February 17, 2011
New Mexico Environment Department
Hazardous Waste Bureau Chief
James Bearzi
james.bearzi@state.nm.us

NMED Secretary David Martin
PO BOX 26110,
Santa Fe, New Mexico 87502
david.martin@state.nm.us

The following comments are submitted to the New Mexico Environment Department for the **Sandia National Laboratories' Corrective Measures Implementation Report** (CMI Report) for the **Mixed Waste Landfill** that is a radioactive and hazardous waste dump contaminating Albuquerque's drinking water aquifer from its unlined pits and trenches.

FOR THE REASONS BELOW, I/OUR ORGANIZATION REQUESTS THAT THE NEW MEXICO ENVIRONMENT DEPARTMENT (NMED):

1) DENY THE SANDIA CMI REPORT AND PROVIDE A PUBLIC HEARING;

2) PERFORM A RISK ASSESSMENT FOR THE MIXED WASTE LANDFILL BASED ON INFORMATION PREVIOUS AND SUBSEQUENT TO THE 2004 PUBLIC HEARING;

3) REOPEN AND RECONSIDER THE DECISION TO LEAVE THE SANDIA MWL DUMP WASTE UNDER A DIRT COVER ABOVE ALBUQUERQUE'S DRINKING WATER;

4) NEW GROUNDWATER MONITORING WELLS SHOULD BE INSTALLED AT THE MIXED WASTE LANDFILL AND THE PLANS SUBMITTED TO THE PUBLIC AS REQUIRED BY 40 CFR 270.42;

5) COMPLETE EXCAVATION AND CLEANUP OF THE MIXED WASTE LANDFILL WITH STORAGE OF THE WASTE IN AN ENGINEERED FACILITY ON SITE.

The CMI Report should not be approved. The following issues have not been addressed:

- **Grounds exist for the termination of the MWL permit.** 40 CFR § 270.43 provides for the termination of permits where relevant facts have not been fully disclosed and/or relevant facts have been misrepresented *at any time.* **Both NMED and Sandia have failed to provide the relevant facts and misrepresented relevant facts about the MWL dump and its groundwater monitoring network.**

- As discussed below, the decision to install a dirt cover over the radioactive and hazardous mixed waste at the Sandia Mixed Waste Landfill dump was based on data from groundwater monitoring wells that were in the wrong locations, with corroded well screens and drilled with Bentonite drilling muds that prevent knowledge of contamination. The monitoring wells could not furnish representative and reliable groundwater samples. NMED was well aware of the defective groundwater monitoring network. (See Attachment 2 1998 Notice of Deficiency). NMED

accepted the erroneous data from the defective monitoring network to make the 2005 decision to install the dirt cover. NMED should not have allowed the installation of the dirt cover knowing that the groundwater monitoring network was defective and that the data from the groundwater monitoring network was unreliable and unrepresentative. Additionally, NMED knew from the 2008 Soil Vapor Report that there was a new release of tritium and solvents from the MWL dump wastes.

- No correctly located upgradient background monitoring well was installed until 2008.

- DOE/Sandia knew in May 1991 from the Tiger Team Assessment of SNL (U.S. Department of Energy May 1991 Tiger Team Assessment of the Sandia National Laboratories, Albuquerque, p. 3-59) that its monitoring wells were <u>insufficient in number</u>, and were <u>installed in the wrong location</u>:

  > **"**The number and placement of wells at the mixed waste landfill is not sufficient to characterize the effect of the mixed waste landfill on groundwater."

- The 1991 Los Alamos National Laboratory Report presented the defective monitoring well network by determining that the direction of groundwater flow at the water table below the Sandia MWL dump was to the southwest and monitoring well MWL-MW3 was the only downgradient monitoring well. Los Alamos National Laboratory EM Division Technical Review of the 1991 DOE/Sandia Report *–Compliance Activities Workplan for the Mixed Waste Landfill,* Sandia National Laboratories, (Rea, Ken, June 1991) (NMED AR 003746). The LANL report stated:

  > <u>"The data from the present monitoring well network indicates that there is only one downgradient and no upgradient wells. *This in itself establishes the inadequacy (under RCRA) of the present well network*</u> [Emphasis supplied]. The presence of this additional well [i.e., proposed angle well MWL-MW4 at a location inside the MWL dump] (neither downgradient nor upgradient) will still not meet RCRA monitoring criteria (p. 3)."

- The New Mexico Environment Department (NMED) issued a report "*Review of Ground Water Monitoring at Sandia National Laboratories' Mixed Waste Landfill*" in 1993 by NMED staff persons Mr. William Moats and Ms. Lee Winn that described 1). the poor knowledge of the groundwater flow direction below and downgradient of the Sandia MWL dump and 2). the improper use of the mud-rotary drilling method to install monitoring wells MWL-MW2, -MW3 and -BW1 at the MWL dump. The 1993 NMED report stated:

  > The hydrogeologic conditions at the MWL have not been adequately characterized. . . <u>Water level data from July 1992 indicate south-directed or southwest directed flow</u> [Emphasis supplied]. However, the gradient

> and direction of ground-water flow are not known with reasonable certainty (p. 3).
>
> The detection monitoring system that currently exists at the MWL is inadequate because the direction and gradient of ground-water flow can not be determined with reasonable certainty (p. 7).
>
> Additional wells installed at the MWL at greater distances from the facility than the existing wells would better define the horizontal gradient and direction of ground-water flow (p. 4).

- The March 1993 Moats/Winn report shows that the NMED was well aware that the mud-rotary drilling method prevented the three MWL dump monitoring wells MWL-MW2, -MW3 and -BW1 from producing reliable and representative data for 1). detection of groundwater contamination and 2). measurement of the hydraulic properties of the in situ geologic formation where the screened intervals were installed. Moats/Winn (1993) stated:

  > The use of mud-rotary drilling methods should be avoided in any future monitor well installations at the MWL. Mud rotary is not a preferred drilling technology due to its potential detrimental impacts to ground-water quality and the hydraulic characteristics of an aquifer (p. 3).

- Further evidence that NMED knew data from mud rotary drilled wells is unreliable is that the NMED HWB ordered DOE/Sandia to replace the three mud-rotary monitoring wells in 2007 with new monitoring wells that were not drilled with the mud-rotary method. The pertinent excerpt from the NMED HWB letter dated March 23, 2007 that ordered replacement of well MWL-BW1 follows:

  > The permittees [i.e., DOE/Sandia] shall install the well in a manner that avoids the use of drilling fluids or construction materials that have the potential to interfere with the reliability of hydrologic or analytical data obtained from the well (p. 2).

  The NMED HWB letter dated July 2, 2007 that ordered replacement of well MWL-MW1 and -MW3 stated:

  > "The mud rotary drilling method shall not be used to install the wells." (p. 2).

- Despite the knowledge of impairment, the NMED HWB accepted reports from DOE/Sandia up to the present time that the three mud-rotary monitoring wells produced reliable and representative water samples for the detection of groundwater contamination from the wastes buried in the MWL dump. NMED HWB allowed DOE/Sandia to use the incorrect pumping test and slug test hydraulic data collected from the three mud-rotary wells to calculate the speed of groundwater travel at the water table below and away from the MWL dump**.**

- The 1994 NMED DOE Oversight Bureau *Memorandum: Review of the March 10, 1993 RCRA RFI Phase 2 Work Plan for the Sandia Mixed Waste Landfill*. U.S. Department of Energy Oversight Bureau, October 13, 1994 (NMED AR 006462). The DOE Oversight Bureau review stated:

  General Comment #7. Page 2-31. Section 2.2.5.2. Paragraph 3: **"**….. Current water level data for the four MWL monitor wells suggest that the hydraulic gradient is toward the southwest, approximately 40 degrees counterclockwise to the regional gradient.**"** Regional gradient was determined to be west-northwest. What will be done to better define the local hydraulic gradient? [Emphasis supplied]. (p. 3).

- The Environmental Protection Agency (EPA) Region 6 issued a Notice of Deficiency (NOD) Report on September 22, 1994 (NMED AR 006433) for the DOE/Sandia RCRA Facility Investigation (RFI) Work Plan for the Sandia MWL dump, dated March 1993. The 1994 EPA Region 6 Notice of Deficiency (NOD) Report Pertinent stated:

  Comment no. 11. On page 2-31 [in the RFI Work Plan], the third paragraph states that regional potentiometric maps indicate that the hydraulic gradient at the MWL is toward the west and northwest. As shown in Figure 2-21, the MWL monitoring well network (i.e., MWL-BW1, MWL-MW1, MWL-MW2, and MWL-MW3) has been installed based on the assumed regional hydraulic gradient. However, the third paragraph further continues to state water level data collected from the MWL monitoring wells suggests the hydraulic gradient is to the southwest (p,5).

  Based on the southwest gradient flow of groundwater, the MWL monitoring wells are located cross gradient instead of downgradient from the MWL; therefore, contaminants emanating from the MWL may not be detected in the monitoring wells [Emphasis supplied] (p. 6).

