State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

CERTIFIED MAIL -- RETURN RECEIPT REQUESTED

November 20, 2006

Ms. Patty Wagner
Manager
Sandia Site Office/NNSA
U.S. Department of Energy
P. O. Box 5400, MS 0184
Albuquerque, NM 87185-5400

Mr. Les E. Shephard
Vice President
Energy, Information and Infrastructure Surety
Sandia National Laboratories
P. O. Box 5800, MS 0724
Albuquerque, NM 87185

RE: NOTICE OF DISAPPROVAL: MIXED WASTE LANDFILL CORRECTIVE MEASURES IMPLEMENTATION WORK PLAN, NOVEMBER 2005, AND REQUIREMENT FOR SOIL-VAPOR SAMPLING AND ANALYSIS PLAN SANDIA NATIONAL LABORATORIES EPA ID NM5890110518, HWB-SNL-05-025

Dear Ms. Wagner and Mr. Shephard:

The New Mexico Environment Department (NMED) has reviewed the subject Corrective Measures Implementation (CMI) Work Plan for the U.S. Department of Energy/Sandia Corporation's (Permittees) Mixed Waste Landfill (MWL) and has found a number of deficiencies.

The deficiencies are described in the comments below, which are divided into two parts based on subject. Comments in Part 1 are related to the construction plans and cover performance modeling. The Permittees shall address these comments within 30 days of receipt of this letter. Comments in Part 2 are related to the fate and transport model and monitoring triggers. The Permittees shall address the comments in Part 2 within 60 days of receipt of this letter.

Part 1, Comments on Landfill Construction Plans and Performance Modeling

The following comments shall be addressed by the Permittees within 30 days of receipt of this letter.

1. Executive Summary, Page iii, last bullet – Define the term "climax ecological community".

2. Section 2.1 – Provide a more detailed schedule that, at a minimum, indicates completion times for the following cover and project elements: subgrade, bio-intrusion barrier, native soil layer, topsoil layer, seeding, fencing, overall completion of project, and submittal of Corrective Measures Implementation (CMI) Report to NMED. As the actual start time is dependent on when the CMI Plan is approved, the completion times can be proposed as the number of days from the start time (assume the start time = 0 days).

3. Section 5.2.2.1.1, last paragraph – Describe the rainfall event that was simulated in the second *in situ* test.

4. Section 5.2.2.2, 1st paragraph on page 5-4 – Specify whether the degree of compaction was measured using the standard or modified proctor test.

5. Section 5.3.2.4, next to last sentence – This sentence refers to a sand layer with an initial water content of 0.036 cubic centimeters being used for a boundary condition. Normally, water content of soil is expressed as a percentage (of the ratio of the mass of water per the mass of solids, or in the case of volumetric water content the ratio of the volume of water to the total volume of soil). Confirm whether this value and unit of measurement are correct.

6. Section 5.7.1 – Specify the values used for the variables R, K, LS, VM and sources of the values used in the MUSLE equation to predict soil loss by water erosion.

7. Section 5.7.2 - Specify the values used for the variables I, k, C, l, V and sources of the values used in the WEQ equation to predict soil loss by wind erosion.

8. Section 7.0 – The NMED expects the vadose zone to be monitored for volatile organic compounds, tritium, and radon, in addition to soil moisture. The NMED may also require soil-gas monitoring to be conducted at depths other than at 173 feet, as implied by the Permittees in the second paragraph of Section 7.1. Monitoring details will need to be included in the long-term monitoring and maintenance plan, due within 180 days following approval of the CMI Report. No response is required at this time.

9. Figure 5-1 – Clarify which curves are representative of the PET data from the four National Weather Service stations in New Mexico and which are representative of the predicted PET data.

10. Appendix A, Construction Specifications, Section 02930, Reclamation seeding and Mulching, Part 3.1.2, #1 – Explain why the TA-3 borrow pits are not to be reseeded by the contractor, given that erosion of the borrow pits should be prevented.

11. Appendix A, Construction Specifications, Section 02200, Earthwork Part 3.3.3, #4 – The Permittees should consider changing the requirement that no proof rolling be conducted within 2 feet of any groundwater monitoring well, measuring device, or other placed surface. The NMED strongly suggests changing the requirement to preclude all heavy equipment from operating within 3 feet of wells or other measuring devices.

