General

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Date: October 29, 2003
Refer to: RRES-GPP-03-093

Mr. John Young, Corrective Action Project Leader
Permits Management Program
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SUBJECT: LOS ALAMOS NATIONAL LABORATORY (LANL) RESPONSE TO GENERAL DRILLING PROGRAM ISSUES

Dear Mr. Young:

This letter responds to comments regarding general drilling program issues at Los Alamos National Laboratory in your letters dated March 25, 2003, April 15, 2003, April 18, 2003, and two letters dated August 29, 2003. This letter addresses the issues raised in your letters in three general categories: well design, construction/sampling/testing, and reporting.

Well Design

Regarding the placement of monitoring well screens such that they straddle the water table, we recognize that the intent of Hazardous Waste Bureau (HWB) is the detection of contaminants that may exist at or near the top of the water table. Department of Energy (DOE) and University of California (UC) share the objective of detecting contaminants near the top of the water table when the well is located near facilities and suspected release locations. However, many of the wells being constructed are not located close to facilities or suspected release locations, and any contamination in the groundwater at these locations is not necessarily expected to be present in the top-most few feet of the aquifer. Key contaminants identified for LANL do not include low-density or light non-aqueous phase liquids.

In addition, straddling the water table with screens creates the following problems that work to the detriment of obtaining quality information from the well:

- the introduction of oxygen to the water table can alter the groundwater chemistry, which can make any sample taken from the well not representative of aquifer conditions;

- hydrologic testing is precluded in screens that straddle the water table because the interval is not fully saturated; and
- filter pack materials that extend above the water table cannot be cleaned as thoroughly as the filter pack material below the water table causing potential for drilling mud or other additives to remain and affect the quality of samples.

Despite these concerns, most multiscreen wells we have constructed recently under NMED oversight have at least one screen that straddles the water table. The exceptions to the above have been wells located far from suspected release locations that have had their screens placed in the uppermost transmissive zones below the water table, with NMED concurrence, in order to sample from the most likely path of contaminant migration. Because the best placement of the well screen depends on well location and upon information gathered at the time of well construction, we plan to continue our current practice of seeking HWB concurrence on every screen placement. We agree that a screen may be placed to straddle the water table when the filter pack extending above the water table can be cleaned (or NMED provides written approval for leaving filter pack materials above the water table in an "as is" condition) and when hydrologic testing at that well is not a priority.

The second well design issue is lengthy screen intervals. We agree to minimize the lengths of screen intervals. Two considerations we have used, and plan to continue to use, are the well lifetime and well construction constraints. The screens lengths at the top of the regional aquifer are selected to endure the expected well life of 30 to 40 years, considering the historic drawdown patterns in nearby wells. Justification for selecting longer screen lengths in water table screens can be found in the EPA Technical Enforcement Guidance Document (TEGD), which states "Long-term structural integrity, i.e., 30 or more years, is essential to the collection of unbiased groundwater samples over the lifetime of the facility and post-closure period" (EPA, 1986, p.81). In addition, well construction conditions, such as encountered at R-23, may call for longer screens than would otherwise be constructed. In the future, when borehole issues arise, we will continue our current practice of seeking agreement with NMED on well screen lengths.

The third well design issue is lengthy filter packs. The Laboratory agrees to limit filter packs to approximately a 10-foot extension above the screen or longer as approved by NMED. Filter pack length has been discussed with NMED a number of times since the inception of the Hydrogeologic Workplan. In regional and intermediate hydrogeologic characterization wells installed since 1997 most of the screens have no more than the 10-foot filter pack extension. However, in some instances the 10-foot extension was exceeded above or below the screened interval because of borehole instability where unavoidable sloughing of the natural materials into the borehole occurred during well construction.

The final well design issue is coring depth and interval. Over the course of installing 19 regional characterization wells, we have recognized that there is little value in coring the boreholes, for the following reasons:

- the geologic units are such that the core is not intact when recovered;

- the stratigraphy across the Pajarito Plateau is heterogeneous, so information gained from core in one location can not be broadly applied;
- geophysical logging provides geologic, hydrologic, and chemical data;
- cuttings from the borehole provide an adequate record of the lithology encountered;
- coring is very slow and costly; and
- coring in deep boreholes requires the use of drilling mud or other additives that would impact the condition of the samples.