- October 30, 1998. New Mexico Environment Department Notice of Deficiency Report for the DOE/Sandia *Report of the Mixed Waste Landfill Phase 2 RCRA Facility Investigation (RFI), Sandia National Laboratories, Albuquerque, New Mexico.* Garcia, Benito M., (NMED AR 010983). The 1998 NMED HWB NOD Report identified many major problems with the monitoring well network at the MWL dump that were not subsequently resolved. The reasons that the deficiencies in the 1998 NMED NOD Report were not resolved should be investigated. The 1998 NMED NOD Report identified that **There is only one downgradient monitoring well installed at the MWL dump:**

  Deficiency #3. Response #37 - - "The water-table map indicates that there is only one downgradient monitoring well at the mixed waste landfill [i.e., well MWL-MW3]. Normally, a minimum of three downgradient wells is required for an adequate detection monitoring system. After the two new wells are

installed [wells MWL-MW5 and -MW6], and the water table map is revised, the HRMB [now the NMED HWB] will reevaluate the adequacy of the detection monitoring system [Emphasis supplied]. HRMB requests a meeting with DOE/SNL technical and management staff to discuss the location and design of the two new wells" (p. 2-3).

- The 1998 NMED NOD Report identified **Monitoring well MWL-MW4 is defective and requires replacement.** The NMED 1998 NOD Report stated the following about the requirement to replace monitoring well MWL MW4:

  Additional Comment #3. Response #38 - - "The top of the upper screen of MWL-MW4 is located approximately 22 ft below the water table. Because of the vertical gradient and the way the well is constructed, MWL-MW4 is of **no value** for determining the elevation of the water table (and therefore, the horizontal direction of ground-water flow and the horizontal gradient [emphasis supplied] (p.7).

  Also, because the top of the upper screen of MWL-MW4 is located 22 ft. below the water table, the well is of little value for detecting any groundwater contamination (if any exists) that may be present in the saturated zone just below the water table [emphasis supplied] (p. 7).

  The defective MWL-MW4 remains in the current monitoring well network.

- The 1998 NMED NOD Report identified that **Core samples collected of sediments below the MWL dump demonstrate that the dump wastes are the source for nickel contamination in the groundwater.** The pertinent excerpts in the NMED 1998 NOD Report about the requirement for DOE/Sandia to investigate the MWL dump as the source for the high concentrations of nickel contamination measured in groundwater samples collected from monitoring wells MWL-MW1 and -MW3 follow:

  Deficiency #2. Response #23 – – The cross-sections indicate:

  D. There is evidence of possible nickel contamination at concentrations ranging from 11.8 – 21.5 mg/kg in soil samples collected at depths of about 70 – 100 ft (Boreholes SB-5 and BH-3).

  E. There is a "hot spot" of contamination at a depth of 50 ft. at Borehole BH-3. Contaminants are Ag [silver] (1.46 mg/kg), Cd [cadmium](1.44 mg/kg), Co [cobalt] (105 mg/kg), Cu [copper] (645 mg/kg), Ni [nickel] (97.5 mg/kg), and Zn [zinc] (413 mg/kg).

  The presence of metal contaminants at depths which can exceed 100 ft indicate that liquid wastes were disposed of in the landfill. Thus, groundwater monitoring for metals is required.

- **The NMED 1998 NOD Report identified failed pumping tests:**

  > **Additional comment no. 5. Response 50.** - - The pumping tests for monitor wells MWL-MW1, MWL-MW2, MWL-MW3, and MWL-MW4 appear to have failed because the yield of each well was too small to permit a successful pumping test to be conducted. The pumping test conducted on MWL-MW4 (Lower) also appears to have failed, . . . none of the drawdown curves appears to have a form which matches that of a type curve. Therefore, the reported values for hydraulic conductivity and transmissivity are not considered by the HRMB [now the NMED HWB] to be reliable [Emphasis added](p. 7-8).

  The unreliable pumping test data that were rejected in the NMED 1998 NOD Report were nevertheless subsequently used by DOE/Sandia to calculate the hydraulic conductivity and lateral speed of groundwater travel away from the MWL dump at the water table in the fine-grained alluvial fan sediments and in the deeper ARG Deposits. The incorrect hydraulic conductivity data and the incorrect lateral speed of groundwater travel were listed in Tables 3-3 and 3-4, respectively, in the December 2002 DOE/Sandia Report by Goering et al., 2002

- **The 1998 NMED NOD Report required a risk assessment for groundwater contamination from the Sandia MWL dump.** The 1998 NMED NOD Report stated (p.4-5):

  > B. Because land located approximately 1 mile west of the MWL could be developed for residential use, DOE/SNL must evaluate the potential for off-site contaminant migration from the landfill. The evaluation should consider ecological and human health impacts from any potential migration.
  >
  > C. The nature and extent of subsurface contamination indicate that some contaminants are a potential threat to ground-water quality beneath and downgradient (west) of the MWL. A simple screening comparison of contaminant concentrations in subsurface soils against available EPA soil screening levels (SSL's) developed for the protection of ground-water resources demonstrates exceedences for cadmium and nickel (U. S. EPA, 1996, *Soil Screening Guidance: Technical Background Document,* EPA/540/R-95/128. Office of Emergency and Remedial Response, Washington, DC. PB96-963502).
  >
  > Therefore, the risk assessment for the MWL must evaluate potential impacts of cadmium, nickel, and other contaminants (metals such as cobalt and copper, and radioactive materials such as uranium and tritium, for which SSL's are not available at this time) on local and regional ground-water quality [Emphasis supplied].

The risk assessment that was required in the 1998 NMED NOD Report for impacts to groundwater was not performed because the unreliable water quality data from the defective monitoring well network were used for the incorrect conclusion that the groundwater contamination pathway below the MWL dump was "incomplete." The groundwater contamination pathway is complete because the background water quality data from well MW-BW2 provides evidence that the buried wastes have contaminated the ground water with Nickel, Cadmium, Chromium, and Nitrates.

- The testimony at the NMED December 2004 Public Hearing by NMED consultant Ms. Paige Walton on the decision to not perform the required risk assessment for the groundwater pathway stated:

  > Both RCRA facility investigations concluded that groundwater had not been impacted by contaminants from the landfill (v. III, p. 1036, l. 18-20).
  >
  > The first step in identifying constituents of concern [for risk assessment] was to compare detected concentrations to natural pathway of concern. However, extensive groundwater monitoring has shown that groundwater is not contaminated as a result of releases from the landfill. (v. III, p. 1036, l. 18-20).
  >
  > Therefore, while groundwater was identified as a potential exposure pathway, it is acceptable, in NMED's view, to evaluate groundwater under the current conditions as an incomplete exposure pathway. (v. III, p. 1039, l. 1-7).
  >
  > In this case, since groundwater has not been found to be contaminated, there is no source, and, therefore, the pathway is incomplete. (v. III, p. 1039, l. 13-15).

  The testimony by Ms. Walton did not mention the findings in the NMED 1998 NOD Report that included a requirement of a risk assessment for the groundwater pathway. The conclusion in the NMED 1998 NOD Report about the RCRA Facility Investigations was that 1). there was only one downgradient monitoring well 2). the onsite monitoring well MW4 was unreliable and required replacement 3). there was no reliable network of monitoring wells 4). groundwater samples collected from monitoring wells MWL-MW1 and -MW3 were evidence of a nickel plume from the nickel wastes buried in the MWL dump.

- The lack of a risk assessment for the MWL is problematic based on new technical information that has surfaced since the 2004 public hearing for the remedy.

- **NMED has (i) failed to exercise control over activities required to be regulated under the Resource Conservation and Recovery Act (RCRA), including failure to issue corrective action approvals for the MWL dump based upon true and**

correct information; (ii) repeatedly issued approvals which do not conform to the requirements of RCRA; and (iii) failed to comply with the public participation requirements of this part. 40 CFR 271.22.

- Under 40 C.F.R. § 271.15(b)(2), NMED has failed to exercise adequate inspection authority designed to allow NMED to:
  i) determine compliance,
  ii) verify the accuracy of information submitted by the permittee and,
  iii) verify the accuracy of sampling, monitoring and other methods used to develop the information submitted to the agency.

- NMED defeated the RCRA requirements for full public participation in the CMI process and prevented public knowledge of the both the defective groundwater monitoring network and the defective cover. 40 CFR 124 and 63 Fed. Reg. 56710 et seq.

- The 2006 TechLaw, Inc. report. Citizen Action was sued in 2008 by the New Mexico Environment Department in a "reverse" Freedom of Information lawsuit. The lawsuit asked Judge Sanchez of the Santa Fe 1st Judicial District Court to keep a 2006 TechLaw report secret from Citizen Action and the public. The TechLaw report concerned computer modeling and dirt cover construction for hazardous and radioactive wastes at the Mixed Waste Landfill above Albuquerque's groundwater that supplies municipal drinking water wells. The Department ultimately lost the lawsuit but continued appealing the ruling so that Citizen Action could not obtain the technical report until late 2009.

