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November 21, 2006

SUBJECT: NMED RESPONSES TO PUBLIC COMMENTS ON THE SANDIA NATIONAL LABORATORIES' MIXED WASTE LANDFILL CORRECTIVE MEASURES IMPLEMENTATION PLAN

Dear Interested Citizen:

On November 3, 2005, Sandia National Laboratories (SNL) submitted to the New Mexico Environment Department (NMED) for approval a Corrective Measures Implementation (CMI) Plan pursuant to Sections IV.D and XI of the Compliance Order on Consent (April 29, 2004), and the Secretary's Final Order (May 26, 2005), *In the Matter of Request for a Class 3 Permit Modification for Corrective Measures for the Mixed Waste Landfill, Sandia National Laboratories, Bernalillo County, New Mexico, EPA ID No. NM5890110518.*

A public meeting was conducted on the technical merits of the CMI Plan on May 25, 2006. A public comment period was held from December 9, 2005 to February 7, 2006, and from May 25, 2006 to June 8, 2006. NMED's responses to public comment on the CMI Plan are available at the NMED web page at *http://www.nmenv.state.nm.us/hwb/snlperm.html* under Mixed Waste Landfill.

NMED's review of the CMI Plan has revealed several deficiencies that must be corrected before implementation of the CMI work. The letter addressing these deficiencies is available on the NMED web page as noted above.

Sincerely,

John E. Kieling
Program Manager
Permits Management Program
Hazardous Waste Bureau

Index of Public Comments Received:
Sandia National Laboratories Mixed Waste Landfill Corrective Measures Implementation Plan
November 2006

Commenter ID	Date of Letter or e-mail	Association/Commenter
A	1/25/06 (rec'd 1/27/06)	Citizen, Donna Detweiler
B	1/28/06 (rec'd 1/31/06)	Citizen, Floy J. Barrett
C	1/28/06 (rec'd 1/31/06)	Citizen, David M. Brugge
D	1/28/06 (rec'd 1/31/06)	Citizen, Maurice Weisberg, MD
E	Not dated (rec'd 2/06/06)	Albuquerque Center for Peace and Justice and Citizens for Alternatives to Radioactive Dumping, Dorelen Bunting and Janet Greenwald
F	2/06/06 (rec'd 2/06/06)	Loretto Community of Catholic Sisters and Co-members, Penelope McMullen
G	2/07/06 (rec'd 2/07/06) (rec'd 5/03/060	Citizen, John Tauxe, Ph.D., PE
H	2/07/06 (rec'd 2/07/06)	Citizen Action New Mexico, Susan Dayton (Comments compiled by Paul Robinson, Southwest Research and Information Center)
I	6/07/06 (rec'd 6/07/06) Meeting 7/19/06	Citizen Action New Mexico, Susan Dayton (Comments compiled by Paul Robinson, Southwest Research and Information Center)
J	6/08/06 (rec'd 6/08/06) Meeting 7/19/06	Citizen, Robert H. Gilkeson
K	6/08/06 (rec'd 6/08/06)	Nuclear Watch of New Mexico, Scott Kovac (Comments compiled by Paul Robinson, Southwest Research and Information Center; and Robert H. Gilkeson)
L	6/08/06 (rec'd 6/08/06)	Citizens for Alternatives to Radioactive Dumping, Janet Greenwald
M	6/08/06 (rec'd 6/08/06)	Embudo Valley Environmental Monitoring Group, Sheri Kotowski (Comments compiled by Paul Robinson, Southwest Research and Information Center; and Robert H. Gilkeson)
N	6/08/06 (rec'd 6/08/06)	Concerned Citizens for Nuclear Safety, Joni Arends

Commenter ID	Date of Letter or e-mail	Association/Commenter
O	6/08/06 (rec'd 6/08/06)	Citizen, Jamie Wells
P	5/30/06	Citizen, Krishan Wahi
Q	6/08/06 (rec'd 6/08/06)	Citizen, Willard Hunter

NMED Response to Public Comments on the Mixed Waste Landfill (MWL) Corrective Measures Implementation (CMI) Plan November 2006

Commenter ID	Commenter / Association	Topic Area	Comment Summary	NMED Response Number	NMED Response
A	**Citizen, Donna Detweiler**	Groundwater Contamination	The commenter was concerned regarding possible contamination of groundwater resulting from releases from the MW, particularly contamination of the Burton Well serving the Kirtland Addition neighborhood. Commenter stated that the fate and transport model (FTM) indicates contamination may reach groundwater in as little as 50 years. The commenter believes there is "much good housing stock here," an apparent reference to the Kirtland Addition neighborhood, and expresses concern that it will be condemned as unlivable in the future.	R1	The low levels of contaminants released from the Mixed Waste Landfill (MWL) have not caused groundwater to become contaminated beneath the landfill and are unlikely to cause groundwater contamination in the future. The fate and transport model (FTM) recently completed by Sandia predicts little chance that groundwater contamination will occur. None of the modeled radionuclides and heavy metals was simulated by the FTM to reach groundwater during the 1,000-year performance period or the extended 10,000-year period. Tritium is the primary radiological contaminant released from the landfill. Both the FTM and modeling done by the WERC predict that the tritium released into the vadose zone will not contaminate groundwater. Furthermore, the FTM suggests that concentrations of perchloroethene (PCE) will peak in less than 50 years for the majority of the model runs. While only 1% of the model runs indicates that PCE concentrations will exceed the regulatory maximum contaminant level (MCL) of 5µg/L, the modeled contamination should have already occurred. Groundwater monitoring during the past 16 years has not detected contaminants in groundwater from the MWL at any level. This is strong evidence that the FTM may be overly conservative. Of the 100 runs, about 40% resulted in predicted PCE concentrations that were below the level of detection. Given that the FTM is conservative (e.g., it ignores dilution of PCE once groundwater is reached; is one-dimensional and thus allows only vertical migration of PCE; it uses PCE source levels up to 10 times that of the maximum level actually detected; the
D	**Citizen, Maurice Weisberg, MD**		The commenter stated that the protection of the integrity of our aquifers is a matter of urgent national security for public health and economic stability. The commenter referenced the National Academy of Science, which reported in 2000 that most of the nuclear bomb sites will never be cleaned up enough to allow public access to the land and the plan for guarding these sites cannot guarantee the safety of the public.		

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			The commenter is also concerned about the leaching of radioactive materials from the MWL and their transport through the vadose zone to groundwater. The commenter references the SNL Chemical Waste Landfill and the Liquid Waste Disposal System as sources of groundwater contamination through a similar pathway. Additionally, the commenter is concerned that liquid waste was disposed in the MWL prior to 1972 and that it has leached from the MWL to groundwater. The commenter also states that tritium is expected to contaminate groundwater is less than ten years, and that it is well known that all landfills leak in wet or dry areas, especially if they are unlined and in porous or sandy soils. The commenter also states that movement of nuclear debris through soil is more rapid than DOE and the nuclear labs have maintained. Contaminants like Sr-90, tritium, and PCE move rapidly in plumes, and that plutonium has different rates of migration depending on local geologic conditions and preferred pathways.		low levels of contaminants released from the MWL have not caused groundwater contamination over the 57-year life of the landfill,) the NMED believes that PCE will not reach groundwater at any detectable level. Although vapor phase migration has played an important role in the contamination of groundwater at the Chemical Waste Landfill, aqueous transport was the dominant mode of migration of contaminants at the Liquid Waste Disposal System (LWDS). Thus, the LWDS site is dissimilar to the MWL. The CWL is also different in that the maximum VOC concentrations of soil gas observed at the Chemical Waste Landfill were several orders of magnitude higher than that detected at the MWL. NMED agrees that all landfills are expected to leak contaminants. However, not all releases pose threats to human health and the environment. PCE and tritium can migrate rapidly in the vadose zone in the vapor phase, and have done so at the MWL. However, as has been mentioned numerous times by the NMED, the levels of PCE and tritium detected at the MWL do not pose significant risk to human health and the environment. Plutonium and Sr-90 migrate with water. The cover proposed for the MWL will reduce the amount of water percolating through the landfill, and thus will prevent the migration of Sr-90 and plutonium. Furthermore, based on what is known about the inventory, it is highly unlikely that there is a sufficient amount of plutonium and Sr-90 in the landfill to threaten groundwater. As mentioned previously, none of the modeled radionuclides and heavy metals was simulated by the FTM to reach groundwater during the 1,000-year performance period or the extended 10,000-year period. See also NMED response R5.

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F	**Loretto Community of Catholic Sisters and Co-members, Penelope McMullen**		The commenter states the FTM concluded that contaminants from the MWL will reach Albuquerque's sole-source aquifer within 50 years. The commenter considers the seriousness of potentially contaminated drinking water and states that the FTM and the Corrective Measure Implementation Plan are dangerously inadequate.		
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		The commenter states the model concludes that PCE, the only organic compound modeled, would reach groundwater for all 100 model runs ("realizations") with the majority of the model runs showing PCE reaching groundwater within 50 years.		
A	**Citizen, Donna Detweiler**	Excavation as a remedy	The commenter would like to see the waste removed and disposed elsewhere away from a large population area.	R2	The NMED previously held a public comment period and public hearing regarding the corrective measures study (CMS) conducted for the MWL. After carefully considering public comment and evidence presented at the public hearing, the Secretary determined that the MWL should be immediately stabilized using a vegetative cover with bio-intrusion barrier in order that Albuquerque's groundwater be protected, to ensure protection of human heath and the environment from radiation emanating from waste in the landfill, and to protect workers from needless exposure to radiation. While groundwater beneath the landfill is not contaminated by releases from the landfill, and likely will never be, the DOE is
B	**Citizen, Floy J. Barrett**		The commenter stated that the people of New Mexico deserve to have the laboratories of this state comply with every possible safety procedure. The commenter believes the MWL model for containment does not insure long-term safety of groundwater and soil.		

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			The commenter also stated there is still time to continue to study and reassess the issues noted by the commenter. The commenter also stated NMED has an obligation to require that Sandia National Laboratories complete reassessments.		required to monitor both the landfill and the groundwater to ensure a timely response in the unlikely event of significant contaminant migration or groundwater contamination. The final order signed by the Secretary requires that the effectiveness of the cover and the feasibility of excavation be re-evaluated every five years; the FTM is also to be updated. The vegetative soil cover with bio-intrusion barrier is feasible to implement, will maintain a low and thus acceptable level of risk to the public, workers, and the environment, is a proven reliable and effective technology, and will further reduce waste mobility. The remedy will prevent wastes from endangering our citizens, our ground water, and our environment by minimizing the infiltration and percolation of moisture into the landfill, by preventing the intrusion of small animals into waste, and by shielding people and the environment from harmful radiation. There is no new information in the FTM that suggests that the NMED should defer approval of the CMI Plan. The FTM's prediction that there is only a small chance that groundwater will become contaminated at levels exceeding regulatory standards corroborates and validates NMED's existing testimony presented at the hearing held on the Corrective Measures Study. Hence, there is no new information generated by the FTM that would form the basis for a different remedy for the landfill. The results instead strongly support the NMED's chosen remedy (cover with bio-intrusion barrier) as an acceptable alternative that is protective of human health and the environment.
C	**Citizen, David M. Brugge**		The commenter states that he had heard that the plan considered economy over safety.		
D	**Citizen, Maurice Weisberg, MD**		The commenter supports the excavation of all mixed wastes buried in unlined, unregulated, and unpermitted pits and trenches and their transfer for storage in hardened facilities above ground. The commenter also referenced Dr. Arjun Makhijani, of the Institute of Energy and Environmental Research (IEER), who supports excavating buried nuclear waste sites as a priority for shipment to a repository.		
F	**Loretto Community of Catholic Sisters and Co-members, Penelope McMullen**		The commenter supports the excavation of the MWL and development of a comprehensive clean up plan to contain the waste in a safer area.		
H	**Citizen Action**		The commenter requests that NMED		

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	New Mexico, Susan Dayton (Comments compiled by Paul Robinson, Southwest Research and Information Center)		consider requiring improvements in the Corrective Measure proposed for the MWL to prevent future releases of VOCs and SVOCs.		
I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		The commenter states that NMED should defer final approval of Mixed Waste Landfill CMI Plan pending review of a remedy based on new information in the FTM and additional information provided in response to NMED queries.		
Q	**Citizen, Willard Hunter**		The commenter states that he has rarely seen a more proud organization than SNL and notes that he is a former employee. The commenter states, however, that money should be spent on proper waste disposal. The commenter also states that DOE has experience with clean-up alternatives, including rehabilitation of nuclear waste sites, which could be applied to the MWL.		