We believe that geologic, stratigraphic, and lithologic data collection via cuttings and geophysical logging is adequate for the use of the data and represents the most cost-effective data collection strategy for well R-26. Therefore, we did not implement your recommendation to core the well R-26 borehole to its total depth during its construction in September/October 2003.

Construction/Sampling/Testing

The first issue in this category is well construction concerns, including stuck casing, unusable or bent screens, bentonite adjacent to screens, tremie pipe or other materials left in the borehole. These types of conditions are obviously undesirable, and considerable effort has been made to avoid them and, when they occur, to retrieve lost or stuck casing and tremie pipe. Sometimes the efforts were successful, while at others the material could not be recovered and was left in place, with concurrence of NMED. Such instances were generally deemed not to impact water quality. None of the conditions at these wells were planned or intentional and are sometimes the result of using drilling methods desired by NMED (such as using air rotary methods, etc.) and often the result of geologic conditions and drilling depths. The results of water-quality sampling at these wells bear out the assertion that the presence of these materials does not affect the representativeness of water samples collected from the wells.

The second issue is that of tracking of drilling fluids. We recognize the need to track fluid quantities used during drilling of these wells, and the DOE and its new contractor will keep an accurate log of fluid use/loss volumes during the drilling, installation, development, and testing of all future wells. With respect to the R-23 borehole, as stated in the report, approximately 55,000 gallons were used as drill fluids to drill the R-23 borehole, and 31,870 gallons were produced from the regional during development and testing. However, approximately 65,000 gallons were land applied according to the Notice of Intent (NOI), as noted in Appendix F, the Waste Characterization Data. Based on the quantity that was later land applied, more water was removed from the regional aquifer during development and testing than was lost during drilling. During drilling, a portion of the drill fluids is lost through borehole invasion and in lost circulation zones. A significant portion of the drilling fluid is returned to the surface carrying drill cuttings from the hole. The purpose of developing the well is to remove the drilling fluids from the area surrounding the borehole. Well development parameters are monitored closely (i.e. pH, conductivity, turbidity, and in some cases total organic carbon [TOC]) to determine when drilling fluid residuals have been removed to acceptable levels. Development continues until these parameters indicate that the water in the well is representative of native water. Wells R-14, R-6, R-20, R-23, and R-32 were drilled with mud in the saturated zone, so additional effort was

expended and increased volumes were purged from these wells during development and testing.

The third issue involves sampling at wells. Regarding groundwater chemistry at well R-13, characterization sampling conducted at the well showed that activities of radionuclides were less than detection. These results will be included in a geochemistry report for R-13. Results of the first characterization sampling round conducted on 10/28/02 are summarized in Attachment A. The uranium (U-234 and U-238) detected in the R-13 characterization sample is natural uranium that has a calculated concentration (based on uranium-238 activity) of 0.47 ppb, which is the background level of natural uranium. Results for uranium-235 are inconclusive because the measured activity and detection limit are greater than the reporting limit. Tritium activity was less than 1 pCi/L prior to characterization sampling. Tritium is far more mobile than the above radionuclides and contamination at R-13, at present, is very unlikely. Because the prominent source for contamination in Mortandad Canyon has included tritium from the inception of releases, and because tritium moves as fast or faster than other contaminants, the absence of tritium and other indicator constituents indicates a lack of contamination of groundwater at R-13. Of course, R-13 will continue to be tested and the understanding of contamination revised if appropriate.

Another sampling issue noted was the apparent inconsistent tritium analyses in R-5 and R-23. From the well completion reports it appears that perched water samples were analyzed for tritium while regional aquifer samples were not. This inconsistency is the result of the lack of data when the well completion report was written in the case of R-5 and an oversight in the case of R-23.

The final sampling issue is analysis of cuttings from the water table in R-16. As with other wells located in areas considered to be uncontaminated, the decision to analyze cuttings for contaminants is made based on the analysis of water from the borehole. The R-16 borehole water sample did not contain mobile contaminants above background, such as tritium or nitrate, and there was no reason to expect less mobile contaminants to be present at such great distances from any potential Laboratory sources. That resulted in the decision not to analyze the cuttings. In wells located in areas of known contamination, the cuttings are analyzed for contaminants regardless of the analytical results of borehole water samples.

