Exhibit 4.

Failure of the Draft LANL SWEIS to Address Environmental Impact Because of Groundwater Contamination From the RCRA Regulated Disposal Sites at Technical Area 54.

1.0 Introduction. The RCRA regulated units at Technical Area 54 (TA-54) of the Los Alamos National Laboratory (LANL) are MDA G, MDA H, and MDA L The regulated units are on Figure 1-6. The Final LANL SWEIS must address the environmental impact of the legacy wastes disposed of at the three MDAs to contaminate the regional aquifer. The Draft LANL SWEIS did not acknowledge the groundwater contamination[1] beneath MDA G that was detected at statistically significant levels in water samples collected from LANL characterization well R-22 (Table 1). The Final LANL SWEIS must acknowledge the uncertainty of the groundwater contamination in the regional aquifer because of the failure of DOE/NNSA, LANL, and the New Mexico Environment Department (NMED) to install the network of monitoring wells at the three MDAs that are required for compliance with RCRA 40 CFR §§ 264.90-100 (referred to as RCRA § 264 Subpart F). The groundwater monitoring program at the three regulated units is not in compliance with RCRA, and for that reason, the Final LANL SWEIS cannot present a finding that LANL meets requirements for expanded manufacturing of plutonium pits. Instead, the Final LANL SWEIS must institute the *"Reduced Operations Alternative"* that was described in the Draft LANL SWEIS.

MDA G is the legacy mixed wastes that are disposed of at Area G, the active LANL landfill for the disposal of low-level radioactive waste. Area G has a size of 65 acres. MDA L is the legacy hazardous wastes disposed of at a 2.6 acre facility that is now permitted for surface storage of hazardous waste. MDA H is a small inactive legacy waste disposal site where disposal of mixed waste was into a set of disposal shafts.

The six LANL characterization wells that are intended to meet the RCRA requirements for monitoring the three MDAs are the characterization wells R-16, R-20, R-21, R-22, R-23, and R-32. The six wells are displayed on Figure 1-6. None of the six wells meet the RCRA § 264 Subpart F requirements for monitoring the regulated units. Exhibit 1 describes the the properties of the drilling additives to mask the detection of LANL contaminants in the water samples produced from the 6 wells.

In addition, A fundamental deficiency is that RCRA 40 CFR § 264.95 requires for monitoring wells to be located at the immediate boundary of the regulated units to monitor the groundwater flowing from beneath the regulated units. Figure 1-6 shows that there are no monitoring wells located close to the downgradient boundaries of the three MDAs The closest well to the downgradient boundary of a discrete regulated unit is well R-22 located approximately 500 feet east from the downgradient boundary of MDA G.

The Draft LANL SWEIS identified the need to install a set of monitoring wells at appropriate locations at the three MDAs to investigate the presence of groundwater contamination at the present time and in the future. From page I-230 of the Draft LANL SWEIS:

> *Uncertainty about the long-term infiltration rates at MDAs leads to uncertainty about the long-term performance of the MDAs. The result is uncertainty about possible future human risk from groundwater contamination assuming nothing is done to reduce long-term infiltration into the MDAs.*

The draft LANL SWEIS is correct about the uncertainty for groundwater contamination due to long-term infiltration into the MDAs. However, more important for MDA L and MDA G is the uncertainty of groundwater contamination that has already occurred because of the waste disposal operations over a thirty year period from the late 1950s until the late 1980s.

2.0. <u>The nature of waste buried at MDA G.</u> MDA G occupies 65 acres and has been an active landfill since 1957. There are plans to expand MDA G by an additional 30 acres. At this time, the waste disposed of at MDA G are described as low-level radioactive
waste. The term "low-level" does not mean the waste have low radioactivity. In fact, the "low-level waste" disposed of at MDA G may have a very high level of radioactivity. In addition, a LANL report[2] documents that "high level" transuranic (TRU) radioactive waste was routinely disposed of in pits at MDA G from 1957 through 1970, with disposal of small amounts of TRU waste continuing through 1979. Furthermore, LANL reports[2] document that prior to 1986, most of the Laboratory's "<u>mixed low-level waste</u>" was disposed of at MDA G. The mixed waste contains both radioactive waste and hazardous waste (toxic chemical waste). The large plumes of solvent chemicals[2] that are present in the unsaturated strata beneath MDA G are evidence of the large amount of hazardous waste that were disposed of in the unlined pits at MDA G. The radioactive and chemical contamination in the regional aquifer beneath MDA G that were detected in water samples produced from well R-22[1] are listed below in Table 1.