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B	**Citizen, Floy J. Barrett**	Bio-transport of contaminants	The commenter is concerned that Sandia's FTM is not comprehensive and does not consider biological transport of contaminants.	R3	The model did not address biological transport. The NMED questions whether source terms and biological transport rates can be reasonably and realistically estimated to generate meaningful results. Models, even as powerful as the ones used for the MWL FTM, have limitations. It is unreasonable to expect the Permittees to evaluate the migration of contaminants caused by what might be thousands of individual species of fungi, mold, bacteria, viruses, and microbes that can be found at the MWL site. NMED agrees that burrowing animals and roots can cause the migration of contaminants to the ground surface. Once on the surface, such contaminants can continue to migrate by the activities of other animals, wind erosion, and surface-water erosion/solution. In the case of the MWL, bio-intrusion, even by ants, is not expected to play a major role in the migration of contaminants because the wastes are relatively insoluble and the debris items mostly large in size. Analytical results of surface-soil samples have demonstrated that since closure of the landfill and the beginning of its operation in 1958, the bio-transport of contaminants has been essentially nonexistent as contaminants migrating by this method, if any, have not been detected above background conditions. Given that the bio-transport of contaminants has not been an important factor for the migration of contaminants in the past, the required bio-intrusion barrier should limit even more so the ability of burrowing animals to bring debris contaminated with chemical and radiological constituents (such as radon-222, radium-226, and uranium-238) to the surface. The barrier should also help limit root penetration which would otherwise assist in the movement of tritium to the surface. As a matter of precaution, the NMED nevertheless intends to require the Permittees to monitor surface soil, including animal burrows and ant mounds.
C	**Citizen, David M. Brugge**		The commenter states that biological transport of contaminants is not limited to reptiles, mammals, birds, and amphibians. The commenter believes that invertebrates, surface and subsurface flora, fungi, molds, bacteria, and other species should be considered. The commenter suggests that the model should address soil bacteria and possibly viruses that become airborne during windy drought conditions at the MWL area. The commenter also suggested that the agent responsible for valley fever may mutate in the MWL area.		
D	**Citizen, Maurice Weisberg, MD**		The commenter stated that biotransport of radioactive contaminants is likely to occur over time and increasingly over the long term. The commenter also referenced Dr. Peter Montague, director of Rachel's Environment and Health Weekly, who indicated 5 or 6 reasons why dirt caps and vegetative covers fail. Among the problems are deep root systems extending as much as 20-30 feet below the surface, burrowing		

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			rodents and insects, erosion, and cave-ins due to collapsing wastes, drums, and debris.		The NMED believes that the rock intrusion barrier will be very effective in preventing animals from burrowing into the landfill. After subgrade preparation, the actual depth to waste will average about two times the thickness of the cover.
F	**Loretto Community of Catholic Sisters and Co-members, Penelope McMullen**		The commenter states the FTM needs to be revised to consider possible transport of contaminants through animals and plants. The commenter also states the FTM needs to be revised to consider the ineffectiveness of a rock bio-intrusion barrier.		It is common practice to construct bio-intrusion barriers from rock; an exhaustive search of the literature concerning the design of rock bio-intrusion barriers is unnecessary. Monitoring systems will be justified and their designs presented in the long-term monitoring and maintenance plan. After a long-term monitoring plan is approved, additional surface-soil sampling will be conducted and the level of risk re-evaluated at a minimum of every five years.
G	**Citizen, John Trauxe, Ph.D., PE**		The commenter believes that the most significant oversight in the contaminant transport modeling of the MWL is the lack of any contributions to transport by biotic activity. The commenter believes this should have been identified in the preliminary exercise of identifying significant features, events, and processes affecting contaminant transport at the site. The commenter notes that recent work at other DOE sites (including Los Alamos National Laboratory and Nevada Test Site) has found that biotic activity in the form of plant uptake and redistribution of contaminants and animal translocation of bulk (contaminated) materials can be significant or even dominant modes of contaminant transport. The commenter states that		

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			in arid environments, plants tend to extend roots to significant depths in search of water, while ants have been found to construct nests to depths of several meters. The commenter believes that a cap thickness of a meter is ineffective at keeping these biota out of the waste in the MWL. The commenter also notes that the model document includes the development of a method for predicting the ground surface flux of radon-222 (^{222}Rn) above the MWL, as a linear function of the concentration of its parent, radium-226 (^{226}Ra), at depth in the MWL. The commenter believes this model is fine under the assumption that all the ^{226}Ra stays at depth, but notes that if biotically-induced transport of waste materials is included as a contaminant transport process, the ^{226}Ra parent material (as well as its parents, such as uranium-238 [^{238}U]) will move into the cap itself and onto the ground surface. The commenter notes that this does not fit the current radon diffusion model assumptions, and suggests that this modeling must employ more sophisticated techniques. The commenter also states that decay cascades can produce		

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			significant doses, and should not be neglected in the dose assessment process. The commenter notes that when coupled with biotic processes in the cap, there is a possibility of bringing radionuclides to the surface. In a May 3, 2006 e-mail to the NMED, the commenter repeats his concern that bio-transport may be significant and that the rock bio-intrusion barrier will not prevent ants and roots from penetrating to depths below the barrier. He also repeats that radionuclides can be brought to the surface by bio-transport, and that the decay products of such radionuclides may pose a threat.		
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		The commenter stated that the FTM is not comprehensive with respect to the potential for releases including vadose zone and groundwater contamination due to transport not considered in the model, including mechanisms such as biological transport of contaminants through the ground surface, human intrusion, and movement of contaminants by wind/air. The commenter also stated that the fate and transport model does not address biological transport of		

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			contaminants resulting from plant and animal uptake of contaminants and subsequent dispersion of soil, plant and animal material by wind. The commenter believes this information is required for a comprehensive model. The commenter also states that the CMI plan does not address the technical literature related to bio-intrusion barriers or identify monitoring systems appropriate for detection of releases associated with bio-intrusion into the MWL. The commenter requests revision of the CMI plan to include a thorough investigation and re-sampling of the soil at the MWL to identify bio-intrusion mechanisms and biological transport of contaminants, and consider the applicability of findings of such investigations to the Corrective Measure for the MWL.		
O	**Citizen, Jamie Wells**		The commenter recommends establishing a program to monitor plants and animals to ensure bioaccumulation and/or transportation of constituents of concern from the MWL do not occur.		

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B	**Citizen, Floy J. Barrett**	Human intrusion and institutional controls	The commenter is concerned that Sandia's FTM is not comprehensive and does not consider human intrusion.	R4	The model does not address human intrusion. Institutional controls will be implemented to prevent human intrusion onto and into the landfill. Under EPA regulations, there is no requirement that a facility must assume a loss of institutional controls and evaluate the construction and occupation of a residence constructed on a landfill. This is a reasonable approach as land zoned as industrial tends to remain industrial. Moreover, should SNL choose to change the land use, enforceable provisions in SNL's RCRA permit require public notice and NMED approval of any cleanups that would need to be conducted, given the new land use. Although the NMED can not say with certainty whether a terrorist act could be successfully launched against the landfill, the MWL site is undoubtedly more secure than most landfills given the nature of the classified work that takes place within Technical Area 3, and is a far less desirable target compared to other facilities at KAFB and SNL.. NMED intends to enforce institutional controls through the Permittees' permit as long as such controls are needed. The FTM makes predictions concerning the future migration of contaminants from the landfill. The model does not make regulatory decisions regarding the implementation of institutional controls, ensuring such controls remain in force in the future, and what must be done in the event of a failure of the remedy.
C	**Citizen, David M. Brugge**		The commenter believes that human intrusion into the MWL is a serious issue requiring further consideration. The commenter suggested there is potential for terrorist explosion in or adjacent to the MWL, which would effectively create a "dirty bomb."		
F	**Loretto Community of Catholic Sisters and Co-members, Penelope McMullen**		The commenter states FTM needs to be revised to consider the comprehensive modeling of institutional controls against human intrusion.		
G	**Citizen, John Trauxe, Ph.D., PE**		The commenter believes that a reasonable potential future receptor scenario includes a residence built directly on top of the MWL. The commenter notes that with ongoing development in the Albuquerque area and a precedent of residential construction on old landfills (e.g., Love Canal, New York), this would trigger the analysis of additional exposure pathways as well, such as exposure to indoor air with its elevated concentrations of gaseous radionuclides and volatile organic compounds (VOCs).		

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H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		In a May 3, 2006 e-mail to the NMED, the commenter repeats his concern that one should assume a loss of institutional controls and that structures could be built on the landfill in the future. The commenter stated that the FTM is not comprehensive with respect to the potential for releases including vadose zone and groundwater contamination due to transport not considered in the model, including human intrusion. The commenter also stated that the FTM does not address transport of contaminants resulting from human intrusion associated with accidental events and the eventual failure of the land use restriction portions of the institutional controls proposed by Sandia for the MWL. The commenter believes this information is required for a comprehensive model. The commenter also stated that the FTM does not identify means to monitor, model and assure the effectiveness of institutional controls or the consequences of the failure of such passive site protection measures.		

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Q	**Citizen, Willard Hunter**		The commenter states that he is concerned regarding the level of security provided for the MWL.		
B	**Citizen, Floy J. Barrett**	Model does not consider all waste types present in the landfill	The commenter is concerned that Sandia's FTM is not comprehensive and does not consider beryllium and metallic sodium as potential contaminants of concern. The commenter is also concerned that Sandia's FTM is not comprehensive and does not consider appropriate "trigger levels" for all contaminants in the known inventory.	R5	The model generally considers only those waste types that have the highest potential for migration and pose an unacceptable risk to the environment. The modeled waste types are chiefly those that are known to occur in large amounts in the landfill, and/or those that migrate easily in the vapor phase. There are hundreds of waste types in the landfill that occur in small quantities and most of these waste types have limited ability to migrate in the absence of water. It would be a poor use of time and money for the Permittees to model and develop triggers for all waste types when in reality few, if any, are likely to pose unacceptable risk to the environment. Based on the inventory, beryllium, sodium, lithium, and probably all SVOCs do not occur in sufficient quantities in the landfill such that if released they would pose unacceptable risk. For this reason, MNED does not believe it necessary to include them with the important waste types that should be modeled. The FTM utilized PCE as a surrogate VOC due to its presence in the MWL as the VOC with the highest *average* concentration in soil vapor, its greater mobility in the environment, and its tendency to migrate downward towards groundwater. A constituent with a greater maximum concentration than PCE is not necessarily a potentially more significant problem because the constituent may not be as mobile, as abundant, or toxic as PCE.
E	**Albuquerque Center for Peace and Justice and Citizens for Alternatives to Radioactive Dumping, Dorelen Bunting and Janet Greenwald**		The commenter supports consideration of all the contaminants for trigger levels.		
F	**Loretto Community of Catholic Sisters and Co-members, Penelope McMullen**		The commenter states the FTM needs to be revised to consider the modeling of all hazardous chemicals and volatile organic compounds known or suspected to be in the MWL.		

