

Exhibit 2.
Deficiencies in the Draft LANL SWEIS for the
Water Quality Data Produced From the LANL Monitoring Wells

1.0. Introduction. During the past ten years, approximately 40 characterization wells were installed in the regional aquifer and in the perched zones of saturation beneath the Los Alamos National Laboratory (LANL). Exhibit 1 documents that the new monitoring wells were drilled with methods that cause the majority of the wells to produce water samples that are not reliable for detection of many of the radionuclide and hazardous contaminants that are generated by the present LANL nuclear weapons research operations. The purpose of this Exhibit is to show that DOE/NNSA and LANL have not installed the required network of monitoring wells at LANL to meet the monitoring requirements for expanded operations to manufacture plutonium pits, a major component of nuclear weapons.

This exhibit will show that the groundwater data presented in the Draft LANL SWEIS are from LANL monitoring wells that do not produce reliable and representative water samples for the detection of contaminants produced by operations to manufacture plutonium pits. LANL is regulated under the Resource Conservation and Recovery Act (RCRA). However, LANL does not have the groundwater monitoring program that is required under RCRA. The noncompliance with RCRA demonstrates noncompliance with the National Environment Protection Act (NEPA), and requires the Final LANL SWEIS to select the Reduced Operations Alternative that is described in the Draft LANL SWEIS.

The Draft LANL SWEIS gives the appearance of presenting the knowledge gained from the large number of new characterization wells. More than 30 of the wells are displayed on Figure E-1 in Appendix E of the Draft SWEIS and in Figure 1-1 of the attachment to this Exhibit. However, the references for Appendix F – “*Environmental Sample Data*” in the Draft LANL SWEIS reveal that the data in Appendix F are from only a small number of the new wells in the regional aquifer and in the perched zones of saturation. The references to Appendix F of the Draft LANL SWEIS show that the water quality data in Appendix F are from only the four LANL *Surveillance Reports* that present analytical data on water samples collected from only a small number of the new characterization wells during the years of 2001 to 2004. For the regional aquifer, the discrete wells that were sampled are as follows:

Year 2001 – no characterization wells were sampled
Year 2002 – Wells R-5, R-7, R-9, R-12, R-13, R-15, R-19, R-22, R-25
Year 2003 – Wells R-5, R-7, R-9, R-12, R-13, R-15, R-19, R-22, R-25
Year 2004 – Wells R-7, R-9, R-12, R-13, R-15, R-19, R-22, R-25 (Wells POI-4
and LOIS(a)-1.1 in perched zones of saturation)

The nine R-series wells in the above list represent only approximately 25% of the total number of characterization wells installed in the regional aquifer beneath LANL. However, a recent LANL Report, the “*Well Screen Analysis Report*” (WSAR) identified

that the majority of the wells in the above list do not produce reliable and representative water samples. Furthermore, because of a limited scope, the WSAR did not identify that practically all of the LANL monitoring wells in the Draft LANL SWEIS do not produce reliable and representative water samples and are not in compliance with RCRA.

2.0. Nonrepresentative water quality from the LANL characterization wells. All of the LANL characterization wells were drilled with fluid-assisted drilling methods using drilling fluids with well known properties to mask the detection of many LANL contaminants in the water produced from the wells. The effects of the drilling fluids to hide groundwater contamination are described in Exhibit 1. Because of concerns raised in reports by Registered Geologist Robert H. Gilkeson¹, the DOE Office of the Inspector General², and by the Environmental Protection Agency³, the DOE/NNSA required LANL to prepare a report that identified the well screens that did not produce representative water samples because of the drilling additives and because of other factors. This report, the LANL *Well Screen Analysis Report*⁴ (WSAR) identified that approximately 50% of the well screens do not produce representative water samples because of the drilling additives.

An important deficiency is that the Draft LANL SWEIS does not acknowledge the LANL reports, the DOE report, and the EPA reports that describe the problems with the new network of characterization wells to detect radionuclide contaminants produced from the current LANL nuclear weapons research operations, and produced from expanded operations to manufacture plutonium pits.