- Describing the Sandia computer model as a "Black Box," the 2006 TechLaw report cautioned NMED against its acceptance to predict contaminant movement beneath the Sandia Mixed Waste Landfill, an old nuclear weapons dump located close to the Mesa del Sol subdivision. Radioactive and other chemical wastes were buried in the unlined dump between 1959 and 1988.

- The existing dirt cover installed over the wastes buried in the MWL is defective because it is not the required design and does not have the required instrumentation to recognize the travel of water through the dirt cover and into the buried wastes (2006 TechLaw, Inc. report, See Attachment 1). The dirt cover placed over the dump will not be effective for the thousand year required protection from the long lived wastes in the dump that can enter air and water.

- The 2006 TechLaw report pointed out mistakes in the design of the dirt cover that was installed over the mixed waste dump. The existing soil moisture probe holes below the MWL dump are inadequate because they only monitor below a small number of the unlined pits and trenches, they do not monitor continuously and they do not monitor the breakthrough of moisture at the base of the dirt cover.

- **NMED provided no opportunity to the public to be informed of or discuss the concerns identified for the dirt cover in the TechLaw report.** The secret 2006 TechLaw Report recommended for the NMED *to not approve* the DOE/Sandia 2005 FTM Report. NMED failed to provide relevant facts to the public regarding the Sandia computer model used in the FTM. NMED made no mention of the criticisms contained in the 2006 TechLaw report for the Sandia computer model during a May 2006 technical "public dialogue." Then in November 2006, NMED staff geologist William Moats, et al wrote a report to wave aside concerns raised by registered geologist Robert Gilkeson and Citizen Action about the unreliability of the groundwater monitoring at the mixed waste landfill. One linchpin used by Moats was to rely upon the Sandia Black Box computer model rejected earlier by the TechLaw report.

- The methodology and conclusions of the NMED November 2006 Moats Report lack scientific basis, are known to be incorrect and the Moats Report requires retraction. In November of 2006 the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) published the report titled Evaluation of the Representativeness and Reliability of Groundwater Monitoring Well Data, Mixed Waste Landfill, Sandia National Laboratories by William P. Moats, David L. Mayerson and Brian L. Salem 31 (referred to as the 2006 Moats Report or the Moats Report). The 2006 Moats Report makes the incorrect conclusion that all of the seven defective monitoring wells displayed on Figure 1 (See Attached) provided reliable and representative water quality data. However, the incorrect conclusion in the NMED 2006 Moats Report was based on the evaluation of the unreliable water quality data from only four of the seven MWL dump monitoring wells (i.e., wells MWL-MW2, -MW3, -MW5 and -BW1) that were known to be defective for many factors that are described in this section.

- The NMED November 2006 Moats Report ignored without explanation the conclusions in the 1993 report by Moats and Winn and the findings in the NMED 1998 NOD Report that described the MWL monitoring well network to be inadequate. The issues in the 1993 NMED Report and in the NMED1998 NOD Report were not resolved at any time including at the NMED December 25, 2004 Public Hearing, when the NMED Moats Report was issued in November of 2006 or to the present time in 2011.

  In addition, the scientific community including the Environmental Protection Agency (EPA) and the National Research Council (NRC) has rejected the methodology of using only the chemistry of groundwater samples to evaluate the ability of monitoring wells contaminated with bentonite clay to provide reliable and representative water samples for the detection of groundwater contamination from the wastes buried in the Sandia MWL dump. According to the March 30, 2009 Memorandum of S.D. Acree, and Richard Wilkin, Ph.D. to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (09RC06-001) – Review of LANL *Well Screen Analysis Report (WSAR), Rev.2,* the study of water quality data alone cannot determine whether the changed water chemistry surrounding a well screen can again

provide representative and reliable water samples. The Memorandum provides that other factors than considering drilling additives may have a greater impact on the suitability of groundwater samples:

> "As in the review of previous versions of these documents (Ford and Acree to Mayer, *2116/06),* this review is focused on the evaluation of the effects of drilling additives on the collection of representative samples from wells installed under the hydrogeologic characterization program. It is noted that factors other than the effects of drilling additives *(e.g.,* screen length, position within the hydrostratigraphic section, location with respect to potential contaminant source areas, groundwater sampling methods) may have a greater impact on whether groundwater samples are suitable for the purpose of early detection of contaminant releases or migration."
> ftp://164.64.146.6/hwbdocs/HWB/lanl/permit/comments/31986%20Robert%20Gilkeson%209-4-2009%20Comment.pdf

- A report by the National Academy of Sciences *Plans and Practices for Groundwater Protection at the Los Alamos National Laboratory* (2007) (p.38) explained that drying will enhance vapor transport of volatile species (citing Stauffer, P.H., K.H. Birdsell, M.S. Witkowski, and J.K. Hopkins. 2005. Vadose Zone Transport of 1,1,1-Trichloroethane: Conceptual Model Validation Through Numerical Simulation. Vadose Zone J. 4:760-773.) Drying occurs from the installation of dirt covers.

  The *Review of Sandia National Laboratories/New Mexico Evapotranspiration Cap Closure Plans for the Mixed Waste Landfill,* Tom Hakonson, Ph.D., Environmental Evaluation Services, LLC 2/15/02 identifies also that a dirt cover can increase vapor phase transport of volatiles (p.7-8):

  > However, it is ironic that a cover that is effective in minimizing soil moisture in the landfill can also contribute to an increase in vapor phase transport of volatiles such as tritium. The relative importance of aqueous versus vapor phase transport of tritium at the MWL will be difficult to determine but will depend on a host of physical, chemical, and biological processes that are complex and coupled. The fact that tritium moves in more than one phase ensures that it will be relatively widely dispersed from the initial burial location. Therefore, I am certain that monitoring data from the MWL will show that tritium is currently present in fauna and flora.

- A $275,000 investigation (April 2010) by the Environmental Protection Agency Office of Inspector General (OIG)found that EPA Region 6 staffers had concerns about the landfill's affect on groundwater and the lack of effective groundwater monitoring at the MWL dump. The Inspector General also found the Oversight Report of the EPA staff's MWL dump concerns are still being kept secret from the public. http://www.epa.gov/oig/reports/2010/20100414-10-P-0100.pdf The (OIG) found (p.3):

Region 6 Actions Limit Public Involvement

Region 6 withheld information from the public regarding the MWL monitoring wells through:

- discontinuation of record keeping,
- misleading communications, and
- inappropriate classification.

- NMED entered into an agreement with EPA Region 6 to withhold information and documentation from Citizen Action and the public regarding the defective groundwater monitoring network at the MWL dump. EPA Region 6 produced an "Oversight Report" that was orally presented to the NMED by Region 6 to avoid production of documentation that the public could obtain regarding the defective groundwater monitoring network. NMED thereby concealed from Citizen Action and the public full and relevant facts of scientific knowledge that Region 6 "found some of CANM's concerns valid." http://www.epa.gov/oig/reports/2010/20100414-10-P-0100.pdf, p.3-4. The erroneous data from the defective groundwater monitoring network was used to make the decision to place a dirt cover over the MWL dump wastes.

- **The wastes at the MWL dump have not been adequately characterized and contamination has been detected in the uppermost zone of saturation.** The dirt cover should not have been installed in the absence of characterization of the waste and the nature and extent of contamination.

- Unsolidified, hazardous chemical wastes such as acids, solvents, TCE and carbon tetrachloride, were disposed of in the classified section of the MWL from 1959-1962. It was not until 1975 that SNL required liquid wastes to be solidified before being placed in the MWL.

- The MWL dump contains High Level Waste from nuclear reactor operations at the Annular Core Research Reactor that irradiated spent nuclear fuel. It is illegal to dispose of high level waste as is being done at the MWL dump. Pu-239 , Americium-241 and Niobium-94 with long half-lives were disposed in the MWL dump. These types of contaminants will remain a perpetual hazard to Albuquerque.

- The proposed soil gas monitoring well network in the vadose zone is inadequate and unacceptable because it does not monitor below the unlined pits and trenches.

- Comparison of recent data from both the old and new background monitoring wells with older downgradient wells demonstrates that contamination of the groundwater was present from the MWL wastes beginning in 1990 for nickel, chromium, cadmium and nitrates. Groundwater may also be contaminated with the highly toxic carcinogen tetrachloroethene (PCE).

- The U. S. Congress commissioned a study of the contamination issues at the Sandia MWL Dump by WERC. However, the WERC Expert Panel was not informed of and could not address the issues of unreliable data from the flawed network of groundwater monitoring wells at the MWL dump and the contamination of groundwater. No references to any of the reports described above, such as the 1998 NMED NOD were provided to the WERC. This constituted withholding of relevant facts.