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			The commenter also states the FTM needs to be revised to consider the modeling of all potential new compounds which could be formed as a result of mixing radionuclides with non- radioactive materials.		
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		The commenter stated that the FTM is not comprehensive with respect to the modeling for the complete suite of radionuclides and daughter products, metals, and volatile and semi-volatile organic compounds in the known inventory of the MWL, including beryllium, nickel, chromium, sodium, lithium, and the range of volatile organic compounds (VOCs) present at the MWL.		
I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		The commenter recommends that an enhanced version of the FTM be run for the full range of VOCs identified in soil in the MWL RFI Phase 2 Report including, but not limited to dichloro-difluoromethane; trichloroethene; 1,1,1-trichlorethane (TCA), toluene, ethylbenzene, xylene, 1,1,2-tri-chloro-trifluoroethane, dichloroethyne, acetone, isopropyl ether, 1,1-dichloroethene and styrene. The MWL RFI Phase 2 Report identifies dichloro-difluoromethane concentrations of 29,000 ppb at 10 feet and 21,500 ppb at 30 feet at Fig. 4.5 – 16 and Fig. 4.5-22, which		

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			are 4-5 times higher than the concentrations of PCE detected at those depths in the same report.		
B	**Citizen, Floy J. Barrett**	Triggers associated with the model do not include monitoring plants, animals, and humans	The commenter is concerned that Sandia's FTM is not comprehensive and does not consider animals, plants, and humans as "triggers."	R6	Triggers are not included for the monitoring of plants, animals, and humans because there are no regulatory standards under RCRA for comparison, and more useful triggers can be established for surface soil by using conventional methods that consider human and ecological risk factors. This is why surface soils rather than plant, animals, and humans, will be monitored for contaminants. Additionally, the NMED can not require the monitoring of humans if the people involved do not wish to be subjected to testing.
E	**Albuquerque Center for Peace and Justice and Citizens for Alternatives to Radioactive Dumping, Dorelen Bunting and Janet Greenwald**		The commenter believes that plants and animals, if found to be contaminated, should be considered a trigger.		
O	**Citizen, Jamie Wells**		The commenter recommends establishing human population level triggers and corrective actions if these trigger are reached.		
B	**Citizen, Floy J. Barrett**	Risk Assessment	The commenter is concerned that Sandia's FTM is not comprehensive and does not consider conducting a risk assessment for the FTM that includes all waste types buried at the MWL, not just the risk posed by tritium as currently considered by	R7	Risk assessments for the MWL are found in the Phase II RCRA Facility Investigation and the Corrective Measures Study Reports. The purpose of the FTM is to predict the future movement and fate of contaminants from the landfill. Although the FTM makes comparisons to regulatory standards which are based on human health risk assessment, the FTM is not a risk assessment.

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			the assessment.		See also NMED response R5 concerning the issue that the FTM does not consider all waste types present in the landfill.
E	**Albuquerque Center for Peace and Justice and Citizens for Alternatives to Radioactive Dumping, Dorelen Bunting and Janet Greenwald**		The commenter requests consideration of all contaminants in the MWL when calculating the risk to the surrounding community.		
F	**Loretto Community of Catholic Sisters and Co-members, Penelope McMullen**		The commenter states the FTM needs to be revised to consider performing a risk assessment for all waste types buried in the MWL.		
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		The commenter stated that FTM does not provide a risk assessment/performance assessment analysis in its evaluation of the potential for release of contaminants from the MWL.		
B	**Citizen, Floy J. Barrett**	New data is needed for model input	The commenter is concerned that FTM is not comprehensive and uses data that are outdated. Commenter believes new data should be gathered to verify the validity of the	R8	Groundwater data has been collected through April 2006, and several sampling events were conducted in the early to late 1990's to characterize surface soil for radionuclides, metals, and tritium emissions.

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			modeling.		Additional data, including soil and soil vapor data, will be acquired once the long-term monitoring and maintenance plan is approved and implemented. Cover construction and preparation of a long-term monitoring and maintenance plan must be completed so that new monitoring data can be obtained to update the FTM as required by the NMED Secretary's Order.
F	**Loretto Community of Catholic Sisters and Co-members, Penelope McMullen**		The commenter states FTM needs to be revised to consider recent data to verify the validity of FTM, since the data used are outdated by at least 10 years.		
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		The commenter states that the model relies on data regarding releases of radionuclides, heavy metals, and volatile organic compounds from the Phase 1 and Phase 2 RCRA Feasibility Investigation (RFI) gathered in 1993 – 1995. The commenter states that no new data was gathered or proposed to calibrate or verify the modeling.		
I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		The commenter recommends implementation of a subsurface sampling program to identify distribution of VOCs detected in the MWL RFI Phase 2 Report to verify and/or refine FTM model results, applying appropriate QA/QC methods including split sampling with NMED incorporating duplicates and blank samples to verify analytic accuracy.		
O	**Citizen, Jamie Wells**		The commenter recommends verification of the FTM after acquiring new data.		

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C	**Citizen, David M. Brugge**	Duration of NMED oversight	The commenter acknowledges New Mexico's oversight is limited to the effects that are predictable during the next 30 years. The commenter suggests that the State should review the threat of adverse impacts on water, air, and safety within the Mesa del Sol development area and possibly impacts to land values, even though the critical stages of these threats are beyond the 30-year oversight period. The commenter suggests that impacts to land values will prevent the University of New Mexico from receiving the full benefit of the Mesa del Sol development. The commenter suggests that the university and the State may have potential liability for any damages.	R9	The NMED intends to enforce controls on the MWL for as long as they are needed. The NMED considered the future migration of contaminants when selecting the remedy for the MWL, and did not limit its consideration of this matter to a 30 year period, as many contaminates could take hundreds of years to reach groundwater. The NMED considered the types and amounts of waste known or suspected to be buried in the landfill, the potential for waste and waste constituents to migrate and their pathways, the levels and risk of current releases of contaminants, and the geologic, hydrologic, and climatic conditions present at the MWL. Using this information, and an assessment of the current and expected future risk, the NMED concluded that the MWL did not pose a current or future threat to human health and the environment. The FTM validates this conclusion.
C	**Citizen, M. Brugge**	Endorses comments made by Citizen Action	The commenter states that he agrees with all comments made by Citizen Action.	R10	See NMED responses to Citizen Action Comments, Commenter identification “H” and “I”.
E	**Albuquerque Center for Peace and Justice and Citizens for Alternatives to Radioactive Dumping, Dorelen Bunting and Janet Greenwald**		The commenter supports the comments submitted by Citizen Action concerning the MWL at Sandia National Laboratories and specifically the FTM.		

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K	**Nuclear Watch of New Mexico, Scott Kovac** (Comments compiled by Paul Robinson, Southwest Research and Information Center; and Robert H. Gilkeson)		The commenter states that Nuclear Watch of New Mexico endorses the recommendations of the comments submitted to NMED by Citizen Action.		
L	**Citizens for Alternatives to Radioactive Dumping, Janet Greenwald**		The commenter states that Citizens for Alternatives to Radioactive Dumping endorses Citizen Action's recommendations concerning the MWL.		
M	**Embudo Valley Environmental Monitoring Group, Sheri Kotowski**		The commenter states that the Embudo Valley Environmental Monitoring Group endorses the recommendations of the comments submitted to NMED by Citizen Action.		
N	**Concerned Citizens for Nuclear Safety, Joni Arends**		The commenter states that the CMI Plan should be denied until all recommendations made by Citizen Action are resolved to Citizen Action's satisfaction.		
E	**Albuquerque Center for Peace and Justice and Citizens for Alternatives to Radioactive**	Vadose zone Monitoring	The commenter believes that contaminants in the vadose zone should be a trigger.	R11	The NMED agrees that soil gas in the vadose zone should be monitored for tritium, radon, and VOCs. The NMED will require the Permittees to develop triggers for soil gas for these radiological and chemical constituents, and include them in the long-term monitoring and maintenance plan. This plan is due 180 days following approval of the CMI Report.

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	Dumping, Dorelen Bunting and Janet Greenwald				The NMED has no authority to enforce DOE Orders, but does have the authority under State law to require the installation of vapor monitoring wells at the MWL. If the commenter believes that requirements of DOE Orders are not being met, the commenter should direct these particular concerns to the DOE.
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		The commenter states that the model does not identify trigger levels for waste constituents that apply at the edge of the MWL or in the vadose zone below the site, but above the water table.		
I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		The commenter recommends establishment of a shallow (less than 50 foot depth) subsurface monitoring program in the vadose zone for detection of VOCs as part of long-term a maintenance and monitoring plan and apply triggers at those sites.		
J.	**Citizen, Robert H. Gilkeson**		The commenter states that the wells are not installed and are needed in the unsaturated strata beneath the landfill to monitor the levels of toxic volatile contaminants (e.g., PCE, TCE, TCA, etc.) and tritium that are released over time from the landfill. The commenter also indicates that		

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			monitoring wells in the vadose zone are required by DOE Order 450.1 for early identification of the release of contamination from the MWL.		
O	**Citizen, Jamie Wells**		The commenter recommends conducting characterization of the site to understand the current situation of the landfill inventory before conducting work, including vadose zone sampling.		
F	**Loretto Community of Catholic Sisters and Co-members, Penelope McMullen**	Long-term monitoring	The commenter states the FTM needs to be revised to consider a plan for monitoring, testing and dealing with contaminants that may show up in the future. The commenter also states the CMI plan should be revised to include full long-term monitoring and maintenance program for public review and comment.	R12	The Secretary's Order requires the Permittees to submit a long-term monitoring and maintenance (LTM) plan within 180 days after approval of the Corrective Measures Implementation Report. The monitoring plan will be designed after the remedy is completed and, thus, the end state of the landfill is known. This is an entirely appropriate sequence. The FTM is not a long-term monitoring and maintenance plan, nor was it intended to be one. The Order states that the long-term monitoring and maintenance plan shall be subject to public review and comment.
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		The commenter stated that the "triggers" identified in the model do not include monitoring mechanisms to reflect either human intrusion, biological transport, or the waste constituents identified at the MWL. The commenter also states that the model discussion of "Trigger Levels"' does not address the degree to which monitoring for moisture content changes would reflect vapor		The scope of the monitoring, sampling and analysis, quality control, frequency, triggers, and the technologies to be utilized are to be detailed in the long-term monitoring and maintenance plan. However, sampling and analysis will be required for a wide range of potential contaminants, and will not be limited to just tritium. Sampling will include animal burrows and ant mounds to assess bio-transport of contaminants, if any. The plan will include monitoring of air, surface soil, subsurface soil gas, and groundwater, but not the monitoring of plants and animals unless required by the DOE (see NMED response R6). The plan must contain contingency procedures should the remedy fail to be protective.

Commenter ID	Commenter / Association	Topic Area	Comment Summary	NMED Response Number	NMED Response
			phase movement of VOCs. The commenter requests that the model identify technologies that could be used to monitor moisture content. The commenter is also concerned that the CMI plan does not provide a comprehensive or detailed long-term operation and maintenance plan for public comment or review. The commenter requests that the CMI plan include a long-term monitoring and maintenance program that addresses: all parameters to be monitored, all media – including air, soil, vadose zone, groundwater and biota (plants and animals); recommended limits of detection for analytic equipment to be used; frequency of sampling and analysis; quality control and quality assurance measures; monitoring and maintenance cost estimates; MWL cover inspections and maintenance activities; and measures to verify that all institutional control aspects of the proposed corrective measure are in place and enforced for the full closure and post-closure period at the MWL. The commenter also states that the CMI plan proposes only three vadose zone monitoring boreholes and does not provide a demonstration that this number of		See also NMED response R8 above concerning the acquisition of new data. The monitoring of moisture content of subsurface soil by the neutron probe method will not detect VOCs. Soil-gas monitoring is done by different means. The three monitoring stations for subsurface soil moisture content are adequate for their purpose. However, the NMED does not consider the monitoring of deep subsurface soil for moisture content to be the most important type of monitoring that should be done at the MWL; it is only one component of a comprehensive monitoring strategy. The effectiveness of the CMI Plan does not rely on the LTM Plan. In fact, the opposite is true. Furthermore, as pointed out by comments from Citizen Action, the CMI Plan does not include much of the essential elements of a LTM Plan. Simply put, the CMI Plan is not a LTM Plan, and it is not intended to be a LTM Plan. As mentioned before, the end state of the landfill must be known before the LTM plan can be finalized. The NMED suggests that commenters may wish to resubmit their comments during the public comment period to be held in the future for the LTM Plan, as many of the suggestions are relevant, and should be considered in the development of the final LTM Plan. Replacement wells can be installed through a vegetative soil cover without risking damage to the cover, as such covers are by nature of simple design.