The findings in the LANL WSAR were from an automated statistical analysis of only the most recent water sample collected from each screened interval. Figure 1-2 (from the WSAR) presents the results of the statistical study of the water quality data for a single sampling event of 64 discrete screened intervals. Figure 1-2 presents grades for each discrete screen from Poor to Very Good. RCRA does not recognize the scheme used in the WSAR to assign grades to the water quality data. Furthermore, the WSAR made the arbitrary decision that screens with grades of Good and Very Good produced representative water samples and screens with grades of Fair and Poor did not. A LANL report⁶ summarizes the grading scheme in the WSAR as follows:

“The WSAR results indicated that for 64 screens analyzed, 16 of the wells had [31] screens that were in Fair or Poor condition and could not be relied upon to provide representative data or to detect contaminants in groundwater.”

The limited statistical analysis in the WSAR did not identify all of the wells that could not be relied upon to provide representative data or to detect contaminants in groundwater. Two EPA reports^{3,5} describe the problems with the LANL characterization wells and the deficiencies in the WSAR. A review of readily available data in the large set of LANL well completion reports shows that when all factors are considered, the total

number of screened intervals in the LANL characterization wells that do not produce representative groundwater samples under RCRA is possibly greater than 90%.

The existing monitoring well network at LANL does not meet the regulatory requirements of NEPA, RCRA, the NMED LANL Consent Order, and DOE Orders 435.1 and 450.1. Therefore, under NEPA, the Final LANL SWEIS must institute the “*Reduced Operations Alternative.*”

2.1. Water quality data in the LANL Draft SWEIS for water samples collected from LANL characterization wells installed in the regional aquifer.

The table below describes the capability of each screened interval in Appendix F of the Draft LANL SWEIS Report to produce reliable water samples.

Table. 1. Regional Aquifer Characterization Wells in Appendix F of the SWEIS

Well/ Screen no.	WSAR Grade	Screen Length ^{6,A}	Comment
R-5, #3	Very Good	60 ft	^B Westbay, ^c screen crosses water table
R-7 #3	Poor	67 ft	Westbay, screen crosses water table
R-9	Very Good	60 ft	screen crosses water table
R-12 #3	Poor	63 ft	Westbay, screen crosses water table
R-13	Good	60 ft	screen too deep below water table
R-15	Very Good	60 ft	well is spreading contamination
R-19 #3	Fair	90 ft	Westbay, screen crosses water table
R-19 #4	Good	65 ft	Westbay, screen too deep
R-19 #5	Poor	50 ft	Westbay, screen too deep
R-19 #6	Poor	105 ft	Westbay, screen too deep
R-19 #7	Fair	20 ft	Westbay, screen too deep
R-22 #1	Poor	60 ft	critical location at Area G, new well needed strata with very low permeability do not meet RCRA requirements, Westbay
R-22 #2	Very Good	70 ft	
R-22 #3	Good	40 ft	strata contaminated with bentonite clay grout

R-22 #4	Poor	20 ft	Westbay, screen too deep
R-22 #5	Poor	40 ft	Westbay, screen too deep
R-25 #4	Very Good	11 ft	cross-contamination, Westbay
R-25 #5	Fair	17 ft	cross-contamination, Westbay
R-25 #6	Very Good	17 ft	cross-contamination, Westbay
R-25 #7	Very Good	18 ft	cross-contamination, Westbay
R-25 #8	Good	19 ft	cross-contamination, Westbay

^A EPA and NMED recommend a maximum screen length of 10 feet. See Section 6.0. ^B
 Westbay, Stagnant water samples are collected with a Westbay^R No-Purge water
 sampling system. See the discussion of the Westbay sampling of well R-5 #3 on the
 next page. ^C

Screens installed across water table create a pathway for atmospheric pressure
 changes to “pump” oxygen into the groundwater and therefore, to change groundwater
 chemistry.

For the 21 screened intervals in the 9 characterization wells represented in Appendix F of
 the Draft LANL SWEIS to monitor water quality in the regional aquifer, the WSAR
 assigns only 11 of the screens as producing representative water samples. However,
 when all of the factors are considered, none of the 21 screens produce representative
 water samples. The reasons the 11 screened intervals graded as Good or Very Good do
 not produce representative water samples are described below;

Well R-5 #3. Very Good. The well does not produce representative water quality
 samples for the following reasons. The long well screen may cause dilution of
 contamination. In addition, the screen straddles the water table and therefore, allows
 “atmospheric pumping” to change the chemistry of the water produced from the well by
 the introduction of oxygen. Water samples are collected with the Westbay^R no-purge
 sampling system that does not purge any volume of water from the screened interval
 before water samples are collected for the analytical suite. The no-purge sampling
 methodology collects “stagnant water” that was in contact for a long period of time with
 the new mineralogy created by the drilling additives that have properties to mask
 detection of contaminants, and altered chemistry because the water samples are affected
 by the “atmospheric pumping”.