- Three of the four newer groundwater monitoring wells were installed too deep to monitor at the water table. The well screens are 30 ft in length rather than the EPA required length of 10 ft. The wells were drilled improperly and are sampled incorrectly. The three wells require replacement as soon as possible.

- NMED and Sandia presented erroneous testimony to the Hearing Officer at the December 2004 Public Hearing that a reliable network of monitoring wells was in place at the MWL dump. The new information presented to NMED by Region 6 would have justified the application of different permit conditions at the time of issuance and constituted a cause for modification of the permit at the time NMED received knowledge of the EPA Region 6 Oversight Report contents. 40 CFR 270.41 (a) (1) and (2).

- The order for the installation of new groundwater monitoring wells was a significant alteration to the permit for the MWL dump and should have been presented to the public as a Level 3 modification. NMED knew or should have known that the permit modification for the groundwater monitoring must have followed the procedures in §270.42(c) for Class 3 modifications for the reason that there has been and is persistent and significant public concern about the proposed modification to the groundwater monitoring network. §270.42(b)(6)(i)(C).

- **Nevertheless, despite the knowledge of facts contained in the above reports, Sandia/DOE was allowed by the NMED to the present day to continue presenting the erroneous well monitoring data from known defective wells. The defective data was used by the NMED and Sandia Labs as a justification for the remedy decision to put a vegetative soil cover over and leave in place the radioactive and hazardous wastes at the dump. Because both NMED and Sandia knew the data was unreliable, unrepresentative and erroneous, the dirt cover should not have been installed.**

- No groundwater monitoring well network is installed for the uppermost aquifer as defined by RCRA and also required by the April 29, 2004 Compliance Order on Consent. Because no monitoring of the uppermost aquifer has taken place the dirt cover should not have been installed.

- There are two zones of saturation below the Sandia MWL dump that require networks of monitoring wells. A reliable network of monitoring wells was not installed in either of the two zones. Figure 2 (see attached) is a geologic cross section that shows

the two zones of saturation below the MWL dump that require networks of monitoring wells. The upper zone is the water table in the fine-grained alluvial fan sediments. The deeper zone is the Ancestral Rio Grande Deposits (ARG Deposits) that are below the layer of fine-grained alluvial fan sediments that form a leaky confining bed above the ARG Deposits.

- After learning from the oral presentation of the Oversight Report EPA by Region 6, that the MWL had defective monitoring wells, NMED did not provide the public opportunity for review and comment on new groundwater monitoring wells that NMED required Sandia to install as required by RCRA. 40 CFR 270.42 Appendix I C. Groundwater Monitoring.

- Wells MWL-MW7, -MW8 and -MW9 – three wells installed in 2008 were drilled with improper methods with 30-ft screens installed too deep to detect contamination and measure the elevation of the water table below the MWL dump. Wells MWL-MW1, -MW2, -MW3, -MW4, -MW7, -MW8, -MW9 and -BW1 – the high-flow pumping methods purged the wells dry and highly aerated water samples were collected up to a week later. This sampling method removes volatile and trace metal contaminants from the collected water samples.

- The current monitoring well network at the Sandia MWL dump includes the six unreliable contaminant detection monitoring wells MWL-MW4, -MW5, -MW6, -MW7, -MW8 and -MW9 and the background water quality monitoring well MWL-BW2. The locations of the seven wells are shown on Figure 3 (see attached). The six contaminant detection monitoring wells in the current network require replacement because they do not meet the intended purpose to 1). monitor contamination at the water table below and downgradient from the MWL dump, 2). measure the elevation of the water table and 3). accurately determine the direction and speed of groundwater travel at the water table below and hydraulically downgradient from the MWL dump. The NMED HWB has not, but should enforce the requirement in the NMED Sandia Consent Order and RCRA for replacement of the six defective monitoring wells in the current network.

- Although NMED recognized that groundwater flow is to the southwest, no groundwater monitoring wells were installed to the south of the MWL dump in either the uppermost aquifer or at the water table. The dirt cover should not have been installed without adequate investigation to the south of the MWL dump.

- The proposed soil gas monitoring well network in the vadose zone is inadequate and unacceptable because it does not monitor below the unlined pits and trenches.

- DOE/Sandia performed a field investigation in 2008 that discovered a 10-fold increase of tritium contamination released from the wastes buried in the unlined trenches and pits at the MWL dump. An investigation of the new contamination discovered in the vadose zone below the unlined trenches and pits was not performed.

- The existing DOE/Sandia 2007 Fate and Transport Computer Model (FTM) will be used to assess the performance of the long-term monitoring. The DOE/Sandia FTM is defective because it does not recognize that the groundwater below the MWL dump is presently contaminated with cadmium, chromium, nickel and nitrate from the wastes buried in the MWL dump.

- The 2007 FTM Report rejected the new computer calculations and the earlier computer calculation in 1995 (Klavetter, 1995) that identified the groundwater is contaminated with PCE from the wastes buried in the MWL dump. PCE is a contaminant in the vadose zone below the MWL dump but the nature and extent of the PCE contamination is not accurately known either in the vadose zone or in the groundwater. PCE has probably contaminated the groundwater but can be masked from detection by the defective monitoring well network at the MWL dump.

- The MWL may be contaminating groundwater with tetrachloroethene (PCE) above the new EPA MCL standards. The DOE/Sandia 2007 FTM Report predicted that the groundwater below the MWL dump is contaminated at the present time with PCE at concentrations above 0.05 ug/L. The EPA is setting a new Drinking Water Standard (DWS) limit for PCE at 0.05 ug/L that is a hundred fold tightening of the current standard of 5 ug/L. The EPA standard is tightened because PCE at any concentration in drinking water may cause cancer.

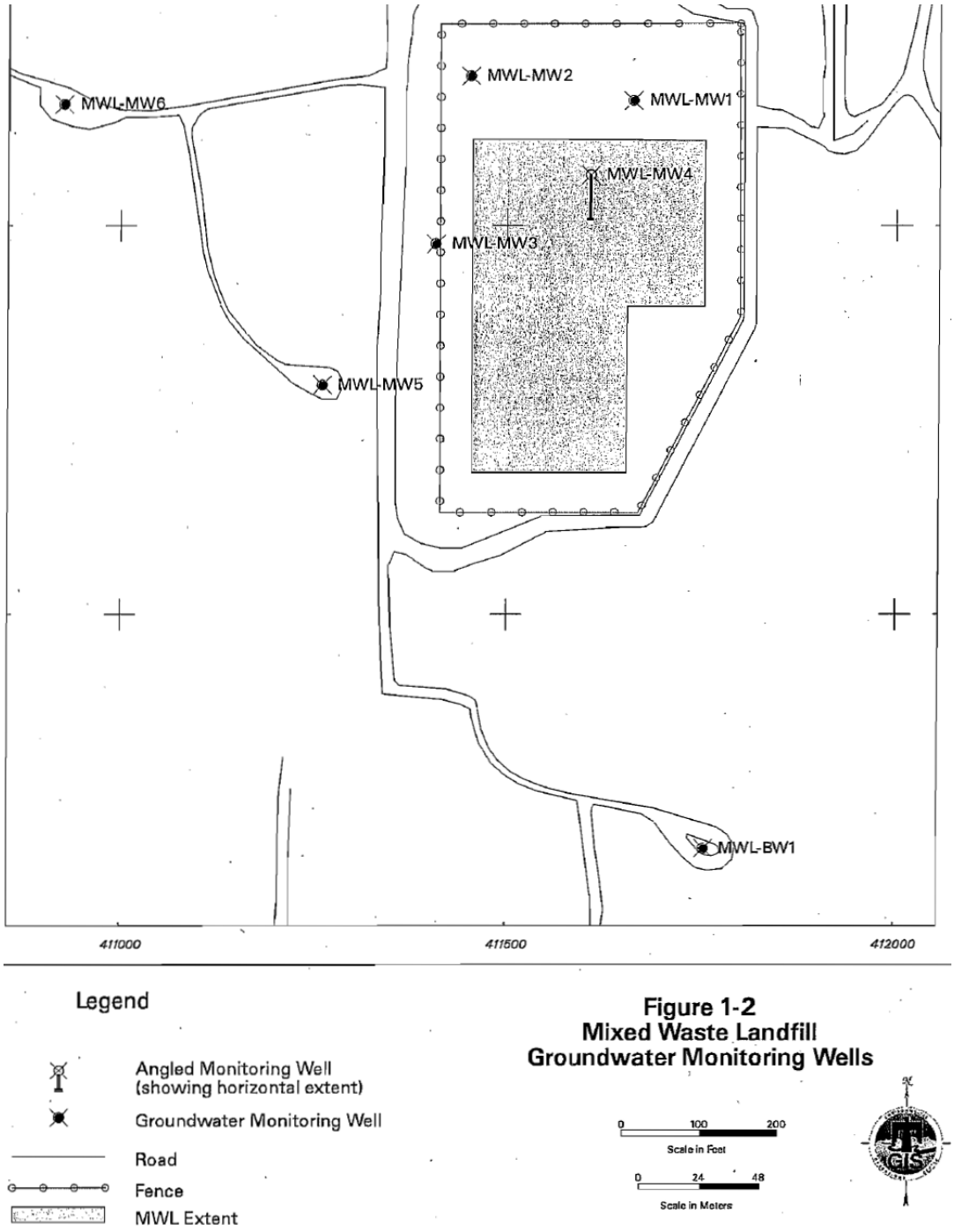
- The realization of the groundwater contamination beneath the MWL dump from comparison of BW2 samples to the cadmium, nickel, chrome and nitrates found in MW1 and MW3 requires that the dump be excavated and that groundwater be properly monitored.

