real answer is zero.

50. **Page 5-58, Section 5.5, *MWL Aquifer Testing***
Pumping rates and drawdown/recovery curves were not provided. Thus, the pumping tests can not be evaluated. The missing information must be provided.

51. **Page 5-58, Section 5.5.1, *Results of MWL Aquifer Testing*, 1st sentence: The text states, "...hydraulic conductivities of MWL geologic strata are representative of silty sands (Freeze and Cherry, 1979)."**
The hydraulic conductivity values shown in Table 5.5-1 for wells MWL-MW2 and MWL-MW3 actually fall within the range given by Freeze and Cherry (1979) for silt.

52. **Page 5-58, Table 5.5-1**
The text must identify whether any slug tests were done on MWL monitoring wells.

53. **Page 5-61, Section 5.6.2, *Conclusions*: The text states, "The existing network is capable of detecting contaminants entering groundwater through both aqueous-phase and vapor-phase pathways."**
See Comment No. 37.

54. **Page 6-1, Section 6, *Vadose Zone Characterization***
Lithologic logs must be provided for the monitoring wells and the boreholes. The locations of geotechnical samples, and the depth to water (where applicable) must be shown on these logs.

Given that there was considerable drilling at the MWL to depths of 100 ft or so, it should be possible to construct a number of informative geologic cross-sections. See Comments No. 23 and No. 26.

55. **Page 6-5, Table 6.2-2**
Assuming that the values for the silt and clay fractions reported in this table are based on a #200 sieve, all but one sample are coarse-grained soils, in accordance with criteria of the Unified Soil Classification System (USCS).

56. **Page 6-8, Table 6.3-1**
Fifteen of the nineteen soil samples for which data are given in the "%-<200-sieve" column are coarse-grained soils, in accordance with the USCS. Three of the other four samples (not sieved) are also probably coarse-grained, given that they were nonplastic.

57. **Page 6-9, Section 6.3.3, *Particle Size Analysis,* 3rd paragraph: The text states, "Figure 6.3-6 shows the relationship between the percent silt and clay, and the sample depth in MW-4. In general, silt and clay percentages increase with depth, and relatively high percentages of silt and clay predominate below 250 ft bgs."**
This statement is based only on the findings from one borehole (MWL-MW4). Because no geologic log for MWL-MW4 has been provided, it is not possible to evaluate whether the analyzed samples are representative of the predominant lithologies encountered during the drilling of MWL-MW4.

The geologic logs of the other monitoring wells also must be provided to assess whether high percentages of silt and clay predominate at depth over the entire site.

58. **Page 6-22, Section 6.3.4, Saturated Hydraulic Conductivity**
The text should identify where the 27 soil samples came from which were analyzed for laboratory saturated hydraulic conductivities. Data in Table 6.3-1 suggest that the 27 samples were from the Phase-2 RFI borehole drilling; however, Figure 6.3-7 suggests that many of the data are derived from samples collected from the MWL-MW4 borehole.

The text must identify what fluid was used for conducting the tests. The text must also identify whether the tests were conducted using rigid-wall or flexible-wall permeameters.

59. **Page 6-22, Section 6.3.5, *Soil Moisture Characteristics***
The text must identify the IP test, and where the IP-test plot was located at the MWL. The IP-test results must be provided to NMED.

60. **Page 7-5, Table 7.3-3**
Vapor-phase transport to ground water was not considered for tritium. This must be explained in the text.

61. **Page 8-1, Section 8, *Conclusions and Recommendations*, 3rd paragraph: The text states, "VOCs in soil gas were detected to depths of 30 ft bgs."**
By design, the active soil-gas sampling was limited to a maximum depth of 30 ft. Generally, soil-gas concentrations increased with depth.

62. **Page 8-2, 2nd paragraph**
Because insufficient information has been provided to make a determination whether site characterization is adequate, the results of the risk assessment may not be valid. See also Deficiency No. 60.

Without institutional controls, waste buried at the MWL represents a greater risk to human health and the environment than that due to natural radionuclides.