12. Appendix A, Construction Specifications, Section 02200, Earthwork Part 3.3.4, #8 and Part 3.3.6, #9 – Both of these sections contain language stating that nonconforming work shall be redone until the specifications are attained "or the Operator accepts the placement conditions". Please note that the NMED expects construction of the cover to comply substantially with the specifications in the approved CMI Plan. Failure to achieve the specifications in the approved CMI Plan, or obtain an NMED-approved change, could lead to disapproval of part or all of the constructed cover.

13. Appendix A, Construction Specifications, Section 02200, Earthwork Part 3.3.6 – The NMED strongly recommends that the Permittees add to the specifications for construction of the native soil layer a requirement for a minimum number of passes with compaction equipment.

14. Appendix B, Construction Quality Assurance Plan, Section 2.6.3, first sentence – Clarify what is meant by the first sentence: "The CQA Certifying Engineer is responsible for ....certifying the CQA document has been approved by the NMED". Did the Permittees intend, instead, to require that the CQA Certifying Engineer be responsible for certifying the results of the CQA Report that is to be submitted for NMED approval? If so, the first sentence should be revised to state "The CQA Certifying Engineer is responsible for certifying in a statement to the owner and the NMED that, in his or her opinion, the cover has been constructed in accordance with all plans and specifications". The next sentence of the paragraph explains further that the certification statement would normally be included in a CQA Report.

15. Appendix B, Construction Quality Assurance Plan, Section 8.7 – The Final Report must be submitted to the NMED as part of the CMI Report. The Final Report must include copies of all quality control data generated by the construction contractor as well as the quality assurance data generated by the CQA contractor.

16. Demonstrate with calculations and other information whether run-off and run-on controls have been adequately designed to handle peak precipitation events. Evaluate and discuss whether additional run-on controls should be constructed at locations further away from the landfill (e.g., at distances of 25 to 50 meters) to provide more protection for the cover from heavy rainfall events.

17. Identify the criteria to be applied to determine whether the establishment of vegetation on the final cover is acceptable, including, but not limited to, species diversity, plant survival, and the extent of ground cover. Explain how measurements will be conducted in the field to assess these criteria.

Part 2, Comments on the MWL Fate and Transport Model (Appendix E)

The following comments shall be addressed by the Permittees within 60 days of receipt of this letter. These comments concern Appendix E (Probabilistic Performance Assessment Modeling of the Mixed Waste Landfill at Sandia National Laboratories) of the CMI Plan.

1. Section 2.1.2.2 -- The last paragraph of Section 2.1.2.2 states, "Present conditions were simulated by modeling infiltration through various thicknesses of an engineered cover, while future conditions were simulated by modeling infiltration through various thicknesses of soil under natural conditions (i.e., the 'natural analog')." This description implies that present and future conditions are simulated using different designs (in the near term an engineered cover which in the future eventually degrades to the conditions of natural soil). Section 3.4.2 states that the engineered soil cover reverts to the natural soil conditions around the landfill. Provide clarification in Section 2.1.2.2 regarding the evolving soil conditions within the cover. Explain what soil conditions are expected to evolve, why and when they will evolve, and what will they evolve to.

2. The first paragraph of Section 3.2.1 states that lead, cadmium, and radionuclides (except radon) were modeled using the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES) and Multimedia Environmental Pollutant Assessment System (MEPAS) simulation tools. Section 3.2.2 states, "A separate model was used to model the transient transport of tritium at the MWL". The reader, however, does not learn until Section 3.7.1 that tritium was also modeled using FRAMES and MEPAS. Revise the text of Section 3.2.1 to indicate tritium was modeled using FRAMES and MEPAS, as well as the separate transient transport model.

The second paragraph of Section 3.2.1 indicates MEPAS is capable of computing contaminant fluxes for multiple routes, including radioactive decay and contaminant degradation. The paragraph states further that MEPAS was used only for the source-term and vadose-zone models, suggesting MEPAS was not used to model radioactive decay. In contrast, Section 3.2.2 indicates that the transient model for tritium and perchloroethene (PCE) accounts for contaminant decay. Clarify whether the modeling of radionuclide transport through the vadose zone at the MWL accounts for contaminant decay.

3. The first paragraph of Section 3.3 references Table E-2, which provides a summary of input parameters and distributions of constituents used in the modeling. Footnotes "b" and "d" reference an EPA fact sheet for tetrachloroethene; the fact sheet was reportedly accessed on the U.S. EPA website at www.epa.gov/WGWDW/dwh/t-voc/tetrachl.html, but it is not referenced in Section 6, References, of the report. The fact sheet was not available at the web address

provided, so the input parameters could not be verified. Provide the fact sheet as an attachment to the report and update the website address, if available, for the fact sheet. Also, revise Section 6 to include this fact sheet among the references. In addition, provide all other internet-referenced data as attachments to the report and cite these sources in Section 6.