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I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		instruments will provide comprehensive vadose zone monitoring. The commenter states that NMED should revise its MWL "Permit Modification" to require submittal, review, and approval of a LTM Plan on a schedule parallel to the schedule for the remaining portions of the CMI Plan rather than deferring the submittal of the LTM Plan until 180 days following completion of the construction of the corrective measure. The commenter also states that the effectiveness of the CMI Plan is dependent on the implementation of the LTM Plan. The commenter states that the CMI Plan already provides substantial information regarding critical portions of the LTM Plan, including trigger levels and moisture monitoring systems. The commenter also indicates that the LTM Plan should include, but not be limited to: • Bio-monitoring program, including establishment of bio-monitoring triggers at a significant increase over background to establish baseline and identify bio-accumulation, if any, in plant, animal and		

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			insects species in and around the MWL for as long as the waste remains in place. The commenter proposes that this program should include the identification of specific species to be monitored, frequency of sampling, and type of contaminants to be monitored [radiological, volatile organic compounds (VOCs), and heavy metals]. • Require SNL/DOE to establish and maintain site access controls and use restrictions as identified in the CMS and Administrative Order on Consent Based immediately. • Vadose zone monitoring of VOCs, moisture, and an appropriate suite of radionuclides and metals to verify model outputs; establishment of a statistically defensible baseline; and consideration of continuous monitoring. • Reinstalled monitoring wells before any cover is installed to insure that drilling equipment does not damage the evapotranspirative cover for the MWL.		
O	**Citizen, Jamie Wells**		The commenter recommends developing, establishing, and		

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			approving a Long-Term Monitoring and Maintenance Plan before construction of the cover.		
F	**Loretto Community of Catholic Sisters and Co-members, Penelope McMullen**	Container deterioration	The commenter states the FTM needs to be revised to consider the analysis of possible deterioration of each type of "container" for each type of waste buried in the MWL.	R13	The model assumes known releases from the landfill are available to migrate, except for sealed radium-226 sources where the model considered various degrees of container leakage. The number of intact containers in the MWL that contain fluids is unknown; however, the inventory suggests that the quantity of such containers is probably not large. NMED believes that many of the steel containers within the landfill have or will eventually rust. Any liquids contained within the containers could migrate from the landfill if conditions are appropriate; however, this does not necessarily mean that any release would pose a risk to human health and the environment. It also does not mean that the landfill would need to be excavated to mitigate a release. Due to uncertainty associated with the inventory, NMED recognizes that continued monitoring is necessary to ensure protection of human health and the environment. New data from monitoring will be used to update the results of the FTM and to screen for any unexpected releases, should any occur.
G	**Citizen, John Trauxe, Ph.D., PE**		The commenter believes that transport and fate of tetrachloroethylene (or perchloroethylene, PCE) is modeled reasonably, including decay from biotic degradation, but notes that future releases of PCE from as-yet unbreached containers was not performed.		
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)		The commenter stated that the FTM is not comprehensive with respect to the physical state of containers for the full range of contaminants at the MWL. The commenter also states that the model does not appear to identify or consider either the mechanisms for deterioration of waste containers or the consequences of the deterioration of waste containers during development of the input parameters and assumptions for its		

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I **O**	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center) **Citizen, Jamie Wells**		VOC, heavy metal and radionuclide models, with the exception of the radon model runs in which radium-226 containers were determined to deteriorate in 1,000 years. The commenter recommends the identification, compilation, and review of container deterioration data applicable to containers identified at or likely to have been disposed of at the MWL including information from other SNL, Lockheed, and DOE sites to determine container patterns applicable to the MWL. The commenter recommends conducting research and testing to understand and model container decay in the landfill.		
G	**Citizen, John Tauxe, Ph.D., PE**	General comment on fate and transport model	The commenter stated that the general approach taken by the fate and transport model is proper and commendable. The commenter stated the model is aimed at identifying appropriate locations and properties or constituents for long-term monitoring, and that the stochastic (probabilistic) modeling provides information for performing a sensitivity analysis, which in turn informs the monitoring program. The commenter believes this is an example of appropriate application	R14	NMED agrees that the general approach using a probabilistic model, as opposed to a deterministic model, is appropriate. The probabilistic modeling approach taken by Sandia is likely the only way that any reasonable model could be generated for the MWL and attempt to account for uncertainties. However, because of the myriad of assumptions and input parameters that could be chosen, there will always be questions that can be raised about the results. However, no matter the results of the model, the NMED will only rely on empirical data acquired from monitoring the landfill to evaluate the remedy's effectiveness.

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			of stochastic modeling, but also noted that several technical flaws (presented below) bring the overall results into question.		
G	**Citizen, John Tauxe, Ph.D., PE**	Modeled inventory distributions	The commenter states that the uncertainty distribution for the inventory of radionuclides in the MWL is undefended, applying a uniform distribution with a minimum at the values reported in SNL (1993) (from the document references) and a maximum of only twice the minimum. Commenter notes that no justification for this distribution is provided in the document, and believes the distribution is narrow based on the uncertainties regarding the inventory that are apparent in the source document. The commenter believes it is highly unlikely that all inventory constituents share the exact same uncertainty distribution, so the uniform (x,2x) distribution seems *ad hoc*. The commenter notes that inventory uncertainty is often the greatest source of modeling uncertainty at other DOE sites and suggests that a more thorough analysis of these distributions should be performed. The commenter repeats this comment in additional comments sent to the NMED by e-mail, May 3, 2006.	R15	The uniform distribution (for the radionuclides considered by the model) was used because there is no indication within the inventory to indicate that each radionuclide required its own uncertainty distribution. Additionally, the quantities of radionuclides disposed of in the landfill are better known than the amounts of chemical constituents. Comparative analyses were performed between simulated and measured soil levels for tritium and PCE, and modeling results matched reasonably the actual levels found in the field. Also, sensitivity analyses indicated that the inventory parameter was not the most significant factor in mobility of radionuclides.

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G	**Citizen, John Tauxe, Ph.D., PE**	External radiation exposure	The commenter notes that external exposures from radionuclides in the ground surface and near surface was overlooked in the model and that this is a potentially significant exposure pathway. The commenter believes this exposure should be included with inhalation of gases and particulates and incidental ingestion of soils by potential future receptors that would have access to the site.	R16	Only tritium and radon are expected to penetrate the cover. Based on characterization studies, existing activity levels of tritium and radon are sufficiently low that they do not pose unacceptable risk to human health and the environment, accounting for both external exposure and ingestion. Because of radioactive decay, the levels of radionuclides seen currently at the surface are unlikely to increase in the future. See also NMED response R4.
G	**Citizen, John Tauxe, Ph.D., PE**	Modeling time	The commenter notes that the period of performance for the model is 1,000 years, but suggests that modeling for peak dose analysis should be done to provide perspective on the long-term significance of waste disposal.	R17	None of the modeled radionuclides and heavy metals was simulated to reach groundwater during the 1,000-year performance period or the extended 10,000-year period. However, the model predicts that aquifer concentrations of PCE will peak in less than 50 years for the majority of the model runs. NMED believes 10,000 years is sufficient and is consistent with conservative model calculations done for other facilities (e.g. Waste Isolation Pilot Plant).
G	**Citizen, John Tauxe, Ph.D., PE**	PCE degradation products	The commenter notes that PCE decay products are not modeled and yet can be significant sources of cancer risk. The commenter states that some of these decay products have higher hazard indices than that of PCE, and cancer risk from them should be included in the model, as well as consideration of variable biodegradation rates, which will vary with location in the model.	R18	The FTM assumes that the entire inventory of PCE was released at one time. Consequently, phased future releases are not considered, as this would be a less conservative approach.. In addition, long-term monitoring parameters proposed by SNL include several PCE breakdown products. Given the low levels of PCE expected to reach the water table according to the model, and the low levels of PCE that actually exists, the NMED believes that PCE degradation products will likely not be of concern. See also NMED response R5.
H	**Citizen Action New Mexico, Susan Dayton** (Comments		The commenter states that the model also does not identify or present model realizations for the decay products of PCE and the other VOCs		

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	compiled by Paul Robinson, Southwest Research and Information Center)		and semi-volatile compounds (SVOCs) that were known to have escaped the MWL in 1993.		
G	**Citizen, John Tauxe, Ph.D., PE**	Model should be realistic in all assumptions	The commenter notes that the model indicates it is conservative in its assumptions, but this philosophy was applied inconsistently between groundwater infiltration and surface water runoff pathways. When one is modeled conservatively, the other is not conservative, if the pathways are linked to the same conditions. The commenter recommends abandoning the attempt to be "conservative" in favor of trying to be realistic in all assumptions.	R19	Whenever the precipitation rate exceeds the infiltration rate, surface-water runoff occurs. In the case of infiltration rate (in this case, the term is used interchangeably with “percolation rate”), the minimum value of the range is based on present-day climate, while the maximum value assumes climate change will occur, based on history, and is based on about twice as much precipitation as currently received at the MWL. The maximum and minimum values chosen for the infiltration rate appear to be realistic. The NMED agrees that assumptions should be realistic, but strives to be conservative, and therefore more protective.
G	**Citizen, John Tauxe, Ph.D., PE**	Monitoring locations	The commenter notes that the model document proposes monitoring of tritium and radon at the site boundary. The commenter, however, suggests that more valuable and interesting data will be obtained by monitoring these constituents on the MWL as they emanate from the cover. The commenter believes monitoring on the MWL cover will provide a more immediate and sensitive indication of gas emanation than can be provided by monitoring at the boundary.	R20	The NMED agrees with this comment. Some monitoring should be done at stations located on the cover. Monitoring stations will be considered in detail in the long-term monitoring and maintenance plan to be submitted by SNL at a later date.

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G	**Citizen, John Tauxe, Ph.D., PE**	Sensitivity analysis	The commenter notes that the sensitivity analysis performed for the FTM attempts to identify those model parameters and processes that most influence the results and recommends them for future monitoring. The commenter believes, however, that the sensitivity analysis is *ad hoc*, rather than comprehensive. The commenter recommends performance of a comprehensive sensitivity analysis and that the inventory distributions should be revisited, or if this was done, that sufficient details be provided for the reader to understand the method.	R21	The sensitivity analyses consider all parameters, but the results of these analyses, which are graphically presented in figures, only present the parameters with statistical significance. NMED also believes that additional details may be needed in the explanation of the sensitivity analyses, as presently explained in Section 2.2.1 of the report. The comment will be considered further after Sandia submits additional information for the FTM.
G	**Citizen, John Tauxe, Ph.D., PE**	Cover design	In a May 3, 2006 e-mail to the NMED, the commenter states "In these arid environments, the best cap is a simple monofill of natural materials such as the alluvium surrounding the MWL. The trick is to make it thick enough to act as a sponge for episodic infiltrating water, and encourage plant growth to keep it dry. Specification of a RCRA Subtitle C type cap is misguided. The optimal cap should be based on performance, not on a rigid design".	R22	The proposed cover (cap) is essentially a monofill as suggested by the commenter. Performance modeling was conducted to arrive at a design intended to limit infiltration to no more than 2.5-3 mm/year.
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul	Convening a technical discussion group	The commenter requests that NMED convene a "technical discussion group" to serve as a public meeting to provide a forum for interested stakeholders regarding the adequacy	R23	NMED convened such a group on May 25, 2006, at the Los Griegos Health and Social Services Center in Albuquerque, New Mexico. The public was given an opportunity at the meeting to discuss any technical issues about the MWL CMI Plan that interested them. NMED also opened another 14-day public

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	Robinson, Southwest Research and Information Center)		of the FTM and the CMI plan. The commenter recommends that this technical discussion group include representatives of the permittee, the NMED, and members of the public who have expressed an interest in the studies conducted by Sandia and/or submitted comments to the NMED on the CMI plan and/or the FTM. The commenter also recommends convening this technical discussion group prior to determining that the CMI plan and the FTM are either "comprehensive" or complete".		comment period on that day, giving the public even more opportunity for input. The NMED, facility representatives from DOE and SNL, and members of the public were in attendance. The NMED had not taken any final action with the CMI Plan or FTM prior to this meeting.
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)	1995 Argonne study and report on MWL	The commenter states that the model identifies a 1995 Argonne National Laboratory report [cited as Johnson 1995 in the FTM] at p. 16 that showed that VOCs released from the MWL could reach the water approximately 250 years from the time of disposal. This study was not provided to NMED as part of the CMS, CMI plan, or the references for either of those reports. The commenter states that NMED should require Sandia to provide the agency with copies of the 1995 Argonne study, review the study, and consider its relevance regarding the adequacy of the Corrective Measure identified in the Permit Modification since Sandia did not present the study to NMED or the public or consider it during the development of the CMS.	R24	NMED will request SNL to provide a copy of the 1995 Argonne National Laboratory study for review. However, the model does not change the result of site characterization studies completed for the landfill. See also NMED response R1.