3.0. <u>The nature of waste buried at MDA L.</u> MDA L occupies 2.6 acres and was an active disposal site for hazardous chemical waste since the late 1950's until 1985. An unlined pit (Pit A) located along the northern side of MDA L received all waste until 1975. Chemical waste were disposed of in Pit A from the late 1950's through December, 1978. A large quantity of <u>liquid</u> toxic chemical waste were disposed of in Pit A.[2] In addition, two surface impoundments at MDA L were used for the disposal of a large quantity of liquid waste from the late 1970's through 1986.[2]

Thirty four unlined disposal shafts were drilled at MDA L between 1975 and 1985. They range in diameter from 3 to 8 feet and are each approximately 60-feet deep. Much of the waste disposed of in the shafts are toxic liquids (solvents) contained in 55-gallon steel drums.[2] Liquids were disposed of in drums or other containers without adding absorbents.[2] Smaller containers were frequently simply dropped into the shafts.[2] Noncontainerized waste were also disposed of in these shafts.

A large vapor plume of solvent contamination is present in the subsurface beneath MDA L. The existence of the plume has been known for over 25 years.[2] The primary solvents in the plume include the toxic contaminants 1,1,1-trichloroethane (TCA), trichloroethylene (TCE), and perchloroethylene (PCE).[2] It is not known if the solvent contamination or other chemical contamination released from MDA L have contaminated the regional aquifer beneath MDA L or if contaminants released from MDA L have contaminated the groundwater beneath the San Ildefonso Pueblo because no reliable monitoring wells have been installed at appropriate locations immediately at MDA L and between MDA L and the Pueblo (see Figure 1-6). The only well between MDA L and the San Ildefonso Pueblo is well R-21. This well does not meet requirements of RCRA §264 Subpart F because of the great distance away from MDA L, the nonrepresentative water chemistry because of the effects of the drilling additives,[8,9] and the great depth of the well screen below the water table of the regional aquifer.[8]

The detection of chemical contamination in the regional aquifer beneath MDA G[1,7] is evidence that it is very likely that the liquid wastes released from MDA L have contaminated the regional aquifer. The disposal of a very large but unknown quantity of liquid chemical waste at MDA L over a time period of greater than 25 years presents a great danger to contamination of the groundwater resources. It is a violation of RCRA § 264 Subpart F that DOE/NNSA and NMED have not required the installation of a network of monitoring wells in the immediate vicinity of MDA L (and MDA G) for monitoring contamination in the regional aquifer.

3.0. <u>Mistakes in the Construction of LANL Characterization Well R-22.</u>
Well R-22 is located atop Mesita del Buey east of MDA G along the direction of groundwater travel from beneath MDA G to the property of the San Ildefonso Pueblo, the Rio Grande, and the Buckman well field, an important groundwater resource to Santa Fe. Figure 1-6 shows the location of MDA G, well R-22, and the southern property line of the Pueblo. The location of the Rio Grande and the Buckman well field are on Figure 1-1. Well R-22 is a multiple-screen well with 5

separate screened intervals at different depths in the regional aquifer. The mistakes in the construction of well R-22 that prevent the well from being in compliance with RCRA § 264 Subpart F for the detection of groundwater contamination from Area G are described below.

3.1. The strata surrounding the screens in well R-22 are invaded with organic drilling additives that were not removed by the well development activities. The LANL water quality data show that the drilling additives have caused a large change to the chemistry[1,9] of the water produced from screen #1. Indeed, a LANL report[3] predicts that screen #1 will not produce representative water samples for the next ten years.

Screen #1 is located in strata with high permeability at the water table of the regional aquifer. Screen #1 is the most important screen in well R-22 for the detection of the release of contamination from Area G to the regional aquifer. The LANL *"Well Screen Analysis Report"*[4] identifies that screen #1 in well R-22 does not produce representative water samples. The scheme in the LANL Workplan for R-well Rehabilitation and Replacement[5] is to seal off screen #1 and use screen #2 as the uppermost screen for monitoring groundwater contamination beneath MDA G. This scheme is unacceptable because of the very low permeability of 0.04 ft/day[6] that was measured for the strata that surround screen #2. RCRA § 264 Subpart F requires that well screens are installed in the aquifer strata with high permeability that are located near the water table and strata with high permeability are above screen #2 at the location of screen #1.