- **The MWL dump has been improperly classified as a Solid Waste Management Unit (SWMU) for closure under Corrective Action. There is the failure to provide a Post-Closure Plan. 40 CFR 264.118. The MWL dump is a "regulated unit" by definition. (40 CFR 264.90(a)).** 40 CFR 270.1 (c) requires that owners and operators of landfills that received waste after July 26, 1982 must have post-closure permits, unless they demonstrate closure by removal or decontamination or obtain an enforceable document in lieu of a post-closure permit. If a post-closure permit is required, the permit must address groundwater monitoring, unsaturated zone monitoring, corrective action and post closure care requirements. **No post closure permit has been submitted for the MWL dump that is leaving wastes in place.**

Thank you for your consideration.

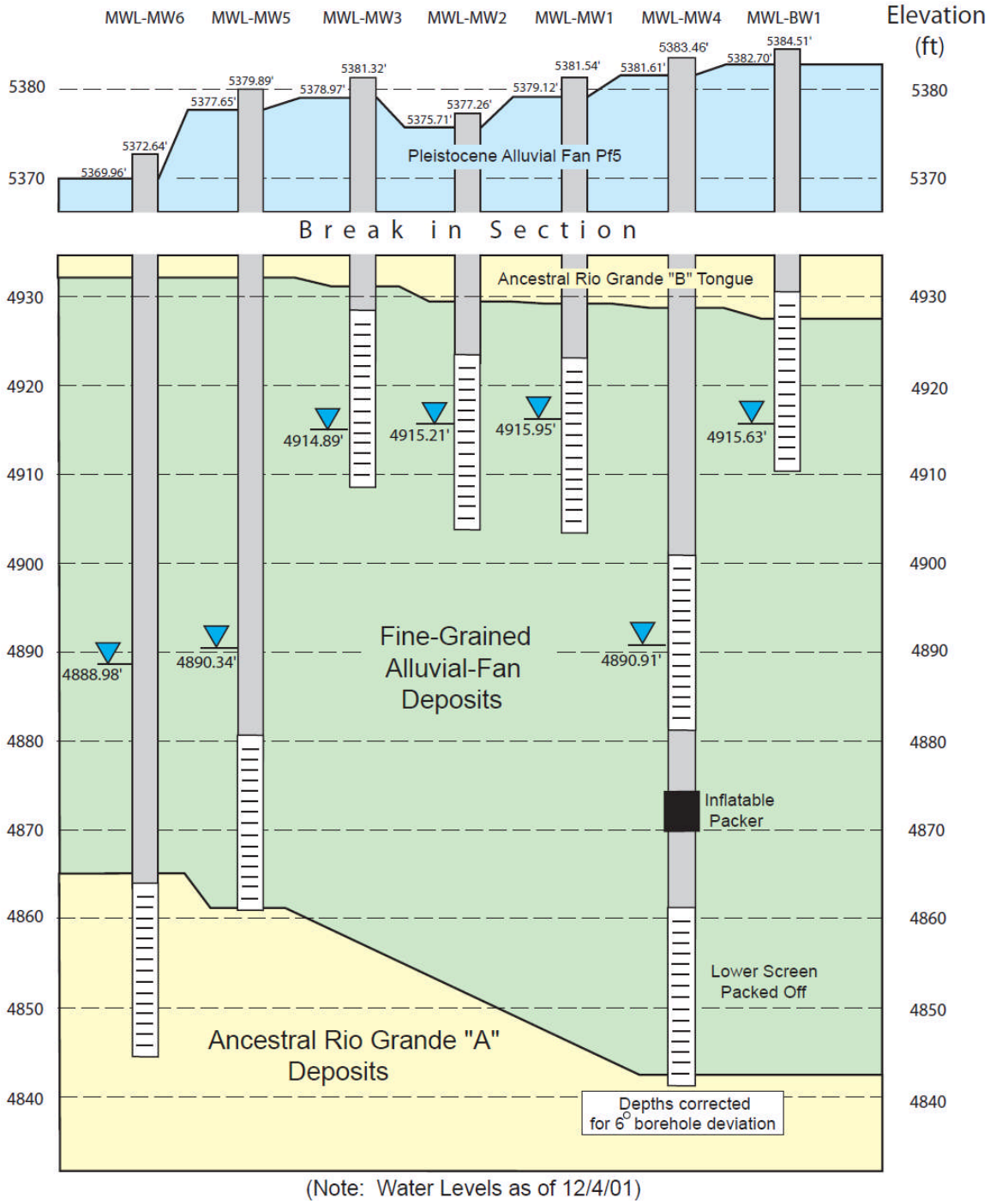
David B. McCoy, Executive Director
Citizen Action New Mexico
POB 4276
Albuquerque, NM 87196-4276
505 262-1862 dave@radfreenm.org

Figure 1. Map of the Sandia Mixed Waste Landfill (Sandia MWL dump) showing the monitoring well network in 2007 of the six monitoring wells MW1 to MW6 and the background water quality well BW1 500 feet south of the dump.



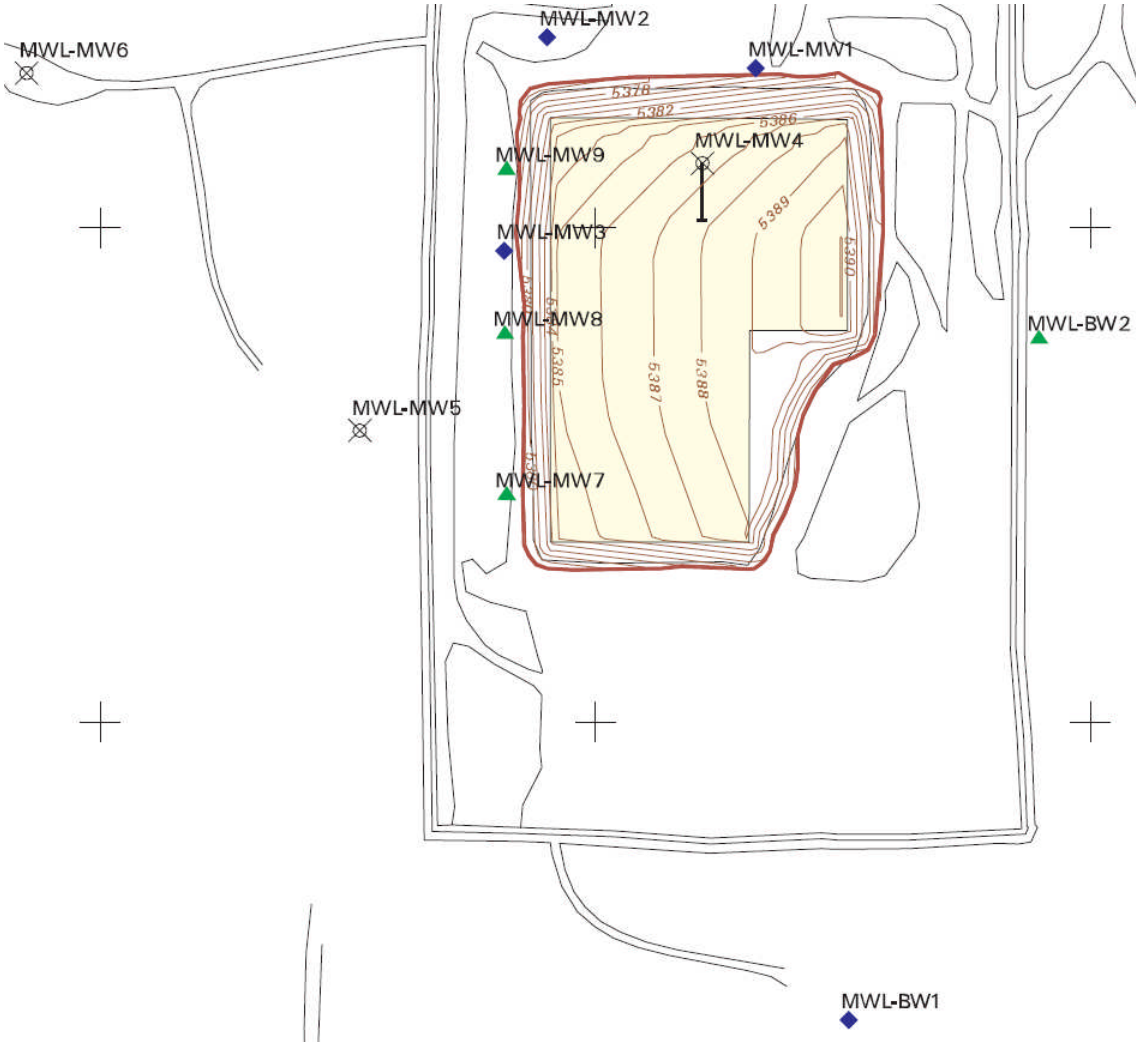
Source: Figure 1-2 in *Mixed Waste Landfill Annual Groundwater Monitoring Report April and June 2007 Sampling Event,* Sandia National Laboratories/New Mexico, Report issued in February 2008.