63. **Page 8-2, last paragraph, 1st sentence: The text states, "Based on the results of this Phase 2 RCRA Facility Investigation and MWL risk assessment, the MWL is recommended for No Further Action."**
See Comment No. 1.

64. **Page 8-2, last paragraph**
See Comment No. 1.

NMED agrees that the MWL will need to be subject to institutional controls.

The detection monitoring system at the MWL is inadequate because the hydraulic gradient and groundwater flow direction are not known with reasonable certainty. Chloride concentrations in groundwater samples from MWL-MW4 exceed the 95th UTL established for the low-TDS hydrochemical facies. Groundwater samples from monitoring well MWL-MW1 and some from MWL-MW3 exceed the 95th percentile for nickel. Additionally, tritium concentrations in sediment samples obtained from the MWL-MW4 borehole at depths below the water table exceed the local background level for tritium.

Ground water at the MWL should be monitored for radionuclides, nitrate/nitrite, and VOCs (EPA Method 8240) in all monitoring wells at a frequency of every two years (following the four quarters of monitoring discussed below). Radiological COCs should include, at minimum, gross alpha, gross beta, gamma spectrum, tritium, Co-60, Cs-137, and Sr-90. Groundwater monitoring should continue for a minimum of 30 years, subject to change by the regulatory authorities.

At least two additional groundwater monitoring wells should be installed (southwest and northwest of the landfill) to reduce uncertainty as to groundwater movement. Additionally, another four quarters of groundwater sampling should be conducted for radiological COCs, nitrate/nitrite, and volatile organic compounds. Groundwater samples from monitoring wells MWL-MW1 and MWL-MW3 should also be analyzed for nickel.

Appendix A, ***Example Statistical Calculations***

65. Most of the background data sets were not provided.

The procedures used by this study to determine site-specific background concentrations for COCs in soil are acceptable. Some of the site-specific maximum background concentrations are lower, and a few somewhat higher than those determined in SNL/Kirtland Air Force Base's (KAFB's) site-wide study. The higher of local or site-wide background levels was used in this review of the MWL RFI report.

Appendix B, ***MWL Borehole Drilling VOC Analytical Results***

66. Review of whether appropriate quality control (QC) goals were achieved could not be completed. SNL can expedite this review by providing the following information:

A. A list of other VOCs, aside from the VOCs listed in this appendix, that were analyzed for and their detection limits. (The actual COCs should be listed, not just the EPA method.)

B. The detection limits of the COCs with J-coded values. (If preferred, this information can be included with that requested by Comment No. 66A).

C. A summary of laboratory QC results. Three tables should be compiled which show:

1. laboratory-duplicate results and corresponding relative percent differences,
2. method-blank results (detected VOCs and levels), and
3. matrix-spike results and percent recovered.

For each of the tables, also indicate which environmental samples correspond to each of the laboratory QC lots.

D. A summary of field QC results. Four tables should be compiled which show:

1. duplicate-sample results and relative percent differences,
2. trip-blank results (detected VOCs and levels),
3. field-blank results (detected VOCs and levels), and
4. spiked-sample results and percent recovered.

For each of the tables, also indicate which environmental samples correspond to each of the field QC lots.

Appendix C, ***MWL Borehole Drilling SVOC Analytical Results***

67. Review of whether appropriate QC goals were achieved could not be completed. SNL can expedite this review by providing the following information:

A. a list of other SVOCs, aside from the SVOCs listed in this appendix, that were analyzed for, and their detection limits,

B. the detection limits of the COCs with J-coded values,

C. a summary of laboratory QC results, and

D. a summary of field QC results.

Appendix D, ***MWL Borehole Drilling TAL Metals Analytical Results***

68. Review of whether appropriate QC goals were achieved cannot be completed. SNL can expedite this review by providing the following information:

A. the detection limits of the data shown as "ND" in this appendix,

B. a summary of laboratory QC results, and

C. a summary of field QC results.

Appendix E, ***MWL Borehole Drilling Radiochemical Analytical Results***

69. All of the radionuclides analyzed and their respective minimum detectable activities (MDAs) must be listed, regardless of whether they are listed in Appendix E.