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			The commenter requests that NMED review the Corrective Measure approved in the Permit Modification as the conclusions of the 1995 Argonne Report are contrary to the conclusions presented in the CMS and Sandia's MWL hearing, i.e., that contaminants such as VOCs could not reach groundwater at the MWL site.		
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)	Trigger levels set too high	The commenter states that the "trigger levels" identified in the model do not provide for early detection and early response to releases prior to the exceedance of health–based standards. The commenter states that the proposed trigger levels do not provide either early detection or early response as they are set at values at or near regulatory standards, rather than at levels that would demonstrate the "edge of the plume." The commenter suggests trigger levels that provide "detection of contamination," which would be established at a level 25–50% above initial concentrations for contaminants of concern.	R25	The trigger levels for releases to the atmosphere as proposed are orders of magnitude less than the modeled values that would result in noncompliance with regulatory standards or DOE Orders. The proposed trigger levels for groundwater constituents mostly are set at one-half of their corresponding MCL values; a few constituents are set at one-half the New Mexico Water Quality Control Commission standards in cases where MCLs do not exist. The NMED will require that the trigger levels for the latter constituents be set to lower levels.
I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson,		The commenter recommends establishment of trigger levels for agency and public notification and initiating responsive action at values 50% - 100% above background and/or 50% above detection limit for		

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	Southwest Research and Information Center)		VOCs identified in 1993-4 and technogenic radionuclides, and an appropriate suite of metals and naturally-occurring radionuclides		
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)	Uncertainties in the fate and transport model	The commenter states that a broad range of sources of uncertainty in the model were identified by the model's lead author Dr. Clifford Ho in a PowerPoint presentation at a DOE-sponsored public meeting on the model in January 2006. The "uncertainty variables" identified by Dr. Ho included: waste inventory and size; thickness of cover; and vadose zone and transport parameters including: infiltration, adsorption coefficient, saturated conductivity, moisture content; tortuosity coefficients, and boundary-layer thickness. The commenter suggests that the model should be revised to identify the full range of uncertainty variables associated with each of the constituents addressed in the FTM, as well as to identify the range of values used in model realizations to account for the uncertainty associated with each variable.	R26	Tables E-2 through E-5 of Appendix E present the variables used in the FTM and their respective range in values. The range in values for each variable is intended to address uncertainty through use of the Monte Carlo approach, whereby many runs of the FTM are made to create many outcomes based on the use of different combinations of input parameters. The results of each model run are equally probable, and the collection of results yields a cumulative probability distribution that can be compared to performance objectives or to assess risk. The commenters did not specify which of the variables were considered by them to be problematic, and for what reason. The NMED believes that the range of the variables shown in tables E-2 through E-5 are reasonable and comprehensive given the dimensions of the landfill; the geologic, hydrologic, and climatic conditions of the landfill; and what is known of the inventory and current releases of contaminants.
I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson,		The commenter also recommends a revised and expanded FTM to address the range of parameters associated with "model uncertainties/sensitivities" – including vadose zone profile (Kd),		

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	Southwest Research and Information Center)		half-life (degradation), inventory of VOCs, as identified at FTM p. 57.		
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)	Relationship between the cover design and fate and transport model	The commenter states that the CMI plan does not effectively incorporate the content and findings of the model in either the evaluation or design of the Corrective Measure proposed for the MWL. The commenter requests revision of the CMI plan to incorporate the analyses and findings in the model when it is determined to be comprehensive and meet the requirements of the permit modification and associated guidelines and regulations by NMED.	R27	Regulations for permitted and interim status landfills require closure of a landfill to meet certain performance standards, including minimizing over the long term the migration of liquids through a closed landfill (for example, 40 CFR 264.310). Using these regulations as guidance for the MWL (the MWL is not a permitted or interim status landfill), the cover design is based on the results of performance modeling, not the FTM. Performance modeling is conducted to predict how much moisture can infiltrate into and percolate through the cover over a specified period of time for various proposed cover designs. The FTM predicts the future migration of contaminants, based in part on using the results of the landfill performance model that was done for the MWL. If the FTM had predicted a high chance that groundwater would become contaminated, the Permittees could conduct further performance modeling in an attempt to improve the cover design to eliminate the predicted threat. However, because the FTM predicts little chance that groundwater contamination will occur at levels exceeding a regulatory standard, no design changes are warranted.
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)	PCE concentrations in error	The commenter states “The FTM states that the maximum PCE detected in 1993 was 5900 ppb at pg.52, but lists the maximum concentration of PCE in 1993 as 5200 ppb on Figure 21 at pg. 53”.	R28	The comment may be incorrectly citing site information. The maximum PCE concentration for 1993 data (at 30 feet) is shown correctly as 5900 ppb on Figure E-21. The maximum PCE concentration of 5200 ppb (at 10 feet) is shown on Figure E-20.

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I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)	New wells are needed	The commenter recommends that the ground water monitoring wells at the MWL be replaced with wells that meet regulatory standards, including RCRA standards capable of meeting applicable data quality objectives and providing reliable and verifiable water quality and soil column data. The commenter also recommends that NMED conduct an independent analysis of the effectiveness of the monitoring wells to identify the occurrence of VOCs and other constituents of concern, including those modeled in the FTM. In a meeting on July 19, 2006, the commenter repeated that new wells should be installed at the MWL to replace wells impacted by drilling mud and additives.	R29	The NMED disagrees with this comment and believes that groundwater data obtained from the monitoring wells at the Mixed Waste Landfill (MWL) are generally representative of formation water (see also NMED report by Moats, Mayerson, and Salem, 2006, entitled *Evaluation of the Representativeness and Reliability of Groundwater Monitoring Well Data, Mixed Waste Landfill, Sandia National Laboratories*). A total of seven ground-water monitoring wells have been installed at the MWL (BW1, MW1, MW2, MW3, MW4, MW5, and MW6). Wells MW1, MW5 and MW6 were installed using the air-rotary casing hammer (ARCH) method. Well MW4 was drilled using sonic resonant technology; whereas, wells BW1, MW2 and MW3 were completed via the mud rotary drilling method. In the above mentioned report, groundwater data from the mud rotary wells (BW1, MW2, and MW3) were compared to corresponding data from wells completed by other drilling methods (MW1 and MW4) and to background hydrochemistry data representative of the Kirtland Air Force Base area. The results of this effort finds that the mud rotary wells, in addition to the other wells at the MWL, yield representative groundwater samples and that comments to the contrary are incorrect. The groundwater data representing water quality at the MWL can be relied upon for characterization purposes and remedy selection.
J	**Citizen, Robert H. Gilkeson**		The commenter states that the strategy to leave chemical and radioactive waste at the Sandia mixed waste landfill and to assure protection of the regional aquifer by long-term monitoring of the existing set of monitoring wells is unacceptable because of the poor quality of the water samples produced from the wells. The commenter believes there are many important factors for why the wells do not meet the regulatory		There is no evidence that the hydrochemistry of groundwater samples from MWL monitoring wells has been significantly impacted by the use of drilling mud or additives. Just because drilling mud or additives have the *potential* to adversely impact water quality results does not mean that this has actually happened at the MWL. Decades of monitoring well installations around the world through a variety of methods show that with proper well development, wells drilled by the mud rotary method or other methods are capable of yielding representative water samples.

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N	**Concerned Citizens for Nuclear Safety, Joni Arends**		requirements for detection monitoring: • Drilling additives with well known chemical properties to mask the detection of contamination were allowed to invade the strata that surround the wells. • The drilling additives lowered the permeability of the strata surrounding the wells so that the wells produce stagnant water that was in contact for a long period of time with the strata affected by the drilling additives. In a July 19, 2006 meeting with the NMED, the commenter repeated his comments on this topic. The commenter recommends that NMED deny the CMI Plan, including the FTM, until such time as the recommendations made by Citizen Action are resolved to their satisfaction. The commenter states that issues related to the quality of the groundwater monitoring data must be resolved before NMED provides any type of approval of the CMI Plan. The commenter also recommends that the issues and comments raised		Although the practice is somewhat dated, it is clear that one commenter is referring to saturated hydraulic conductivity (Ksat) when using the term permeability. Note that the NMED responses will use the term "Ksat" rather than the less precise and dated term "permeability", as the latter term is often confused with a different physical property of rock formations. Because of the depth to the water table (about 460 feet), nearly all drilling methods capable of being successfully employed at the MWL will impact to some degree and at least temporarily the pristine environment of the saturated zone. This is because at minimum, for the common drilling methods either water or air must be injected to lubricate and/or cool the drill bit, and to transport cuttings to the surface. While desirable to have ideal and pristine conditions, one must accept the natural conditions that exist at sites and the limits of technology, and their influence on data quality objectives. The development of wells is a standard practice intended to restore the natural properties of the saturated zone to the extent *reasonably* possible. The NMED believes that wells that are properly and timely developed, including those installed using the mud rotary method, can yield representative water samples. The monitoring of groundwater in any given well over several years is also standard practice to allow for the restoration of water quality. A number of the wells at the MWL have sampled periodically for more than a decade. Although not prohibited by regulation, the NMED discourages the use of the mud rotary method for well installations because of its *potential* impacts on water quality and formation properties. A report prepared by the NMED in 1993 on the MWL monitoring well network makes this point, and subsequently, other wells completed at the MWL have been installed by other drilling methods. No evidence has been provided that the Ksat of the sediments surrounding any well at

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			by Robert H. Gilkeson must be addressed by Sandia National Laboratories and NMED prior to any type of approval of the CMI Work Plan is made by NMED. The commenter states that Concerned Citizens for Nuclear Safety has been involved with groundwater issues at Los Alamos National Laboratory (LANL) for many years. As the Department of Energy (DOE) owns both LANL and Sandia, the commenter was not surprised to learn that the same types of problems exist at Sandia as at LANL.		the MWL has been decreased by drilling mud or additives. The low Ksat of the sediments surrounding the shallower wells drilled by any method was expected given the geologic logs indicate that silty fine-grained sands make up the uppermost part of the saturated zone. Wells MW1 and MW4, drilled using the ARCH method without using drilling mud or additives (beyond water and air) also encountered the same silty sands as the wells drilled by the mud rotary method. These latter wells are also low yield wells due to the low Ksat of the saturated sediments they are screened in. There are no regulatory requirements or technical reasons that mandate that wells be screened only in high Ksat strata. In fact, such a requirement at the MWL would mean that the uppermost aquifer (i.e., the geologic unit that, in the event of a release, would be affected first) would go unmonitored. NMED strongly disagrees with this approach. The FTM predicts little chance of groundwater contamination. Soil and soil vapor data collected during the RCRA Facility Investigation demonstrate that there is no significant contamination in the vadose zone beneath the MWL. Given the latter, it is inconceivable that groundwater contamination is being masked by drilling additives when there is no expression of that contamination in the vadose zone. The vadose zone must be significantly contaminated before one would expect any groundwater contamination to be present, a condition which simply does not occur at the MWL. Because the well network is reliable, the NMED will not require replacement of wells except on a case-by-case basis as wells become useless for sampling due to the dropping water table. Note that not all wells are likely to be replaced after going dry, and that the NMED may choose different locations to install replacement wells.