Well R-9. Very Good. Early water chemistry data⁷ show residual effects of drilling
 additives. Dilution by long screen and top of well screen is above water table. Water
 samples are affected by the new mineralogy and by “atmospheric pumping”/

Well R-13. Good. Water chemistry⁷ is affected by the new mineralogy formed by
 organic drilling additives. Top of 60-ft long screen is 125 feet below water table.
 Important permeable strata near water table are not monitored.⁸ See Exhibit 3.

Well R-15. Very Good. 60-ft long screen is installed across the water table and also has breached a confining bed and is spreading contamination to greater depth in the regional aquifer.^{1,9} The pump installed at the bottom of the long screen ensures dilution of contamination at the water table. There is an immediate need to rehabilitate or replace well R-15. Contaminants⁷ detected in the well include hexavalent chromium, perchlorate, tritium, and nitrate. Other contaminants such as 1,4-dioxane may be present but are not detected because of the dilution or because of the affects of “atmospheric pumping”.

Well R-19 #4. Good. Representativeness of water samples cannot be certain because of the no-purge water sampling methodology, the dilution because of the 65-ft long screened interval, and the screen is located over 200 feet below the water table.⁶

Well R-22 #2. Very Good. The very low permeability of the screened interval of 0.04 ft/day¹⁰ does not meet the requirements of the RCRA Statute¹⁴ to collect water samples from the strata with high permeability. Strata with high permeability¹¹ are present both above and below the low permeability strata that are monitored by screen #2.

Well R-22 #3. Good. A LANL report¹¹ documents that screen #3 is contaminated by bentonite clay grout materials that were misplaced during well construction. In addition, the screened interval has a relatively low permeability of 0.2 ft/day¹⁰ compared with strata above the screen that may have a permeability greater than 50 ft/day.

Well R-25 #4, #6, #7. Very Good, #8. Good. Mistakes in the construction of well R-25 allowed cross-contamination of the water in the regional aquifer with solvent and high-explosives contaminated water from a perched zone of saturation above the regional aquifer for a period of time of greater than one year.¹² Because of the long period of cross-contamination, the no-purge water samples collected from the well with the Westbay^R sampling equipment cannot ensure that representative water samples are collected.

2.2. Water quality data in the Draft LANL SWEIS for water samples collected from LANL characterization wells installed in the perched zones of saturation

Tables F-11, F-15, and F-16 in Appendix F of the Draft LANL SWEIS present a statistical analysis of analytical data for water samples collected from wells installed in perched zones of saturation. The tables do not identify the discrete wells that are sampled. The tables do not identify the total number of wells that are sampled. The source of the analytical data for the tables in the Draft LANL SWEIS are the LANL Surveillance Reports and the data represent water samples collected over the years of 2001 through 2004.

The LANL *Surveillance Reports* for water samples collected over the four year period of 2001 to 2004 include analytical data from only eight LANL characterization wells with screens installed in the perched zones of saturation. Six of the eight wells are multiple-screen designs with water samples collected by the Westbay^R no-purge sampling system.

There are a total of 13 screened intervals in the multiple-screen wells. However, the LANL *Well Screen Analysis Report* (WSAR) identified that 5 of the 13 screens were dry and did not produce water samples. Furthermore, a later LANL report⁶ identified that an additional screened interval did not produce water samples for a total of 6 “dry screens.” The available information indicates that most of the “dry screens” are the result of the plugging action of the drilling additives that were used to drill the boreholes for the wells. Table 2 identifies the discrete wells and the Grades in the WSAR.

Table 2. Perched Zone Characterization Wells in Appendix F of the SWEIS

Well/ Screen no.	WSAR Grade	Comment
R-5 #1	dry –not graded	
R-5 #2	Very Good	----- A LANL report ⁶ identified the screened interval as incapable of producing water samples
R-7 #1	dry – not graded	
R-7 #2	dry – not graded	
R-9i #1	Fair	
R-9i #2	Fair	
R-12 #1	Poor	
R-12 #2	dry – not graded	

Table 2 (cont.)