Figure 2. Schematic of the Monitoring Wells and the Hydrogeologic Setting at the Sandia MWL dump. The permeable sands and gravels in the Ancestral Rio Grande "A Deposits (ARG deposits) are the valuable groundwater resource for Albuquerque and the surrounding region.



Source: Figure 3-13 in *Mixed Waste Landfill Groundwater Report, 1990 through 2001, Sandia National Laboratories, Albuquerque, New Mexico* SAND 2002-4098 (Goering et al., 2002).

Figure 3. Location of the new detection monitoring wells MWL-MW7, -MW8 and -MW9 along the western boundary of the Sandia MWL Dump and new background monitoring well MWL-BW2 200 feet east of the MWL Dump.



Scale 0……..200 feet

Source: Figure 1-2 in Mixed Waste Landfill Groundwater Monitoring Report Calendar Year 2008, Sandia National Laboratories, May 27, 2009

TechLaw
Quality & Integrity

560 Golden Ridge Road, Suite 130
Golden, CO 80401
(303) 763-7188
(303) 763-8889 FAX
www.techlawinc.com

January 31, 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 06110.310; State of New Mexico Environment Department, Santa Fe, New Mexico; General Permit Support Contract; Sandia National Laboratories; Technical review of the *Probabilistic Performance-Assessment Modeling of the Mixed Waste Landfill at Sandia National Laboratories*, presented in Appendix E of the Sandia National Laboratories (SNL) *Mixed Waste Landfill Corrective Measures Implementation Plan* (the CMI Plan), dated November 2005; Task 2 Deliverable

Dear Mr. Cobrain:

Enclosed please find the deliverable for the above-referenced work assignment. This deliverable consists of comments developed during a technical review of the *Probabilistic Performance-Assessment Modeling of the Mixed Waste Landfill at Sandia National Laboratories* (the Assessment), which is presented in Appendix E of the Sandia National Laboratories (SNL) *Mixed Waste Landfill Corrective Measures Implementation Plan* (the CMI Plan), dated November 2005. The selected remedy for the Mixed Waste Landfill (MWL) is a 3-foot-thick soil cover, with an underlying biointrusion barrier, which is considered by the Assessment.

The deliverable presents numerous comments that request further clarification in the Assessment. The following points are significant issues discussed in the deliverable:

- Section 3.3 indicates the minimum thickness of the cover is set equal to zero as a bounding value to account for a worst case scenario in which complete erosion of the cover occurs at some point during the 1,000-year performance period. Although this scenario is for modeling purposes only, if the scenario runs indicate the potential for erosion of the soil cover, then design modifications may be necessary to demonstrate ongoing integrity during the performance period. These modifications may include additional run-on/run-off controls, which would not directly impact the actual cap design. Also, Section 3.3 states that the cover integrity will be maintained, however, it appears unlikely that the United States federal government can or will be able to maintain the integrity of the cover for the entire 1,000-year performance period. Consequently, the cap should be designed to require little maintenance and preferably none at all.

- Tables E-3 and E-4 indicate that the waste zone thickness and vadose zone thickness were modified to accommodate the modeling of cadmium beneath the MWL waste zone. This is a significant deviation from the input parameters for other constituent modeling. Table E-3 explains that the cadmium waste zone was increased to simulate the maximum penetration

depth of the coolant water that *may* have carried cadmium. Correspondingly, Table E-4 indicates a decreased thickness for the vadose zone for cadmium modeling. These modifications were not discussed in Section 3.3, nor were they justified in the Assessment. The Assessment should be clarified to explain why the maximum depth of contamination was used as the waste zone thickness for cadmium, yet the maximum depth of contamination was not used for any of the other constituents considered by the performance assessment modeling.

- 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. A similar discussion for inhalation and dermal adsorption doses for radon gas and gas-phase PCE should be presented in the Assessment.

- Section 4.2.2 discusses the proposed neutron probe system for monitoring moisture content beneath the MWL. In order, however, for the neutron probes to detect a potential, but not determinate, issue with infiltration through the soil cover, the water will move through the biointrusion barrier, the waste zone, and then the vadose zone prior to detection, which will require a considerable length of time. More importantly, the percolation of water through the waste zone will leach waste constituents, thus increasing contaminant transport from the MWL. The neutron probe system is more reliably a vadose zone monitoring system for the waste zone, rather than a tool to determine loss of integrity in the soil cover. Moisture detection within the biointrusion barrier is a more reliable location for detection of infiltration through the overlying soil cover.

- The NMED should consider the Assessment's language regarding trigger level exceedance. TechLaw prepared a comment regarding the trigger discussion in Section 4.1 of the Assessment. Of particular concern, however, is the discussion in Paragraph 3 on page E-59a, which indicates that SNL will negotiate the use of trend analysis to determine action following an exceedance. Paragraph 3 states, "The length of this period [for sampling after an exceedance] and the increased sampling frequency will be negotiated with the NMED. Once the increased sampling data have been collected, the data and any resulting trends will be evaluated to determine the significance of the exceedance...." The use of data trends for trigger evaluation is not typically performed and not usually negotiated as an option to determining the statistical significance of each exceedance. The transition from compliance monitoring to detection monitoring can be based on a single exceedance, according to regulations and federal EPA guidance. In addition, a single exceedance can be used to initiate an interim corrective action. SNL, however, proposes waiting for an indeterminate time prior to determining that an exceedance requires initiation of further action. TechLaw is concerned that this may be a *de facto* assumption of regulatory authority.

TechLaw reviewed the probabilistic performance-assessment model as requested; however, we have reservations regarding the level of detail presented in the Assessment. Compared to typical reports for modeling studies, the Assessment is very brief, particularly when considering the complexity of using a Monte Carlo approach with multiple models, scenarios, and constituents of concern. In general, the Assessment provides a narrative report of a probabilistic model that is presented as a "black box." The Assessment discusses the input parameters and selectively presents output results, but we do not have adequate information to assess that the "black box" is operating satisfactorily. The Assessment does not present a discussion regarding software quality assurance – we do not know how well the various models work separately or together. Also, the Assessment 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 (i.e., the data quality objectives, the software code, etc.), 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 Assessment, however, does not provide this level of information and we caution its acceptance without a full understanding of the "black box."

The draft of the deliverable was e-mailed to you on January 31, 2006, at david.cobrain@state.nm.us. The deliverable is formatted in Microsoft Word 2000. If you have any questions, please feel free to contact me at (303) 763-7188, Ms. Paige Walton at (801) 451-2978, or Mr. Gary Walvatne at (503) 557-9698.

Sincerely,

June K Dreith

June K. Dreith
Program Manager

Enclosure: Technical Review of *Probabilistic Performance-Assessment of the Mixed Waste Landfill at Sandia National Laboratories*

cc: Mr. John Young, NMED
Mr. Will Moats, NMED
Mr. Gary Walvatne, TechLaw
Mr. Jim Ashworth, TechLaw
Ms. Paige Walton, TechLaw

TASK 2 DELIVERABLE

SANDIA NATIONAL LABORATORIES
ALBUQUERQUE, NEW MEXICO

TECHNICAL REVIEW OF APPENDIX E, PROBABILISTIC PERFORMANCE-ASSESSMENT MODELING OF THE MIXED WASTE LANDFILL AT SANDIA NATIONAL LABORATORIES,

OF THE

MIXED WASTE LANDFILL CORRECTIVE MEASURES IMPLEMENTATION PLAN

Dated November 2005

Submitted by:

TechLaw, Inc.
300 Union Boulevard, Suite 600
Lakewood, CO 80228

Submitted to:

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

In response to:

Work Assignment No. 06110.310

January 31, 2006

Sandia National Laboratories
Albuquerque, New Mexico

Technical Review of Appendix E,
Probabilistic Performance-Assessment Modeling of the
Mixed Waste Landfill at Sandia National Laboratories,
of the
Mixed Waste Landfill Corrective Measures Implementation Plan

Dated November 2005

The following comments were developed during a technical review of the *Probabilistic Performance-Assessment Modeling of the Mixed Waste Landfill at Sandia National Laboratories* (the Assessment), which is presented in Appendix E of the Sandia National Laboratories (SNL) *Mixed Waste Landfill Corrective Measures Implementation Plan* (the CMI Plan), dated November 2005. The selected remedy for the Mixed Waste Landfill (MWL) is a 3-foot-thick soil cover, with an underlying biointrusion barrier, which is considered by the Assessment.