4. Section 3.4.2, page E-35, 2nd paragraph – Explain why future infiltration rates would be less than current rates.

5. Section 3.6, Fate and Transport of Radon – Radon was modeled as originating from radium-226 sources. Explain why radon originating from the decay of depleted uranium was not incorporated into the radon fate and transport model.

6. Section 4, Pages E-59 and E-59a – Revise the trigger evaluation process to follow the corrective action process described in the Consent Order (April 29, 2004) if a trigger level is exceeded (step 3A), provided the Consent Order is still in force at the time the trigger level is exceeded. If the Consent Order has terminated, the trigger evaluation process should follow the standard RCRA corrective action process.

7. Section 3.3 -- The fourth paragraph of Section 3.3 discusses the dose via inhalation and dermal adsorption for gas-phase tritium, but a similar discussion is not presented for radon gas or gas-phase PCE. Clarify whether this dose discussion is applicable to all gas-phase constituents considered in the Report. If the dose discussion is only applicable to gas-phase tritium, then explain why this is the case. Alternatively, discuss inhalation and dermal adsorption doses for radon gas and gas-phase PCE.

8. Section 3.4.1 -- The first paragraph of Section 3.4.1 states the modeling study of water infiltration through the cover was "discretized by placing computational nodes at predetermined vertical spacing in a conceptual soil profile to evaluate the performance of a cover 3 ft in thickness." The model evaluated a soil profile that was actually 6 feet thick in order to avoid impacts due to boundary conditions, but these impacts and boundary conditions are not discussed. Thirty nodes were located within this 6-foot-thick soil profile. However, the discussion does not describe how or why the 30 node locations were predetermined within this soil profile. Explain the specific impacts caused by boundary conditions. Clarify how and why the computational node locations were predetermined.

The conceptual soil profile for the infiltration model, as discussed in Section 3.4.1, is presented side-by-side in Figure E-3 with nodal discretization used in the UNSAT-H model. As illustrated, the conceptual soil profile does not correspond to the components of the MWL soil cover cross-section. The soil profile illustration is dimensionless; i.e., it is not clear whether the soil profile is 6 feet thick. Also, only 23 of the 30 computational nodes within the cross-section are shown. In addition, the nodal depth locations can not be determined from the illustration. Revise the Figure E-3 conceptual model to clearly indicate the components of the MWL soil cover (i.e., subgrade layer, biointrusion barrier, native soil layer, topsoil layer, and vegetation) and their location relative to the MWL waste zone. Revise Figure E-3 to include a vertical scale for depth

(i.e., inches or feet below the cover surface) and the locations of all 30 computational nodes. Clarify the soil type specified for each component of the soil cover.

9. Section 4.2.2 -- Section 4.2.2 discusses the proposed neutron probe system for monitoring moisture content beneath the MWL. However, for the neutron probes to detect percolation through the soil cover, water will have to move through the bio-intrusion barrier, the waste zone, and a portion of the vadose zone prior to detection, which would be expected to require a considerable amount of time. The neutron probe system is thus more reliably a vadose-zone monitoring system rather than a tool to determine loss of integrity of the soil cover. If the Permittees want to monitor the cover for performance, the neutron probes should be placed just below the cover in the subgrade.

10. Figures -- Figures E-13, E-15, E-19, and E-24 present a graphical illustration of the sensitivity analyses performed for some of the constituents. The figures present histograms to compare ΔR^2 for constituent concentration and dose. Clarify why actual concentrations and doses were not presented in the sensitivity analyses.

11. General Comment on the Fate and Transport Model -- Compared to typical reports for modeling studies, the report as presented is brief, particularly when considering the complexity of using a Monte Carlo approach with multiple models, scenarios, and constituents of concern. In general, the report provides a narrative of a probabilistic model that is presented as a "black box." The report discusses the input parameters and selectively presents output results, but there is not adequate information to assess whether the "black box" is operating satisfactorily. The report does not present a discussion regarding software quality assurance – it is not known how well the various models work separately or together. Also, the report does not provide a critique of the modeling runs, except for an occasional qualitative statement. In contrast, a typical modeling report is a detailed and exhaustive presentation that addresses the conceptual development and construction of the model (e.g., the data quality objectives, the software code), the software quality assurance performed (including software validation and verification) to assess model performance both separately and when working together, the details regarding specific inputs and outputs for all runs of every scenario, and a quantitative analysis of the sensitivities of the input parameters, including an assessment of the bias of the model toward specific outputs. The report, however, does not provide this level of information. The Permittees must provide additional information to address the deficiencies mentioned above.