The fourth issue concerns the use of injection (slug) tests in the wells. We agree that slug tests are less desirable than other testing methods, however, in many wells, the slug test is the only type of hydrologic testing method reasonably available. The primary objection to this type of testing raised by NMED (letter dated December 14, 2001) is the introduction of water into the well. DOE and LANL maintain that this concern is unfounded for the following reasons:

- the water introduced in an injection test is an insignificant volume compared to the amount of water added during the construction of the well;
- the water introduced is from the same source as the water in the well and has the same chemical characteristics; and

- the well is developed after the injection test, thereby removing much more water than the water added during the test.

However, DOE and LANL would like to work with NMED to develop a demonstration that introducting of water into the well does not affect the representativeness of samples collected after testing and development are completed. DOE and LANL propose to use water pumped out of the well for the injection slug, such that the same water that is removed from the well is returned during testing.

Reporting
One issue in reporting are the allegations of "careless work" cited in the letter dated August 29, subject "well completion reports submitted in 2003." With respect to the specific examples cited in well R-32, the sample referenced in the appendix refers to a baseline composite sample that was used to measure progress of well development. Many samples are collected and analyzed in-house to determine how effective well development procedures are. Composite samples collected prior and during development are not representative of actual formation water from individual screened intervals. The primary purpose of collecting such samples is for a semiquantitative assessment of how well development is proceeding and effecting the removal of drill additives from the well. The inclusion of a single development sample data point in the appendix out of several taken during the development process was inadvertent. The analytical results of baseline composite samples collected to determine well development progress will not be included in future well completion reports. Another reporting issue involves the failure in Table 7.1-1 to note that the drill casing left in the ground is blocking the top screen in R-16. on table 7.1-1. Table 7.1-1 is correct in that a screen was placed at the depths cited; these depths span the measured static water level in the well at the time of well construction. There is no intent to mislead the reader that screen 1 is functional, as there are numerous citations within the report describing the nonfunctional nature of screen 1. For example,

- Figure 3.0-1, well summary data sheet notes that screen 1 is located behind stuck casing.
- Figure 3.0-2 operations chronology, indicates that the11 3/4-inch casing would not retract and backfill operations continued up into casing.
- Figure 7.2-1, as-built configuration diagram, indicates that screen 1 is "isolated behind abandoned casing." Also note that #5 at the bottom of the figure states that "11 3/4" casing abandoned in borehole rendering screen #1 non-functional'.
- Page 17, paragraph 2, discusses in detail the loss of screen #1.
- Page 20, paragraph 1, 3rd sentence, refers to screen 1 as isolated by drill casing.
- Appendix A, under the Actual Work column, reference is made to only 3 operable screens in the well.

With respect to interpretive conclusion statements made in the well completion reports regarding impacts to the regional aquifer, we understand NMED's concern. The statements are based on professional evaluation of the data and judgment at the time the report is written. The conclusion is subject to change in the future based on continued data collection and interpretation.

If you have any questions, please contact either Charlie Nylander at (505) 665-4681 or Mat Johansen at (505) 665-5046.

Sincerely,

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IM-5, MS A150
RRES-GPP File, MS M992
RRES-RPF, MS M707 (ER2003-0662)

Attachment A

Radionuclide Analytical Results for R-13 Characterization Sample of the Regional Aquifer, Collected October 28, 2002

Radionuclide	**Concentration (pCi/L)**	**Detection Limit (pCi/L)**	**Reporting Limit (quantitation limit)(pCi/L)**	**Status**
Am-241	0.0077	0.055	0.02	U- not detected
Cs-137	-0.556	2.95	2.00	U- not detected
Pu-238	-3.01E-10	0.064	0.040	U- not detected
Pu-239,240	-0.0076	0.056	0.040	U- not detected
Sr-90	0.015	0.143	0.200	U- not detected
U-234	0.303	0.037	0.020	D- detect
U-235	0.032	0.032	0.005	inconclusive
U-238	0.158	0.041	0.020	D- detect
Gross alpha	0.543	1.56	5.00	U- not detected
Gross beta	1.92	1.32	5.00	J - detect below Reporting Limit