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I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)	New geophysical surveys needed	The commenter recommends that NMED require a revised set of geophysical surveys of the MWL to update and enhance the Phase 2 data to provide detailed information about the shape, distribution and content of containers in the MWL, the distribution of metals and other materials in landfill, and otherwise expand knowledge of inventory. This updated geophysical baseline should include replication of geophysical investigations in the RFI Phase 2 Report with contemporary equipment and analytic capabilities, as well as conduct of additional geophysical analyses including, but not limited to, sonar, ground penetrating radar, and magnetic resonance.	R30	Geophysical surveys are conducted chiefly to determine the trenches/pits and boundaries of a landfill by locating buried metal. The MWL and the trenches contained within it have been adequately characterized by geophysical surveys conducted during the Phase 2 RCRA Facility Investigation. There is no need to conduct other geophysical surveys of the MWL. Individual containers could not be well delineated, even with the benefit of the latest geophysical methods.
O	**Citizen, Jamie Wells**		The commenter recommends conducting characterization of the site to understand the current situation of the landfill inventory before conducting work, including: • Noninvasive geophysical characterization using magnetic resonance and radar, and the latest instrumentation, which has a higher data resolution and different frequencies (older instrumentation use one frequency) than when the previous geophysical surveys were performed. The		

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			commenter suggests that this data should be maintained in the appropriate format so they can be used in the future as refinements in technology and algorithms advance in this field. This could assist in a better understanding of the waste and containers.		
I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)	Model input data	The commenter recommends full disclosure of FTM model input data.	R31	Tables E-2 through E-5 of Appendix E present the variables used in the FTM and their respective range in values.
I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)	VOC levels modeled	The commenter recommends that enhanced FTM realizations include considerations of VOC concentrations 100x and 1000x the concentrations identified in soil the MWL RFI Phase 2 Report.	R32	The model assumed PCE concentrations up to 10 times that of the maximum level actually detected. Inputs to the FTM should be not only conservative, but also reasonable and realistic. If PCE levels were increased to 100 to 1000 times of the maximum actually detected, the model would undoubtedly predict significant groundwater contamination for a much larger percentage of modeling runs. There is no basis to model such high concentrations based on the actual releases of VOCs reported in the Phase 2 RCRA Facility Investigation Report.
I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson,	Other models of VOC fate and transport	The commenter recommends the identification and submittal to NMED and review of other models of VOC movement conducted by Sandia for other waste sites at SNL including, but not limited to, the	R33	Modeling must be done on a site by site basis, as every site generally has different source terms, and geologic, hydrologic, and climatic conditions. Sandia has modeled vapor-phase migration of VOCs at the Chemical Waste Landfill. The modeling results have been

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	Southwest Research and Information Center)		Chemical Waste Landfill, Liquid Waste Disposal System, and Lurance Canyon sites located at SNL.		submitted to and have been reviewed by the NMED. However, the FTM is more appropriately tailored for the MWL as it utilizes site-specific information to the extent possible. Contaminant migration at the Liquid Waste Disposal System was primarily by aqueous-phase transport. This is probably also true for contaminant migration at the Lurance Canyon Burn Site. Neither of these sites is a close match with the MWL with respect to the conditions mentioned above, thus the modeling done for these sites would not be particularly useful for the MWL.
O	**Citizen, Jamie Wells**		The commenter recommends validation of the FTM by using the code at other sites selected by the NMED.		
I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)	Run-on/run-off controls	The commenter recommends locating run-off and run-on collection and diversion canals and swales approximately 25 to 50 meters away from the perimeter of cover system to manage flows from peak precipitation events.	R34	This point was considered and discussed during the Technical Discussion Public Meeting sponsored by NMED on May 25, 2006. NMED declined to act on this recommendation, because due to a 3,000-foot long sled track located east of the MWL, overland flow of surface water would be mostly prevented by the sled track from reaching the eastern edge of the future landfill cover. The sled track is elevated above the surrounding ground surface and thus acts as a barrier to westerly directed surface water flow.
I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)	Wind erosion	The commenter recommends including an erosion resistant layer (armor) to reduce wind erosion effects.	R35	This point was considered and discussed during the Technical Discussion Public Meeting sponsored by NMED on May 25, 2006. The topsoil used for the cover will include a 25 percent mix of gravel that will help reduce wind and water erosion prior to vegetation becoming established on the cover. The topsoil/gravel mix is an erosion resistant layer. Further enhancements to the cover to deal with this issue are therefore unnecessary.
I	**Citizen Action New Mexico, Susan Dayton**	Defining seeding success	The commenter recommends identifying specific vegetative cover standards for determination of re-	R36	The NMED agrees with this comment. NMED will require SNL to define the criteria that will be used to assess whether vegetation of the cover has been successfully accomplished.

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	(Comments compiled by Paul Robinson, Southwest Research and Information Center)		vegetation success including, but not limited to, species diversity, plant survival, and ground cover parameters.		
I	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)	Endorses comments made by Robert Gilkeson	The commenter presented recommendations submitted by Robert H. Gilkeson to the NMED.	R37	See NMED responses to Robert Gilkeson Comments, commenter identification "J".
K	**Nuclear Watch of New Mexico, Scott Kovac**		The commenter states that Nuclear Watch of New Mexico endorses the recommendations of the comments submitted to NMED by Robert H. Gilkeson.		
M	**Embudo Valley Environmental Monitoring Group, Sheri Kotowski**		The commenter states that the Embudo Valley Environmental Monitoring Group endorses the recommendations of the comments submitted to NMED by Robert H. Gilkeson.		
J	**Citizen, Robert H. Gilkeson**	Sampling procedures	The wells are sampled with procedures that strip from the water the volatile chemical solvent contaminants that are known to be	R38	Several of the wells at the MWL are constructed such that their screens straddle the water table. This is a common practice that is effective for monitoring the uppermost part of the saturated zone and to account for potential seasonal variations in water

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			released from the landfill (e.g., PCE, TCE, and TCA). The wells are sampled with procedures that expose the water to oxygen and therefore, many metal and radioactive contaminants known to be disposed of at the landfill are hidden from being detected. The commenter states that the collection of water samples after the wells are purged dry is unacceptable because of aeration and oxidation of the water that trickles into the wells, and therefore, a loss of many contaminants from the water and especially volatile solvents. The commenter suggests that PCE, one of the parameters for compliance monitoring, is a volatile solvent that will be stripped from the groundwater that recharges into the wells after they are purged dry. It is essential for the monitoring wells at the Sandia mixed waste landfill to provide a continuous flow of water for monitoring of sensitive water parameters with a closed flow-through cell with the collection of water samples after the sensitive parameters stabilize and during the continuous flow of water. In a July 19, 2006 meeting with the		levels and contaminant concentrations. The surface of the water contained in any given well is in contact with air (and thus oxygen). The formation water at the water table surrounding the wells is also in contact with air. No matter what sampling procedures are employed, some of the water that flows into the wells will have been exposed to oxygen in air. Not all of the wells at the MWL are low yield wells (will purge dry). Additionally, applicable regulations or guidance do not state that low yield wells are unacceptable. It is a standard EPA procedure to purge low yield wells dry, and then to collect water samples from them as soon as possible after they have sufficiently recovered. Low yield wells at the MWL are now sometimes taking days to recover after being purged dry. The fact that it takes so much time for the wells to recover indicates that the groundwater flow into these wells is not turbulent, hence there is less concern that appreciable volatile organic compounds are being stripped from the water samples. In the case of the MWL, it is known from soil-gas surveys and subsurface soil samples that volatile organic compounds are unlikely to reach groundwater, especially at detectable levels. This has been confirmed by the FTM. Regardless, the pumping and sampling procedures employed by Sandia are appropriate, and in fact are a necessity given the natural conditions that exist at the MWL. The majority of the wells at the MWL are “low yield wells” because the saturated sediments that they intercept have low Ksat – Ksat is a physical property that essentially is a measure of how easy groundwater can flow through the aquifer. The NMED and EPA both recognize that low yield wells exist in the real world and sometimes that the desired ideal sampling conditions can not be obtained. Because low yield wells are a reality, and contamination is not always in high Ksat zones, the sampling of low yield wells is not prohibited by regulation and procedures for sampling them are found in EPA guidance. See also NMED response R29.

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			NMED, the commenter repeated his comments on this topic.		As mentioned previously, in order to conduct a technically sound groundwater investigation at the MWL, SNL has had to construct some wells such that their well screens straddle the water table. The wells must monitor the water at the water table no matter the Ksat of the sediments that are encountered there. Sediments at the water table beneath the MWL have low Ksat. At the MWL, because the water does not flow into the wells easily because of low Ksat, the wells are purged dry even though the purging rate is only about 1 gallon per minute or less. Also, because the water does not flow into the wells easily, it may take several days before sufficient amounts of water will recharge the well to allow the collection of samples. Depending on the well, the time it takes for recovery has increased from a few hours to days as water levels have dropped over the years. Although ideal sampling procedures can not be achieved with the low yield wells at the MWL, no-purge sampling conducted at TA-V and the Tijeras Arroyo leads NMED to conclude that volatile organic compounds would still be detected.
J	**Citizen, Robert H. Gilkeson**	Regulatory requirements for wells	The commenter indicates that the existing network of monitoring wells at the Sandia mixed waste landfill does not meet the requirements of the RCRA Statute, the NMED Sandia Consent Order, or the DOE Orders for the detection of contamination released from the waste buried in the landfill. In a July 19, 2006 meeting with the NMED, the commenter repeated his comments on this topic.	R39	NMED disagrees with this comment and believes that the monitoring wells at the MWL substantively meet regulatory requirements under the New Mexico Hazardous Waste Management Regulations, requirements pursuant to the Sandia Consent Order issued April 29, 2004, and guidance issued by the U. S. Environmental Protection Agency. NMED has no authority to enforce DOE Orders, and so considers them irrelevant to a state-enforced cleanup action. The Mixed Waste Landfill is subject to corrective action under the New Mexico Hazardous Waste Management Regulations, 20.4.1 NMAC, which for the most part incorporate federal regulations promulgated under the Resource Conservation and Recovery Act (RCRA). NMED has negotiated a Consent Order with Sandia and the U. S. Department of Energy which contains groundwater monitoring well installation, development, purging,
O	**Citizen, Jamie Wells**		The commenter recommends conducting characterization of the		

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			site to understand the current situation of the landfill inventory before conducting work, including groundwater monitoring that meets 40 CFR 264 Subpart F.		and sampling requirements that is consistent with the New Mexico regulations and guidance. The EPA and the NMED have published guidance on how to properly construct monitoring wells and to collect and analyze groundwater samples. The monitoring wells at the MWL and the sampling procedures employed at the landfill by Sandia meet both NMED and EPA regulatory requirements, guidance, and requirements of the Consent Order. Neither the Consent Order nor any other applicable standard prohibits the installation of wells using the mud rotary method or any other method. The Consent Order appropriately requires development of a well to create an effective filter pack, correct damage to the formation caused by drilling, remove fine particles from the formation near the borehole, and assist in restoring water quality. The Consent Order applies to wells installed after the effective date of the Order. The existing wells at the MWL were all installed prior to this date. When new wells are installed at the MWL as replacement wells, they would need to meet the requirements of the Consent Order, provided the Order is still in effect at that time. Although the regulatory requirements of 20.4.1.500 NMAC incorporating 40 CFR 264 Subpart F can be used as guidance, nearly all of the requirements of Subpart F do not apply to the MWL because it is not a permitted unit. Instead, the landfill is regulated as a Solid Waste Management Unit subject to corrective action pursuant to 20.4.1.500 NMAC incorporating 40 CFR 264.101. Although not required by regulation, Sandia commonly uses flow-through cells while purging to measure certain field parameters (pH, temperature, and specific conductance). See also NMED responses R5 and R40.