There is an immediate need to install a cluster of new monitoring wells immediately east of the boundary of MDA G that are installed in the aquifer strata with high permeability at a shallow depth below the water table of the regional aquifer, and in the deeper intervals of aquifer strata with high permeability that are located in the depth interval between screen #2 and screen #3 (see Figure 1-9).

Some of the hazardous and radionuclide contaminants that were detected in screen #1 of well R-22 are listed in Table 1. The nature of contamination in the strata at the top of the regional aquifer beneath Area G are not accurately known because of the properties of the organic drilling additives to mask the detection of contamination. A LANL Report[7] acknowledges the large number of chemical contaminants that were detected in the groundwater samples from well R-22 during the first year of collecting samples.

> "Thirty-one volatile and semi-volatile organic compounds have also been detected in water from well R-22. Only two of these,
> pentachlorophenol (1 detection, 6.2 ppb, MCL = 1 ppb)
> and benzo(a)pyrene (2 detections, 0.24 ppb, MCL = 0.2 ppb)

were present at concentrations above the MCL. <u>Monitoring for organic compounds</u>
<u>at well R-22 will continue.</u>" [MCL means EPA Drinking Water Standard]

Table 1. Contaminants[1] detected in water samples collected from Well R-22.

***tritium (109 picocuries per liter (pCi/L) for a sample collected at the water table),**
***technetium-99 (4.3 and 4.9 pCi/L),**
***pentachlorophenol (6.2 micrograms per liter (ug/L)),**
***chloroform (0.94 ug/L),**
***phenol (19 and 32 ug/L),**
***4-methylphenol (44 to 210 ug/L),**
***2-butanone (6.9 to 8.9 ug/L),**
***diethylphthalate (1.3 ug/L),**
benzoic acid (3 to 12.5 ug/L),
butyl benzyl phthalate (9.8 ug/L),
toluene (0.2 to 0.76 ug/L),
methylene chloride (0.62 and 2.2 ug/L),
bis(2-ethylhexyl)phthalate (1.0 and 3.9 ug/L),
several substituted benzene compounds including
isopropylbenzene (0.16 to 0.54 ug/L), and
1,4-dichlorobenzene (0.16 to 0.23 ug/L).

- <u>Mobile Contaminants</u>. Tritium, Technetium-99, and the six chemical contaminants

with asterisks in the above list are highly mobile in groundwater. The six chemical contaminants are commonly found in groundwater beneath toxic waste landfills studied by the Superfund activities of EPA.

- <u>Pentachlorophenol</u>. Pentachlorophenol was detected in a groundwater sample from

well R-22 at a concentration more than <u>six times greater</u> than the maximum contaminant level (MCL) allowed by the Federal Drinking Water Standard. In addition, EPA has assigned a maximum contaminant level goal (MCLG) of zero for this chemical contaminant because of the serious health issues. The health issues include
1). damage to the central nervous system, 2). reproductive effects,
3). damage to liver and kidneys, and 4). cancer.

- <u>Radioactive Tritium and Technetium-99</u>. A tritium level of 109 pCi/L was measured

in a water sample collected from the water table of the regional aquifer during the drilling of the borehole for well R-22. The fluid-assisted drilling methods diluted the actual level of tritium in the groundwater. The anomalously high levels of tritium and the presence of technetium-99 are direct evidence that contamination from MDA G has reached the regional aquifer. Other radionuclide contaminants may have traveled from MDA G to the regional aquifer, but are not noticed because of the mistakes in the installation of well R-22 and the other characterization wells that surround MDA G.

The plan by DOE to continue monitoring for chemical and rationalize contaminants in the water produced from well R-22 is irresponsible because LANL reports acknowledge that it may be as long as ten years before the well produces reliable water samples. In fact, it is very probable that screen #1 in well R-22 will never produce reliable and representative water samples because of the new mineralogy of iron coatings on the strata that surround the well screen.

3.2. <u>The Westbay^R Sampling System Collects Stagnant Water From Well R-22.</u> The poor quality of the water samples collected from well R-22 are compounded because no attempt is made to purge the stagnant water from the well before samples are collected for the analytical suite. Water is not pumped from the screened intervals in well R-22. Instead a small Westbay[R] sampler collects stagnant water samples that were in contact for a long period of time with the new chemistry introduced by the organic drilling additives.