Perched Zone Characterization Wells in Appendix F of the SWEIS

Well/ Screen no.	WSAR Grade	Comment
R-19 #1	dry – not graded	
R-19 #2	Fair	
R-19 #3	Fair	
R-25 #1	Fair	
R-25 #2	Fair	

Well LOI(a)-1.1 – This single-screen well was not graded in the WSAR. However, a review of the LANL water quality data website⁷ reveals that the analytical results for

dissolved iron, manganese, nickel, and zinc were at anomalously high levels in the first water samples collected from the well, and trended to lower values in the more recent samples. The trend in the dissolved concentrations of the metals is evidence of chemical processes that form a new mineralogy on the strata surrounding the well screen with properties to remove contaminants from the water samples collected from the well i.e., the well does not produce representative water samples.

Well POI-4. This single screen well was not graded in the WSAR. However, a review of the LANL water quality data⁷ is an indication that the well may produce reliable and representative water quality data. A study of all available information on drilling, well construction, and sampling methodology should be done to make a finding that the well produces reliable and representative water quality data.

The available information show that only one of the perched zone wells included in Appendix F of the Draft LANL SWEIS may produce representative water samples. It is essential for the Final LANL SWEIS to accurately present the inability of the LANL monitoring wells to produce scientifically sound and technically defensible data under RCRA for the detection of contamination in the perched zones of saturation beneath LANL. Accurate knowledge of contaminants in the perched zones is essential information for the early detection of contaminants that are traveling down through the vadose zone to the regional aquifer.

3.0. Nonrepresentative water quality from the old LANL Test Wells. Appendix F of the Draft LANL SWEIS places an unacceptable reliance on water quality data from the old LANL test wells for the radionuclide contaminants Americium-241, Cesium-137, Cobalt-60, Neptunium-237, Plutonium-238, Plutonium-239 and -240, Potassium-40, Radium-226, Sodium-22, Strontium-90, Tritium, Uranium-234, Uranium, 235 and-236, and Uranium-238. In fact, none of the old LANL test wells produce water samples that are representative under DOE Orders, the NMED Consent Order, or RCRA for any of the contaminants of concern in the groundwater beneath LANL.

The well construction features¹³ that prevent the old test wells from producing representative water samples were general knowledge in the monitoring well industry for more than the past twenty years. They include

- 1). the dilution of contaminants by the long well screens,
- 2). the installation of the long well screens across the water table to allow the change in water chemistry that results from invasion of oxygen from “atmospheric pumping”,
- 3). the use of common iron well screens and casing that hide the presence of radionuclide and hazardous contaminants, and
- 4). the use of the mud-rotary drilling methods that hide the presence of contaminants.

The environmental sampling data in Appendix F of the Draft LANL SWEIS include the spurious analytical data from the old LANL test wells TW-1, TW-2, TW-3, TW-4, TW-8, DT-5A, DT-9, and DT-10. The old test wells should have been plugged and abandoned twenty five years ago. The presentation of the spurious water quality data from the old

test wells in the LANL *Surveillance Reports* from first publication up to the present time are a misrepresentation of having factual knowledge that the groundwater was not contaminated by LANL wastes.

The routine long-term collection of spurious water samples from the old test wells for LANL contaminants is one of many examples of the failure over decades of time of DOE/NNSA, LANL, and NMED to follow good scientific practices. The Final LANL SWEIS should stop the disingenuous presentation of the spurious contaminant data from the old test wells.

3.1. The dilution of contamination by the long screens in the old test wells

- Test Well TW-8. Well TW-8 is an example of the long length of the well screens in the old test wells. The well was drilled in 1960 with carbon steel casing installed in an unsealed borehole over the depth interval of 64 to 1065 feet below the land surface.¹³ The well screen was formed by cutting slots in the bottom 112 feet of the carbon steel well casing. The long length of the slotted casing ensures dilution of contamination at the water table; an important concern at the location of the well is the detection of contaminants including hexavalent chromium at the water table. Instead of providing reliable analytical data on the presence of contamination, the long screen in test well TW-8 is a pathway for spreading contamination at the water table to a greater depth in the regional aquifer. Indeed, there is data to show that the unsealed borehole for well TW-8 is allowing contaminated water in a perched zone of saturation to contaminate the regional aquifer. There is an immediate need to plug and abandon old test well TW-8 and all of the other old test wells.

The concern of EPA¹⁴ for long well screens is described below:

“To avoid dilution, the Agency prefers that well screens be kept to the minimum length appropriate for intercepting a contaminant plume, especially in a high-yielding aquifer. The screen length should generally not exceed 10 feet.”