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J	**Citizen, Robert H. Gilkeson**	Wells are set in sediments with low hydraulic conductivity	The commenter states that the wells are not installed in the aquifer strata with high permeability – the strata where the highest levels of contamination are expected and the strata that are fast pathways for horizontal travel of contaminated groundwater over great distance. The commenter states that there is a fundamental requirement of RCRA Subpart F is for the monitoring wells to be installed in the geologic strata that have a sufficient permeability to provide a continuous flow of groundwater with a minimum of drawdown of the water level in the well during the collection of groundwater samples. In a July 19, 2006 meeting with the NMED, the commenter repeated his comments on this topic.	R40	NMED agrees that groundwater will travel faster in strata with higher Ksats (given the hydraulic gradient is constant), and that such lithologic units have the potential to transport contaminants most quickly. However, as indicated above, most of the wells at the MWL are constructed such that their screens straddle the water table in order to monitor the uppermost water in the saturated zone (first water), regardless of the Ksat of the sediments that make up that part of the aquifer. If contamination is not detected in the uppermost zone of saturation at the MWL, then contamination is unlikely to occur at deeper levels where Ksat values at the MWL tend to be higher. Groundwater in lithologic units having low Ksat values (like aquitards) will still flow if subject to a hydraulic gradient (the normal case) and thus these units are subject to becoming contaminated. Based on slug tests, typical Ksat values for sediments in the uppermost part of the saturated zone at the MWL range from about 10^{-7} to 10^{-5} cm/s. These are relatively low Ksat values. As previously stated, some of the regulatory requirements of 20.4.1.500 NMAC incorporating 40 CFR 264 Subpart F may be considered useful guidance. However, the bulk of the requirements of Subpart F do not apply to the MWL because it is not a permitted unit. Instead, the landfill is regulated as a Solid Waste Management Unit pursuant to corrective action under 20.4.1.500 NMAC incorporating 40 CFR 264.101. The regulations in Subpart F do not mandate that monitoring wells be installed in geologic strata with high Ksat. The regulations also do not require that wells be capable of supplying water at rates that will minimize drawdown. The regulations do not specifically address Ksats or drawdown because sediments exhibiting high Ksat and that are capable of supporting low drawdown conditions at high pumping rates simply do not occur at all sites. See also NMED response R29.

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J	**Citizen, Robert H. Gilkeson**	PCE standard	The commenter states "Because of health concerns, the Environmental Protection Agency (EPA) has set the Drinking Water Standard for PCE at a Maximum Contaminant Level (MCL) of 5 ug/L (5 parts per billion). In addition, because of the danger to health, the EPA has set a Maximum Contaminant Level Goal of ZERO for the presence of PCE in groundwater".	R41	The EPA drinking-water MCL for PCE is 5 µg/L, and is an enforceable standard. The EPA MCL goal of 0 (zero) is not a standard, and therefore is not enforceable.
J	**Citizen, Robert H. Gilkeson**	Iron and Turbidity	With regard to well MW1, the commenter states "The water that recharged the well and was collected for the analytical suite had a turbidity slightly higher than the recommended upper limit of 5 NTUs in the RCRA guidance. The elevated turbidity may be responsible for the large difference between total iron and dissolved iron. However, the microbial processes greatly increase the level of colloidal iron in the groundwater and the high level of colloidal iron is probably the cause of both the high turbidity and the high level of total iron".	R42	The commenter provides no evidence that large volumes of iron precipitates are present in the sediments surrounding well MWL-MW1, and are plugging up formation materials, reducing their Ksat. MW1 was drilled using the ARCH method without the use of organic drilling additives. A reducing environment does not occur in the groundwater (See NMED response R29). See also NMED report by Moats, Mayerson, and Salem, 2006, entitled *Evaluation of the Representativeness and Reliability of Groundwater Monitoring Well Data, Mixed Waste Landfill, Sandia National Laboratories*. Although the turbidity of the groundwater samples from MW1 (median of 6.59 NTU) is slightly higher than 5 NTU, it causes no significant problems. At Sandia, the turbidity of samples of natural spring water is often much higher; obviously, the springs have not been impacted by organic drilling additives. Water samples from well MW1 yield a median total iron concentration of 0.24 mg/L and a median dissolved iron concentration of 0.11 mg/L. These are background levels. At MW1, the turbidity of the water and the moderately higher levels of total iron observed are caused by suspended sediment

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					and corrosion of the stainless steel well screen. The suspended sediment occurs in the well because the filter pack is too coarse to prevent the finest particles of formation material from entering the well, and because small pieces of corroded well screen are suspected to be present in the well, mixed in with sediment. Higher turbidity can cause higher concentrations of metals to be detected in groundwater because suspended sediments contain much higher concentrations of metals compared to water. The metals in the suspended sediments, including iron, are leached into the water sample when the sample is preserved with nitric acid, elevating the amounts of metals beyond that actually present in formation water.
J	**Citizen, Robert H. Gilkeson**	Nickel and Turbidity	With regard to MW1, the commenter states "In addition, nickel is at an anomalous high level in the water produced from the well. The nickel may have been leached from the stainless steel well screen. Nevertheless, the high nickel values are evidence that the water produced from the well is from a stagnant zone surrounding the well screen and is not representative of the groundwater in the aquifer".	R43	The moderately high nickel levels seen in groundwater samples from this well are likely derived from leaching of the stainless-steel well screen. This is based on the fact that soil sample results from borings completed under the landfill do not indicate the existence of nickel contamination in the vadose zone. Although some groundwater adjacent to and down gradient of the well may be contaminated with dissolved nickel from leaching of the well screen, the zone of dissolved nickel is likely to be almost negligible in extent given the very small average linear velocity of the groundwater. Furthermore, whenever any low yield well is purged, it is not possible to remove all water that is present within the well. Even if purged dry, some stagnant water in the sump and below the level of the pump intake will remain in the well. For MW1, some stagnant water containing dissolved nickel will be trapped in the well below the pump intake and will mix with larger amounts of fresh formation water entering the well during recovery. Because there is no way to avoid this, water samples from MW1 will always contain moderately high levels of nickel for the rest of the life of the well.

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J	**Citizen, Robert H. Gilkeson**	Problems with wells at Los Alamos Laboratories (LANL)	The commenter states "The effects of the bentonite clay and the organic additives to mask the detection of contamination is a concern for the monitoring wells installed at the Los Alamos National Laboratory (LANL). See Appendix A with particular attention to reports A-4 and A-5 by the EPA and the DOE IG for the mud rotary monitoring wells at LANL". In a July 19, 2006 meeting with the NMED, the commenter repeated his comments on this topic.	R44	SNL and LANL are two different sites. Just because a problem may exist for some LANL monitoring wells does not mean that the same problem exists for wells at SNL. The MWL is over 60 miles from LANL, so problems with wells at LANL are not relevant to issues of groundwater monitoring at the MWL. The most significant problems with wells at LANL involve complexly-built wells in complex geology with small multiple screens which were not adequately developed. In contrast, wells at the MWL are simpler, constructed in relatively simple geology, have larger screens, and except for MW4, have but one screened interval. See also NMED report by Moats, Mayerson, and Salem, 2006, entitled *Evaluation of the Representativeness and Reliability of Groundwater Monitoring Well Data, Mixed Waste Landfill, Sandia National Laboratories*.
J	**Citizen, Robert H. Gilkeson**	Separating screened intervals, MW4	The commenter states "Well MW4 has two screened intervals with each screen having a length of 20 feet. The rehabilitation of MW4 shall include installation of a low-flow submersible pump between two inflatable packers to restrict the interval of aquifer strata that produce water from the well".	R45	The lower screened interval is currently always separated from the upper screened interval by an inflatable packer, including during times of sampling.
J	**Citizen, Robert H. Gilkeson**	Eh and dissolved oxygen levels, MW5 and MW6	The commenter states "For the water produced from well MW5, the Eh and dissolved oxygen levels are much lower than the levels measured in the background groundwater. Furthermore, the water produced from MW6 has a negative Eh and a low level of dissolved oxygen. The	R46	The negative Eh values from the one sampling event quoted by the commenter are almost certainly errors. Eh measurements for water samples collected at the MWL are typically made using a flow-through cell. Wells MW5 and MW6 were drilled using the air rotary casing driven (ARCH) method. Organic drilling additives were not used to complete these wells. The hydrochemistry of

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			negative Eh and presence of dissolved oxygen do not occur together in groundwater and show the need to improve the measurement procedures with monitoring a continuous flow of water from the well using a closed flow-through cell". In a July 19, 2006 meeting with the NMED, the commenter repeated his comments on this topic.		groundwater water samples obtained from both wells are indicative of oxidizing conditions, not reducing conditions. The median Eh values for MW5, MW6, and BW1 are 78.6, 129.0, and 141.8 millivolts, respectively. The median dissolved oxygen values for MW5, MW6, and BW1 are 2.49, 2.43, and 6.8 mg/L, respectively. Both Eh and dissolved oxygen are lower for MW5 and MW6 because the groundwater encountered in these wells occurs deeper in the aquifer. Deeper groundwaters are typically older groundwaters, and older groundwaters tend to have lower dissolved oxygen levels and lower Eh compared to younger groundwaters. See also NMED report by Moats, Mayerson, and Salem, 2006, entitled *Evaluation of the Representativeness and Reliability of Groundwater Monitoring Well Data, Mixed Waste Landfill, Sandia National Laboratories*.
J	**Citizen, Robert H. Gilkeson**	Iron and manganese concentrations, MW5	The commenter states "An additional indication that well MW5 does not produce representative water is that the concentrations of iron and manganese are much higher than the concentrations measured in the background well MWL-BW1. The elevated iron and manganese levels in well MW5 may be due to chemical processes from the organic drilling additives. As explained above, the chemical processes will create iron coatings on the aquifer strata that have enhanced properties to remove contaminants of concern for the compliance monitoring from the groundwater produced from well MW5. The coatings also lower the	R47	Although well MW5 was drilled using the air rotary casing driven method without the use of drilling mud or organic additives, sodium-bentonite grout inadvertently infiltrated the filter pack and screen of the well during installation. The median concentrations of total iron (0.133 mg/L) and manganese (0.116 mg/L) of water samples collected from MW5 are representative of background levels. Organic additives were not used to construct the well, thus, the levels of iron and manganese do not represent the reduction of iron and manganese minerals. Moderately oxidizing conditions are present in the well, not reducing conditions, as demonstrated by a median dissolved oxygen concentration of 2.49 mg/L, as well as the presence of nitrate and sulfate in water samples. NMED therefore concludes that the grout was successfully removed prior to placing the well into service. See NMED report by Moats, Mayerson, and Salem, 2006,

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			permeability of the strata that surround the well screen".		entitled *Evaluation of the Representativeness and Reliability of Groundwater Monitoring Well Data, Mixed Waste Landfill, Sandia National Laboratories*.
J	**Citizen, Robert H. Gilkeson**	Zinc concentrations	The commenter states "The zinc data for water samples collected from the mixed waste landfill monitoring wells in April 2005 are summarized below. The NMED Approved Background Value for total zinc and dissolved zinc is 260 ug/L (parts per billion). Note that the total zinc concentrations measured in the seven monitoring wells are over an order of magnitude lower than the NMED approved natural background concentration of total zinc in groundwater. Of more importance are the very low levels of dissolved zinc in the groundwater produced from the monitoring wells. The very low dissolved zinc levels are evidence that the wells are surrounded by a reactive contaminant capture barrier that prevents the wells from producing representative water samples: 1). for the *in situ* groundwater chemistry, and 2). for the presence of contamination from waste released	R48	NMED disagrees. The zinc levels are representative of background concentrations and are consistent with those seen in groundwater samples from numerous wells and springs located across the Kirtland Air Force Base area. The median values of total and dissolved zinc detected in water samples from BW1, MW2, and MW3 (wells drilled by the mud rotary method) are higher than the median value for samples collected from MW1 (drilled using the ARCH method). Additionally, the median values of total zinc detected in water samples from BW1, MW2, and MW3 are generally higher than the median values representing water samples from MW4 , MW5, and MW6 (drilled by sonic resonant or ARCH methods). These statistics are opposite of what would be the case if reducing conditions were prevalent in the wells as suggested by the commenter. The wells do not need to be replaced. See also NMED report by Moats, Mayerson, and Salem, 2006, entitled *Evaluation of the Representativeness and Reliability of Groundwater Monitoring Well Data, Mixed Waste Landfill, Sandia National Laboratories*. See also NMED response R29.