3.3. <u>The screened intervals in well R-22 are not installed in the aquifer strata with high permeability.</u> An additional problem with well R-22 is that except for screen #1 the screened intervals are not installed in the aquifer strata with high permeability. The strata with high permeability are the strata where the highest levels of contamination are expected and are the strata for fast horizontal travel of contamination away from MDA G. From the text book *Applied Hydrogeology* by Fetter (1994):

> **"Heterogeneities in the aquifer can cause the pattern of the solute movement to vary from what one might expect in homogeneous beds. Because flowing groundwater always follows the most permeable pathways, those pathways will also have the most contaminant."**

The regional aquifer strata beneath MDA G and the San Ildefonso Pueblo have high heterogeneity. The regional aquifer is a "layer cake" of strata with very high and very low permeability. Figure 1-9 shows the "layer-cake" strata and the location of well screens in Well R-22. Figure 1-9 is a comparison of the permeability of the aquifer strata from the Schlumberger borehole geophysics to the location of the screened intervals in well R-22.

The figure shows that screens were not installed in two thick intervals of basalt strata that have high permeability, possibly greater than 125 feet per day. Instead, screen #2 is installed in basalt strata that the borehole geophysics show to have very low permeability. The low permeability was confirmed by aquifer tests[6] that measured a permeability of 0.04 feet per day for the basalt strata that surround screen #2. .

It is both puzzling and troubling that
1). screened intervals in well R-22 were not installed in the strata with high permeability that were identified by the drilling activities and the borehole geophysics (Figure 1-9), and
2). the LANL Reports[6.10] misrepresent the regional aquifer strata beneath Area G and the San Ildefonso Pueblo as having low permeability – see Figure 1-5.

The presence of strata with high permeability were proven by both the borehole geophysics[7] and the drilling record[11] for well R-22. There was knowledge of the strata with high permeability before well R-22 was constructed and before the LANL Reports were written. DOE must reconcile the failure to monitor the "fast pathways" for the travel of contaminants in groundwater laterally away from Area G and the misrepresentation of the danger of Area G and Area L to the groundwater of the San Ildefonso Pueblo, the Rio Grande, and the Buckman well field, an important water resource to Santa Fe.

The report by Keating et al[12] brings attention to the great uncertainty in the direction and speed of travel of groundwater in the basalt strata beneath MDA G and MDA L as follows:

> *"As shown in Table 3, a significant proportion of uncertainty in fluxes downgradient of LANL results from uncertainty in the permeability of the basalts. Basalt units are very important for potential contaminant transport because of their expected low effective porosity. Therefore, we can expect at least a factor of 3 uncertainty in the associated travel times resulting in uncertainty in the flow equation"* [page 666, Keating et al., 2005].

> *"The current understanding of hydrostratigraphy, as implemented in the numerical models, is sufficient to explain general trends in heads (spatial and temporal) but is lacking in a few key areas such as in the vicinity of R-9, R-12, R-22, and R-16. Detailed transport calculations in the vicinity of these wells would benefit from a refinement of the hydrostratigraphic framework model"* [page 667 to 668, Keating et al., 2005]

"The implication of this work for contaminant transport issues is that because of parameter uncertainty, predicted fluxes and velocities are quite uncertain. Uncertainties in permeability and porosity values lead to additional model uncertainty" [page 668, Keating et al., 2005].

"These uncertainties can be reduced meaningfully with more data collection, including multiwell pumping and tracer tests" [Keating et al., 2005].

The uncertainty in the Keating et al report for the impact of Area G on the water resources is an issue that must be resolved by the installation of the needed network of monitoring wells immediately at MDA G, MDA L, and MDA H as required to meet the requirements of RCRA § 264 Subpart F. There is a need to characterize the flow of groundwater away from TA-54 to the San Ildefonso Pueblo, the Rio Grande, and the Buckman well field. This characterization requires the installation of monitoring wells at appropriate locations for multi-well pumping tests and tracer tests as this need was identified in the report by Keating et al.

The demonstrated failure of DOE/NNSA, LANL, and NMED to comply with RCRA § 264 Subpart F and DOE Orders to have accurate knowledge of the impact of the Laboratory's RCRA regulated mixed waste and chemical waste disposal facilities on the groundwater resources leaves no recourse for the Final LANL SWEIS but to institute the ***"Reduced Operations Alternative"*** for the future operations at the Los Alamos National Laboratory

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