12. Provide information evaluating the risk to ecological receptors for tritium, radon, and radon daughter products, which are expected to be released to surface soil and the atmosphere.

13. Provide information evaluating the risk to human receptors for tritium, radon, and radon daughter products that would be expected to be released to surface soil and the atmosphere. Include external exposures.

14. The NMED expects surface soil surrounding animal borrows (including ant nests) to be monitored for radionuclides and metals. Develop triggers that are protective of both human health and the environment for radionuclides and metals in soil.

15. Develop triggers for tritium, radon, PCE and total VOCs as soil vapor. The NMED expects soil-gas in the vadose zone to be monitored for these constituents.

16. Table E-6 – The proposed trigger value for "infiltration" is 25% by volume. Specify whether "infiltration" means moisture content. Also, the proposed trigger is too high, as it likely represents conditions whereby there is near complete saturation of the soil.

17. Provide NMED a copy of the reference: Johnson et al (1995), *A Human Health Risk Assessment for the Mixed Waste Landfill, Sandia National Laboratories, Albuquerque, New Mexico*, Argonne National Laboratories, Argonne, IL.

18. Table E-6, the proposed trigger levels for 1,1,1-TCA, ethylbenzene, styrene, toluene, and total xylenes in groundwater are set too high. For these unnatural constituents, the levels of detection normally achieved by laboratories are much lower than groundwater standards set by the New Mexico Water Quality Control Commission (WQCC). The trigger levels can be set to much lower levels, and still allow for a given trigger level to be sufficiently above the limit of detection such that the constituent can be readily quantified with a high degree of confidence. Additionally, trigger levels should be set well below WQCC standards or below U. S. Environmental Protection Agency Maximum Contaminant Levels so that there will be time to react to prevent unacceptable levels of contamination should any trigger levels be exceeded.

19. Propose some additional monitoring to be conducted at locations within the landfill where contaminants were detected at their highest levels during the RFI. These locations should be subject to the same triggers as those proposed as points of compliance in Table E-6.

20. Expand the listing of proposed monitoring triggers in Table E-6, giving consideration of the following table:

Environmental Medium	**Monitoring Parameters**	**Main Potential Receptors**	**Sampling Points**
Air	radon, tritium	humans	landfill perimeter and interior stations
Surface Soil	radon, tritium, other radionuclides, metals	humans and ecological receptors	landfill perimeter, interior stations, and animal burrows located on cover
Subsurface Soil	moisture	humans via groundwater	neutron probe monitoring wells
Subsurface Soil Gas	radon, tritium, VOCs	humans via groundwater	beneath landfill
Groundwater	tritium, radon, isotopic uranium,VOCs	humans	down gradient groundwater monitoring wells

Radionuclides (other than radon and tritium) and metals should be the same as those listed in Table E-2. VOCs should include PCE, all organic constituents listed in Table E-6, and all other organic constituents normally detected by method 8260. NMED reserves the right to require additional monitoring pending review of the long-term monitoring and maintenance plan to be submitted later by the Permittees and pending receipt and review of public input of this latter mentioned plan.

General Comments and Requirements for Soil-Gas Sampling

As the Permittees are aware, most site characterization data for the MWL (other than groundwater data) dates before the mid 1990's. Because the rupturing of containers and the leaking of their contents could have occurred since the mid 1990's, the NMED requires more current soil-gas data to help resolve this issue. The Permittees shall therefore collect and analyze active soil-gas samples taken at depths of 10 and 30 feet at a minimum of three locations within the landfill where previous sampling has detected the highest soil-gas concentrations in the past. The soil-gas samples shall be analyzed for volatile organic compounds, tritium, and radon. Pursuant to Section VI.A of the Order on Consent (April 29, 2004), the Permittees shall provide for approval to the NMED within 30 days of receipt of this letter a work plan to conduct the active soil-vapor sampling described above. The work plan shall be prepared in accordance with Section X.B of the Consent Order.

Please contact William Moats of my staff at (505) 222-9551 if you have any questions.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

JPB:wpm

cc: J. Kieling, NMED, HWB
W. Moats, NMED, HWB
L. King, EPA-Region 6 (6PD-N)
J. Gould, DOE/NNSA/SSO, MS 0184
P. Freshour, SNL, MS 1087
File: Reading and SNL, 2006