Appendix F, ***MW-4 VOC Analytical Results***

70. Holding times were exceeded for all samples that had been reanalyzed. Thus, decisions made from these data are inconclusive.

71. Review of whether appropriate QC goals were achieved cannot be completed. SNL can expedite this review by providing the following information:

A. other VOCs analyzed for and their detection limits,

B. the detection limits of the COCs with J-coded values; Laboratory Reporting Limits for each volatile organic compound,

C. a summary of laboratory QC results, and

D. a summary of field QC results.

Appendix G, ***MW-4 SVOC Analytical Results***

72. Review of whether appropriate QC goals were achieved cannot be completed. SNL can expedite this review by providing the following information:

A. other SVOC's analyzed for and their detection limits,

B. the detection limits of the COCs with J-coded values,

C. a summary of laboratory QC results, and

D. a summary of field QC results.

Appendix H, ***MW-4 TAL Metals Analytical Results***

73. Review of whether appropriate QC goals were achieved cannot be completed. SNL can expedite this review by providing the following information:

A. a summary of laboratory QC results, and

B. a summary of field QC results.

Appendix I, ***MWL Groundwater Major Ion Chemistry Data***

74. Manganese, nitrate/nitrite, pH, iron, and total dissolved solids are not normally considered to be major ions. The title of this appendix should be changed to reflect the inclusion of minor/trace groundwater constituents and chemical properties.

75. There must also be some notes explaining the codes used in the columns for "well", "qualifier" and "sample type".

76. For MWL-MW4 groundwater data, clarification is needed to determine if the data are representative of ground water from the upper and lower screened zones combined, the upper screened zone only, or the lower screened zone only.

Appendix J, ***MWL Groundwater TAL Metals and Nitrate Data***

77. There should be some notes explaining the codes used in the columns for "well", "qualifier" and "sample type". The apparent inclusion of field QC results in this table makes it difficult to review the environmental data.

78. For MWL-MW4 groundwater data, clarification is needed to determine if the data are representative of ground water from the upper and lower screened zones combined, the upper screened zone only, or the lower screened zone only.

79. Review of whether appropriate QC goals were achieved could not be completed. SNL can expedite this review by providing the following information:

A. a summary of laboratory QC results, and

B. a summary of field QC results.

Appendix K, *MWL Ground-Water Radiochemical Data for 1994 and 1995*

80. There should be some notes explaining the codes used in the columns for "well" and "sample type".

81. For MWL-MW4 groundwater data, clarification is needed to determine if the data are representative of ground water from the upper and lower screened zones combined, the upper screened zone only, or the lower screened zone only.

Appendix L, *MWL Control Charts for Radioactive Indicators*

82. It is not clear how the control charts were generated. Additional explanation is needed before these charts can be evaluated.

Appendix M, *MWL Groundwater VOC and SVOC Data*

83. There should be some notes explaining the codes used in the columns for "well", "qualifier" and "sample type". The apparent inclusion of field QC results in this table make it difficult to review the environmental data.

84. For MWL-MW4 groundwater data, clarification is needed to determine if the data are representative of ground water from the upper and lower screened zones combined, the upper screened zone only, or the lower screened zone only.

85. Review of whether appropriate QC goals were achieved could not be completed. SNL can expedite this review by providing the following information:

A. a summary of laboratory QC results, and

B. a summary of field QC results.

References

Freeze, R. A., and Cherry, J. A., 1979, Groundwater: Prentice-Hall Inc., Englewood Cliffs, New Jersey, 604 p.

Moats, W. P., and Winn, L., 1993, Review of ground-water monitoring at Sandia National Laboratories' Mixed Waste Landfill: New Mexico Environment Department Report NMED/DOE/AIP-94/3, 8 p.

Moats, W. P., and Winn, L., 1995, Background Ground-Water Quality of the Kirtland Air Force Base Area, Bernalillo County, New Mexico: New Mexico Environment Department Report NMED/DOE/AIP-95/4, 319 p.