2. MODELING APPROACH

2.1.2.2 Recent Cover Performance Modeling (pages E-19 through E-20)

1. 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 (engineered cover vs. natural conditions, respectively), however, Section 3.4.2 clarifies that the engineered soil cover reverts to the natural soil conditions around the landfill. Provide a brief clarification in Section 2.1.2.2 regarding the evolving soil conditions within the cover.

3. PERFORMANCE-ASSESSMENT MODELING OF THE MIXED WASTE LANDFILL

3.1 Scenarios and Performance Objectives (page E-23; Table E-1, page E-24)

2. Section 3.1 references Table E-1, which presents a summary of scenarios and performance objectives. The performance objective for Scenario 1 references 40 CFR 264.301 for the performance objective for water percolating through the landfill cover. Although the performance objective value for hydraulic conductivity of 10^{-7} centimeter/second (cm/s) is correct, the reference is incomplete. The maximum landfill liner hydraulic conductivity value is provided at 40 CFR 264.301, but this specifically addresses the bottom liner system. The hydraulic conductivity requirement for the landfill cover is promulgated at 40 CFR 264.310(a)(5), which in turn refers back to §264.301. Revise the citation to also include the reference to 264.310(a)(5).

3.2 Performance-Assessment Models

3.2.1 FRAMES/MEPAS (pages E-23 and E-25)

3. 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. The paragraph states further that MEPAS was used only for the source-term and vadose-zone models and not 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 why the modeling of radionuclide transport through the vadose zone does not incorporate radioactive decay, particularly since this is a feature of MEPAS.

3.3 Input Parameters and Distributions (pages E-26, E-31, and E-32; Tables E-2 through E-5, pages E-27 through E-31)

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

5. The second paragraph of Section 3.3 states: "The minimum thickness of the cover is set equal to zero as a bounding value to account for the possibility that complete erosion of the cover may occur in the future. This is a conservative bounding assumption since the intent is to maintain the integrity of the cover at the MWL." The reasoning behind the minimum bounding value for the cover thickness is logical and allows modeling of a worst-case scenario (i.e., no cover). As the selected final remedy for closure of the MWL, however, the 3-foot-thick vegetated soil cover (with an underlying biointrusion barrier) should demonstrate ongoing integrity during the 1,000-year performance period. If there is a possibility for complete erosion of the cover during the performance period,

then the cover design may require modification to mitigate the potential for erosion. Further, it is unlikely that the United States federal government can or will maintain the integrity of the cover, as stated, for the entire 1,000-year performance period. Since the performance assessment, as defined in DOE Order 435.1, is required to "demonstrate there is a reasonable expectation that performance objectives established for the long-term protection of the public and the environment will not be exceeded following closure of the facility," then the cover design should mitigate the potential for a reduction in cover thickness due to soil erosion or other causes. If the full design thickness of the cover can not be reasonably assumed for the 1,000-year performance period, then evaluate additional run-on/run-off controls for the soil cover and the area surrounding the MWL, as necessary, to mitigate any reasonably anticipated damage to the cover during the performance period.

6. Section 3.3 does not discuss the modification of the waste zone thickness and vadose zone thickness to accommodate the modeling of cadmium beneath the MWL waste zone, even though it is a significant deviation from the input parameters for other constituent modeling. Table E-3 indicates that the cadmium waste zone thickness extends 93 feet below the maximum depth (thickness) of the MWL waste zone. Table E-3 explains that the cadmium waste zone was increased to simulate the maximum penetration depth of the coolant water that *may* have carried cadmium. Correspondingly, Table E-4 indicates a decreased thickness for the vadose zone for cadmium modeling. Clarify why the maximum depth of contamination was used as the waste zone thickness for cadmium, yet the maximum depth of contamination was not used for any of the other constituents considered by the performance assessment modeling.

7. 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 Assessment and, if so, revise the discussion accordingly. If the dose discussion is only applicable to gas-phase tritium, then revise Section 3.3 to discuss inhalation and dermal adsorption doses for radon gas and gas-phase PCE.

3.4 Water Infiltration through the Cover
3.4.1 Model Description (pages E-32 and E-34; Figure E-3, page E-33)

8. 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. Figure E-3 indicates sandy loam is used throughout the entire thickness of the soil profile; although sandy loam is a good soil for growing vegetation, it is not satisfactory for the construction of a landfill cap with a performance objective value for hydraulic conductivity of 10^{-7} cm/s. 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 ground surface) and the locations of all 30 computational nodes. Clarify the soil type specified for each component of the soil cover.

4.1 Trigger Evaluation Process (page E-58)

9. The second paragraph of Section 4.1 states "...any recommendations for corrective action because of trigger exceedances will be based upon data trends rather than upon single detection values above the trigger level." This discussion regarding data trends does not present any timeframe for trend analysis (e.g., length of time or number of data points in exceedance of a limit) nor does it describe what constitutes a trend. Data trends may be useful for long-term assessment of constituent releases and corrective action effectiveness; however, triggers are typically evaluated based upon the statistical significance of each exceedance. For example, a spike in a constituent's concentration in groundwater samples collected around the MWL requires a move from compliance monitoring to detection monitoring. This spike may also indicate the development of a plume requiring an interim corrective action, rather than possibly waiting for several years to determine whether a trend is present in the data prior to acting. Revise the trigger evaluation process to determine the statistical significance of each exceedance of the groundwater protection standard for the MWL.

4.2 Proposed Triggers
4.2.2 Vadose Zone Monitoring Triggers
4.2.2.1 Moisture Content (pages E-64 to E-65)

10. The first paragraph of Section 4.2.2.1 states, "A significant increase in moisture content beneath the landfill may indicate that the disposal cell cover may not be performing as originally designed, and that infiltration through the cover is greater than originally predicted." Section 4.2.2 discusses the proposed neutron probe system for monitoring moisture content beneath the MWL; however, the three probe holes (200 feet in length at a 30-degree angle from the surface, or 173 feet of total depth) should not be relied upon

to measure significant increases in moisture content due to infiltration through the cover. In order for the neutron probes to detect a potential, but not determinate, issue with infiltration through the soil cover, the water will move through the biointrusion barrier, the waste zone, and then the vadose zone prior to detection, which will require a considerable length of time. More importantly, the percolation of water through the waste zone will potentially leach waste constituents, thus increasing contaminant transport from the MWL. The neutron probe system is more reliably a vadose zone monitoring system for the waste zone, rather than a tool to determine loss of integrity in the soil cover. Moisture detection within the biointrusion barrier is a more reliable location for detection of infiltration through the overlying soil cover. Consider revising the proposed trigger for detection of infiltration through the cover to include measurement of moisture directly beneath the 3-foot-thick soil cover. Also, the biointrusion barrier may be designed with geosynthetic drains to carry any moisture within the cover system out and away from the soil cover and the underlying waste zone.

FIGURES

11. Figures E-13, E-15, E-19, and E-24 present a graphical illustration of the sensitivity analyses performed for some of the constituents addressed by the Assessment. 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.

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

GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

1089

CERTIFIED MAIL -- RETURN RECEIPT REQUESTED

October 30, 1998

Michael Zamorski
Acting Area Manager
Kirtland Area Office
U. S. Department of Energy
P. O. Box 5400
Albuquerque, NM 87185-5400

Joan B. Woodard
Vice President, Div. 6000
Sandia Corporation
P. O. Box 5800
Albuquerque, NM 87185-0724

RE: Notice of Deficiency: Mixed Waste Landfill RFI Report

Dear Mr. Zamorski and Ms. Woodard:

The Hazardous and Radioactive Materials Bureau (HRMB) of the New Mexico Environment Department (NMED) has reviewed your responses (dated June 15, 1998) to HRMB's Letter of Denial issued for the submittal *Report of the Mixed Waste Landfill Phase 2 RCRA Facility Investigation (RFI), Sandia National Laboratories, Albuquerque, New Mexico.* Your supplemental information still leaves deficiencies in the RFI, which are noted in Enclosure A. Additional concerns and questions have been raised as a result of review of the risk assessment proposed for the landfill; these are also included in Enclosure A.

Other comments are provided in Enclosure B to communicate the HRMB's position on certain issues. The U. S. Department of Energy (DOE) and Sandia National Laboratories (SNL) are not required to respond to the comments in Enclosure B.

DOE/SNL must respond to the deficiencies and concerns noted in Enclosure A within 30 days of receipt of this letter.

You may contact William Moats of my staff at 827-1558 if you have any questions or comments.