The NMED Consent Order¹⁵ for LANL requires the monitoring wells to meet the above RCRA guidance for screen length. In addition, the NMED Consent Order requires the monitoring wells to meet the requirements of the NMED Hazardous Waste Bureau Position Paper “*Use of Low-Flow and Other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring*,” October 30, 2001. Below is an excerpt from the NMED Position Paper:

“The screened interval of the monitoring well should be short. Optimal screen length should be less than 10 feet (USEPA, March 1998). Low-flow purging and sampling may be approved for use in wells with screen lengths greater than 10 feet, provided pump intake placement is demonstrated to be appropriate. Wells with screened intervals connecting intervals of different head and/or hydraulic conductivity may act as conduits for vertical flow within the screened interval” [From page 6 of NMED Position Paper].

3.2. The spurious water quality data from the old test wells because of the common steel casing and screens.

An example of the poor quality of groundwater samples collected from the old test wells is the discussion in the minutes of the Jan, 28, 2004 LANL Groundwater Protection Committee Public Meeting:

Comment of meeting attendant: “Water samples from TW-3 had the appearance of iced tea. Believe TW-3 should be plugged and abandoned.”

Reply by LANL: “The color of the water was due to corrosion of the metal casing.”

Old test well TW-3 was replaced by LANL characterization well R-6 according to the following statement in the well R-6 completion Report:

“R-6 will serve as a replacement well for the obsolete monitoring well TW-3 and as an upgradient monitoring point for municipal water supply well Otowi-4” [Emphasis Added]. [LANL well R-6 Completion Report, Kleinfelder Project No. 37151].

Why does the Draft LANL SWEIS present analytical data from an old test well that a LANL report describes as an obsolete monitoring well?

The properties of the corrosion products to prevent water samples from being representative of hexavalent chromium, other trace metals, and most radionuclide contaminants are well understood in the technical literature. From page 6-30 in “*RCRA GROUNDWATER MONITORING: DRAFT TECHNICAL GUIDANCE*” – *The EPA RCRA Manual for Monitoring Wells*, EPA, November 1992:¹⁴

“The presence of corrosion products represents a high potential for the alteration of ground-water sample chemical quality. The surfaces where corrosion occurs also present potential sites for a variety of chemical reactions and adsorption. These surface interactions can cause significant changes in dissolved metal or organic compounds in ground-water samples (Marsh and Lloyd, 1980).”

“According to Barcelona et al. (1983), even purging the well prior to sampling may not be sufficient to minimize this source of sample bias because the effects of the disturbance of surface coatings or accumulated corrosion products in the bottom of the well are difficult, if not impossible, to predict. On the basis of these observations, the use of carbon steel, low-carbon steel, and galvanized steel in monitoring well construction is not recommended in most natural geochemical environments.”

- The features described above in the construction of well TW-8 and the presence of corrosion products in the water samples may mask the detection of hexavalent chromium and other contamination in the regional aquifer. The features of well TW-8 and TW-3 are common to all of the old LANL test wells. The wells have no value for knowledge of the presence of contaminants. Instead, the wells are a danger as

pathways for contamination to reach the regional aquifer.

4.0. Summary. The mandate for DOE/NNSA to demonstrate Environmental Stewardship requires that all of the old test wells are plugged and abandoned and the reports that presented findings based on the spurious contaminant data produced over the decades be retracted. An example of an important report in the Draft LANL SWEIS that DOE/NNSA is required to take action for retraction is the ATSDR (Agency for Toxic Substances Disease Registry) “*Draft Public Health Assessment of the Los Alamos National Laboratory*,” released for public comment in June, 2005. Note that the Draft LANL SWEIS presented the Draft ATSDR report as a published report and a basis for a “clean bill of health” for LANL operations. It was disingenuous of the Draft LANL SWEIS to present the Draft ATSDR report. Because of the large number of concerns for the poor quality of the ATSDR Draft report by the public and by EPA, the final report was never released. A reason for DOE/NNSA to demand retraction of the ATSDR Draft Report is that similar to the Draft LANL SWEIS, the ATSDR review of public health from LANL operations was from the spurious data produced by the old LANL test wells.

In fact, DOE/NNSA and LANL have not installed a reliable network of monitoring wells that are capable of producing the data required for the ATSDR to perform a public health assessment. This is another reason that requires, under NEPA, for the Final LANL SWEIS to make a finding that LANL is unsuited for expanded operations to manufacture plutonium pits and for the Final LANL SWEIS to institute the “Reduced Operations Alternative.”

References

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