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			from the mixed waste landfill. The low levels of dissolved zinc and the low permeability of the strata surrounding the monitoring wells are evidence of the need to replace the wells."		
J	**Citizen, Robert H. Gilkeson**	Well development	The commenter states "The ASTM guidance for successful well development does not guarantee that all or even most of the drilling fluids are removed from the aquifer strata that are in contact with groundwater samples that are collected from the monitoring wells for contaminant analyses. The small diameter of the Sandia monitoring wells, the great depth of the wells, the short screen length, the small slot size of the screen openings, and the small size of the filter pack sediments that surround the well screen are factors that prevent removal of most of the bentonite clay muds and drilling fluids that are entrained into the aquifer strata".	R49	Proper well development can remove much, and ideally, nearly all drilling fluids. However, small amounts of drilling fluids would be expected to remain in the formation and filter pack following even the best efforts to develop a well. However, the drilling fluids that remain after proper well development must have limits to their ability to adsorb contaminants. Many water-supply wells are drilled using the mud rotary method because it is readily available and cost-effective. According to the commenter's position, which NMED disagrees with, one would never expect to see VOC or metal contaminants in the groundwater at such wells because of the unlimited capabilities of these reactive barriers to adsorb these contaminants. Unfortunately, this is not true as there are many examples of water-supply wells were groundwater contamination with VOCs or metals have been detected, and in fact, Safe Drinking Water Act compliance is based in many cases on samples from wells installed in such a manner. The installation of wells to depths of hundreds of feet always has an affect on water quality. This is one reason why the NMED typically requires sampling and analysis of groundwater over a period of several years. For example, it is well known that the introduction of air in the saturated zone using the air rotary drilling method can remove (air sparge) VOCs from groundwater in the vicinity of wells, and thus it may take several quarterly sampling events before VOCs will be detected in the groundwater. Water sampling has been conducted at the MWL

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					for as much as 16 years for some wells. NMED disagrees with the argument that the diameter, depth, screen lengths, and screen slot size of the wells, and the grain size of the filter packs conspire to prevent the removal of drilling fluids. The diameters of monitoring wells at the MWL are not especially small, but instead are typical for wells installed to depths of several hundred feet or more. The wells are as deep as they need to be in order to monitor the groundwater at the water table. The screen lengths of the wells (20 feet), with originally typically 15 feet of saturated length, are typical of monitoring wells employed throughout New Mexico (with dropping water levels at the MWL, the saturated portion of the screened intervals have actually decreased since the wells were installed). In fact, rather than being short, the screen lengths of the MWL wells are on the large end of the range recommended by EPA guidance. The slot size of the well screens, typically 0.010 inch for the older wells, is common among wells installed in the KAFB area. There is also nothing particularly unusual about the filter pack dimensions for wells located at the MWL. In the case of the MWL, the NMED believes that the low Ksats of the aquifer sediments presented the biggest challenge with respect to adequately developing the wells. Based on well development records, considerable effort was made to properly develop the wells at the MWL, and this effort was successful.
J	**Citizen, Robert H. Gilkeson**	Drilling fluids plugging saturated zone	The commenter states "The features of the Sandia monitoring wells at the mixed waste landfill that prevent the recovery of most of the drilling fluids that have invaded the aquifer strata where screens are installed include 1). because of the great depth to the	R50	NMED disagrees that drilling fluids are easy to emplace within the saturated zone surrounding the well, but at the same time, are nearly impossible to remove. If this were the case, no well anywhere in the world over a few hundred feet deep could ever be used to monitor groundwater. Drilling fluids that enter sediments in the vadose zone are of less importance than those penetrating the saturated zone, because

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			water table of the regional aquifer, the mud rotary drilling method operated as a powerful injection pump for invasion of the bentonite clay into the strata that surround the well screens, 2). the great depth of the monitoring wells limits the pumping energy for development, 3). the small inside diameter for well casing of 4.5 inches limits the size (power) of submersible pumps, 4). the short length of the well screens, 5). the small spacing of 0.01 inch for the slots on the well screens, and 6). the medium-grained sand in the filter pack that surrounds the well screens. Factors 2 through 6 restrict the energy for recovering the drilling fluids compared to the much greater energy of the mud rotary drilling method for invading the strata with the drilling additives". In a July 19, 2006, meeting with the NMED, the commenter repeated his comments on this topic.		the former fluids will not impact groundwater quality. Although the column of drilling mud above the saturated zone is large and can exert considerable pressure, there is a limit to the rate, and thus the extent, that drilling mud can penetrate into the saturated zone. Drilling mud, like water, can only migrate into the saturated zone as fast as the Ksat allows, this being the Ksat *for mud with respect to the formation materials* (not the Ksat for water). The Ksat for mud will be lower than that of water because Ksat is inversely proportional to the viscosity of a fluid, and mud has a higher viscosity than water. Thus, the mud will advance into the formation at a slower rate than if the fluid was water assuming other hydraulic properties remain constant. As mentioned previously, proper well development can remove much of the drilling fluids which penetrate into the saturated zone. Following displacement of the drilling mud from a well once well construction begins, the groundwater will apply hydraulic pressure against the drilling mud that has penetrated into the formation. As a consequence, pressure exerted by groundwater will help force drilling mud out of the formation and back into the well where it can be removed by development. As development continues, dilution of the mud by the groundwater will continuously lower its viscosity, further assisting in the removal of mud from the formation. The key is timely and effective development, which was accomplished at the MWL. The commenter implies that a large region surrounding the wells would be invaded by drilling mud. The rate at which drilling mud was able to penetrate the saturated zone in the uppermost part of the aquifer was estimated by the NMED to be only 8.6 cm/hour. The calculations for this figure are based on a Ksat of 10^{-6} cm/s, a hydraulic gradient of 475 feet, a porosity of 25%, density of drilling mud of 1.2 g/cm^3, a dynamic viscosity for drilling mud of 30 cp, and a dynamic viscosity of water (at 20

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					°C) of 1 cp. At the calculated rate, it would take 11.6 hours for the drilling mud to advance 1 meter into the saturated zone.
J	**Citizen, Robert H. Gilkeson**	Turbidity too high, MW3	The commenter states "An additional problem is that the water produced from well MW-3 is at a turbidity level three times greater than the maximum level allowed in the RCRA guidance".	R51	NMED disagrees. The median turbidity value for groundwater samples from MW3 is 2.99 NTU, which is less than the maximum recommended value of 5 NTU.
J	**Citizen, Robert H. Gilkeson**	Negative Eh and purging, MW4	The Commenter states "… the chemical data show that the water produced from the well has a negative Eh and is possibly anaerobic instead of the high positive Eh and aerobic chemistry of the background groundwater at well BW1. For well MW4, the measurements that show dissolved oxygen in the water with negative Eh are in conflict and show the need to improve the methods that are used for measuring these sensitive water parameters. The trend in Eh and dissolved oxygen measurements show that the necessary amount of groundwater was not purged from the well before samples were collected for the analytical suite. In a July 19, 2006 meeting with the NMED, the commenter repeated his comments on this topic.	R52	The median Eh of groundwater samples from MW4 is 285 millivolts; whereas the median Eh of samples from BW1 is 141.8 millivolts. Thus, the median Eh of water samples from MW4 actually exceeds that from BW1, opposite of what was argued by the commenter. The commenter did not consider all the relevant data. Well MW4 was drilled using the sonic resonant method, and without using organic drilling additives. As organic drilling additives were not used, a reducing groundwater environment would not be expected, and is not present. See also NMED report by Moats, Mayerson, and Salem, 2006, entitled *Evaluation of the Representativeness and Reliability of Groundwater Monitoring Well Data, Mixed Waste Landfill, Sandia National Laboratories*. Because of potential errors in Eh measurements (see response R46), some SNL personnel may need more training or may need to exercise more care in obtaining Eh measurements, as negative Eh measurements should not be expected from water samples collected at the MWL.

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J	**Citizen, Robert H. Gilkeson**	Wells improperly located relative to groundwater flow direction	In a meeting with NMED on July 19, 2006, the commenter expressed concern that the MWL wells are worthless for samples because the groundwater flows from east to west.	R53	There are two newer wells, not considered by the commenter, located west of the landfill that were installed by the Permittees and required by the NMED. These wells were installed primarily with the intent to augment the monitoring well network with respect to determining the direction and gradient of groundwater flow. There is also an additional well drilled beneath Trench D, and three older wells located along the west-central boundary, and near the northwestern and northeastern corners of the landfill. These older wells were placed in these positions because early regional water levels were taken into account, suggesting north-directed groundwater flow. However, it is noteworthy that the northern part of the landfill is especially important from an environmental perspective because this is the portion of the landfill known to have had the most disposal of liquid and tritium wastes, and also where the highest concentrations of VOCs in soil gas have been detected. The older wells are therefore situated at very useful locations.
J	**Citizen, Robert H. Gilkeson**	Major ion chemistry is not reliable	In a meeting with NMED on July 19, 2006, the commenter expressed concern water samples are not reliable for major ion chemistry, as well as contaminants because sensitive water parameters have not stabilized.	R54	The NMED disagrees with this comment. Piper and stiff diagrams show that all major ions have maintained consistent concentrations throughout the 16 years of monitoring done at the MWL. See also the NMED report by Moats, Mayerson, and Salem, 2006, entitled *Evaluation of the Representativeness and Reliability of Groundwater Monitoring Well Data, Mixed Waste Landfill, Sandia National Laboratories*.
J	**Citizen, Robert H. Gilkeson**	Sampling procedures are not the same as those specified by the LANL Consent Order.	In a meeting with NMED on July 19, 2006, the commenter expressed concern the sampling procedures employed at the MWL do not meet those required by the LANL Consent Order, and thus do not meet industry standards.	R55	The groundwater sampling methods employed at the MWL meet substantively guidance issued by the EPA and NMED. Industry follows guidance issued by the EPA. The wells are purged prior to sampling. Eh, pH, specific conductance, and temperature are generally measured during purging and sampling, and using a flow-through cell.

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					The LANL Consent Order controls activities at LANL, not the MWL.
J	**Citizen, Robert H. Gilkeson**	Downward trends for Eh	In a meeting with NMED on July 19, 2006, the commenter states that most wells are trending to lower values of Eh which indicates a chemistry affected by drilling additives or contamination from the mixed waste dump.	R56	The NMED disagrees with this comment. There are no notable trends in Eh values for any water samples from MWL wells. See also NMED report by Moats, Mayerson, and Salem, 2006, entitled *Evaluation of the Representativeness and Reliability of Groundwater Monitoring Well Data, Mixed Waste Landfill, Sandia National Laboratories*.
P	**Citizen, Krishan Wahi**	Delay not protective	The commenter recommends approval of the CMI Plan recognizing that parameter and model uncertainty can be reduced, but not eliminated, no matter how much money is spent. The commenter states that more complicated facilities use the principle of ALARA (as low as reasonably achievable) to provide the balance in protecting human health. The commenter states that indefinite delays do not contribute to public health and safety.	R57	The NMED agrees that it is not possible to remove all uncertainty with respect to site investigations and models based upon them. The NMED also agrees that indefinite delays are not protective of human health and the environment. NMED is cognizant of strategies that dwell on uncertainty to undermine any scientific conclusions. Such strategies have been effective at delaying Congressional action on climate change that could be costly to industry. Of course, the scientific community is unanimous in its concurrence that global warming is a reality, despite the uncertainties in science. NMED believes this is a useful analogy in considering comments about uncertainly in scientific results.
Q	**Citizen, Willard Hunter**	Seismic threat	The commenter is concerned that the potential for a seismic threat does not appear to be addressed by the CMI Plan and the FTM. The commenter indicates that DOE requires new seismic design requirements in SNL buildings and questions why similar seismic	R58	Analogous, but not controlling, environmental regulations would not prohibit the construction of a hazardous waste landfill at the MWL site based on seismic threat because there is no evidence of Holocene fault movement within 200 feet of the site. The vegetative soil cover to be employed at the MWL, being a simple design of essentially a monolithic layer, would be expected to survive intact if an earthquake occurred nearby.

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			analysis does not apply to the MWL.		
H	**Citizen Action New Mexico, Susan Dayton** (Comments compiled by Paul Robinson, Southwest Research and Information Center)	Sampling of landfill surface	The commenter also states that a consultant working for Citizen Action opined that sampling of the landfill surface was not random and grid locations too coarse, and that some sampling occurred over the most recent trenches dug at the MWL.	R59	The NMED disagrees with the comment that adequate surface-soil sampling was not done and was not random. This issue was dealt with in much detail during the hearing on the MWL Corrective Measures Study. A grid of random spacing and orientation was placed over the landfill surface. Analytical results of the surface soil sampling detected plutonium in surface soil which was caused by undocumented spills from containers of mixed waste stored on the landfill's surface. The levels of plutonium contamination found on the surface of the MWL do not pose unacceptable risk to human health or the environment.