Sincerely,

Benito J. Garcia
Chief
Hazardous and Radioactive Materials Bureau

Enclosure

cc: Mark Jackson, DOE/KAO
George Laskar, DOE/KAO
Stephanie Kruse, NMED/HRMB
Bill McDonald, NMED/DOE OB
Dick Fate, SNL
David Miller, SNL
David Neleigh, EPA
File: HSWA, SNL-OU 1289, 98

010983

Enclosure A
Notice of Deficiency

Department of Energy (DOE)/Sandia National Laboratories (SNL) Responses (June 15, 1988) to Hazardous and Radioactive Materials Bureau's (HRMB's) Letter of Denial (September 11, 1997) for

Report of the Mixed Waste Landfill Phase 2 RCRA Facility Investigation, Sandia National Laboratories, Albuquerque, New Mexico

Deficiencies

1. Response 8 -- The table must be revised to show the detection limits for the values listed as nondetects. The detection limits must be provided to evaluate whether they met data quality objectives.

HRMB suggests that DOE/SNL contact Radian Corporation, which conducted the field study, to obtain the detection limits for uranium, Pu-238, and Pu-239/240.

2. Response 23 -- The cross-sections indicate:

A. There has been a release of cadmium along the west side of the landfill. Cadmium concentrations range from about 1.02 - 1.97 mg/kg in soil samples collected at depths varying from 10 ft to greater than 100 ft.
B. There has been a release of cobalt along the southeast corner of the landfill (Borehole BH-13). In this area, cobalt concentrations range from about 5.83 - 9.62 mg/kg in soil samples collected at depths varying from 10 ft to greater than 100 ft.

C. There is evidence of possible copper contamination at concentrations ranging from 18.7 - 70 mg/kg in soil samples collected at depths of about 40 - 150 ft (Boreholes SB-4, SB-5, and BH-3).

D. There is evidence of possible nickel contamination at concentrations ranging from 11.8 - 21.5 mg/kg in soil samples collected at depths of about 70 - 100 ft (Boreholes SB-5 and BH-3).

E. There is a "hot spot" of contamination at a depth of 50 ft , Borehole 3 (BH-3). Contaminants are Ag (1.46 mg/kg), Cd (1.44 mg/kg), Co (105 mg/kg), Cu (645 mg/kg), Ni (97.5 mg/kg), and Zn (413 mg/kg).

The presence of metal contaminants at depths which can exceed 100 ft indicate that liquid wastes were disposed of in the landfill. Thus, ground-water monitoring for metals is required.

3. Response 37 -- The water-table map indicates that there is

is capable of migrating to depths below the bottoms of the trenches (or pits). What is the mechanism of transport of this tritium?

Cross-sections show that elevated tritium activities occur at depths which exceed 100 ft. Thus, ground-water monitoring for tritium is required.

9. Response 62 -- The following comments concern the MWL risk assessment.

A. Risk assessment performed for the MWL evaluates an industrial worker exposure scenario to determine current and future risk from the MWL. No human intrusion scenarios are included in this risk evaluation. The MWL land use restriction to an industrial exposure scenario is obviously representative of and applicable to the current land use designation. However, this situation requires assurance that an industrial land use designation will be maintained in the future. Therefore, DOE/SNL must provide NMED/HRMB with a method or mechanism to assure that DOE/SNL have the ability and systems in place to make controls of the land restriction effective.

In addition, the controls have to be appropriate for the hazard involved. Therefore, DOE/SNL has to document an auditable program of monitoring the controls for effectiveness and reporting their implementation.

B. Because land located approximately 1 mile west of the MWL could be developed for residential use, DOE/SNL must evaluate the potential for off-site contaminant migration from the landfill. The evaluation should consider ecological and human health impacts from any potential migration of COC's.

C. The nature and extent of subsurface contamination indicate that some contaminants are a potential threat to ground-water quality beneath and downgradient (west) of the MWL. A simple screening comparison of contaminant concentrations in subsurface soils against *available* EPA soil screening levels (SSL's) developed for the protection of ground-water resources demonstrates exceedances for cadmium and nickel (U. S. EPA, 1996, *Soil Screening Guidance: Technical Background Document*, EPA/540/R-95/128, Office of Emergency and Remedial Response, Washington, DC, PB96-963502). Therefore, the risk assessment for the MWL must evaluate potential impacts of cadmium, nickel, and

other contaminants (metals such as cobalt and copper, and radioactive materials such as uranium and tritium, for which SSL's are not available at this time) on local and regional ground-water quality.

D. Section 7.2, *MWL Exposure Routes*, page 7-1, last paragraph states that radionuclides evaluation includes ingestion in drinking water, ingestion in soil, external gamma radiation, and inhalation of soil-derived particulates and vapor-phase radon and tritium. However, evaluation of external gamma radiation exposure and exposure to radon gas is not documented in the subject report. Please provide the rationale for excluding this information from the report or, more preferably, provide data on the possible radon and external gamma radiation exposures to potentially impacted organisms.

E. Section 7.3, *Risk Assessment Analysis*, pages 7-2 through 7-8 implies that metal concentrations were measured in surface-soil samples. However, no surface-soil sampling and analysis data could be located in the subject report. Thus, DOE/SNL shall present all surface-soil sampling results and data, including soil sampling locations, depth, types of laboratory analyses used, detection limits, and quality assurance/quality control measures employed.

F. Tables 7.3-1 and 7.3-4 (pages 7-3 and 7-7, respectively) report maximum concentration of hexavalent chromium only. Results for both total and hexavalent chromium (if measured) shall be reported. In addition, background comparisons shall be made between relevant (i.e., comparable) chromium species, i.e., chromium (VI) maximum soil concentrations shall be compared with chromium (VI) NMED/HRMB-approved soil background levels for the KAFB area (NMED/HRMB-approved background soil concentration is 1 mg/kg for chromium (VI) and it is not 17 mg/kg, as reported in Table 7.3-4).

Also, please verify that Table 7.3-4 (page 7-7) reports correct and comparable background soil concentrations for aluminum and manganese.

G. Due to the qualitative nature of soil-gas survey results (both passive and active), it is inappropriate to use them in a quantitative risk assessment. Please use analytical results of soil-matrix sampling in a quantitative risk analysis.

H. Please clarify why cobalt, thallium, and vanadium RfD's are missing from Table 7.3-7 (page 7-10). Consequently, potential human health risks are not evaluated for these contaminants. In addition, Table 7.3-7 is missing a legend defining reported parameters and their sources.

I. Appendix N, page N-8 discusses potential sources of PEF's used to estimate exposure from inhalation of fugitive dust; however, it does not document their values.

J. In addition to human health risk evaluation, this risk assessment shall also address ecological risks for the MWL.

10. Response 64 -- Explain what is meant by "an additional four sampling events will be conducted".

11. Response 79 -- Approximately 1/2 of the information included in Attachment 80-1 (*Summaries of Laboratory and Field QC Results for MWL Groundwater Quality Data*) is labeled "draft". Draft information is unacceptable for the purpose of making final decisions. DOE/SNL must provide copies of final documents not labeled as draft for HRMB's review.

Enclosure B
Notice of Deficiency

Department of Energy (DOE)/Sandia National Laboratories (SNL) Responses (June 15, 1998) to Hazardous and Radioactive Materials Bureau's (HRMB's) Letter of Denial (September 11, 1997) Concerning

Report of the Mixed Waste Landfill Phase 2 RCRA Facility Investigation, Sandia National Laboratories, Albuquerque, New Mexico

Additional Comments

The following comments are provided to communicate the HRMB's position on certain technical issues. DOE/SNL are not required to respond to the comments in this enclosure (Enclosure B).

1. Response 10 -- Regulation 10 CFR 30.15 does not address the allowable tritium activity for a self-luminous "EXIT" sign.

2. Response 32 -- Large values (+/- 2-sigma) for uncertainty can be an indication that data are of marginal or poor quality.

3. Response 38 -- The top of the upper screen of MWL-MW4 is located approximately 22 ft below the water table. Because of the vertical gradient and the way the well is constructed, MWL-MW4 is of no value for determining the elevation of the water table (and therefore, the horizontal direction of ground-water flow and the horizontal gradient).

Also, because the top of the upper screen of MWL-MW4 is located 22 ft below the water table, the well is of little value for detecting any ground-water contamination (if any exists) that may be present in the saturated zone just below the water table.

4. Response 39 -- The horizontal gradient (and direction of ground-water flow) must be determined from measurements of water levels in monitor wells, not from computer-generated flow nets.

The site-specific water-level map, which is based on water level measurements, suggests a horizontal gradient of 0.0041 ft/ft. It is hoped that a more reliable horizontal gradient can be determined after the two new wells are installed.

5. Response 50 -- The pumping tests for monitor wells MWL-BW1, MWL-MW1, MWL-MW2, MWL-MW3, and MWL-MW4 (Upper) appear to have failed because the yield of each well was too small to permit a