General

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

ENTERED

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

September 18, 2006

Mat Johansen
Groundwater Project Manager
Los Alamos Site Office, Department of Energy
528 35th Street, Mail Stop A316
Los Alamos, NM 87544

David McInroy
Remediation Services Deputy Project Director
Los Alamos National Laboratory
P.O. Box 1663, Mail Stop J591
Los Alamos, NM 87545

RE: NOTICE OF DISAPPROVAL
WELL SCREEN ANALYSIS REPORT
LOS ALAMOS NATIONAL LABORATORY
EPA ID #NM0890010515 HWB-LANL-05-022

Dear Messrs. Johansen and McInroy:

The New Mexico Environment Department (NMED) is in receipt of the United States Department of Energy (DOE) and University of California (collectively the Permittees) document entitled *Well Screen Analysis Report* (hereafter, the Report) dated November 2005 and referenced by LA-UR-05-8615/ER2005-0841. Los Alamos National Security, LLC (LANS) replaced the Regents of the University of California on June 1, 2006. NMED has reviewed the Report and hereby issues this notice of disapproval (NOD).

1. Comments on the Tiered Analysis Process:

Influence of Sampling Methods on Quality of Water Samples

The Permittees used a comprehensive tiered analysis approach, that identified as many as 48% of the evaluated screens as having been impacted by residual drilling fluids (including drilling or development additives) and bentonite, and thus, are unable to produce reliable and representative samples. All of the failed screens are in multiscreen wells. Despite the fact that the quality of water samples collected from a screen is closely associated with a sampling method, the Report does not provide further analysis of the potential influence of sampling methods on the quality of water samples.

14269

The sampling method, specifically whether purging is conducted before collection of samples, may play a crucial role in determining the quality of water samples. This is especially critical if residual drilling fluids and bentonite are present around screened intervals in the affected wells. According to *Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers* (EPA 542-S-02-001, 2002), monitoring wells must be purged so that water samples representative of formation water can be obtained. Water in a screen generally is in a constant state of natural flux as groundwater passes through a well. However, water above the screened section may remain relatively isolated and can become stagnant. Stagnant water is subject to physiochemical and biological changes when organic compounds contained in drilling fluids are present, often resulting in anaerobic water that is chemically different from formation water. As a result, no-purge sampling methods cannot assure collection of water samples that are not impacted by the stagnant or chemically altered water. Purging is a safeguard against collecting a sample biased by stagnant water. Purging is also an efficient way to reduce the contact time of formation water with a screen and any surrounding areas impacted by drilling fluids or other anthropogenic influences on water quality, which helps to minimize the potential influence of such factors on water sample quality.

The Permittees must provide the sampling methods that were used to collect water samples from each screen for data used in the analysis. The Permittees must specifically note whether or not purging was performed before collection of samples from each screen and, if purging was conducted, the purging methods used and volumes of water removed. The Permittees also must analyze whether there is a significant difference in the sample results.

2. Influence of Mineralogical Composition Changes on Quality of Water Samples

The presence of residual drilling fluids may not only turn groundwater from aerobic into anaerobic water, but also cause composition changes in aquifer solid materials adjacent to well screens. For example, the availability of organic compounds contained in drilling fluids likely stimulates sequential microbial metabolism, including iron and sulfate reduction. As a result, it is likely that iron sulfides are produced as precipitates, thereby enhancing the reactivity of the aquifer solids adjacent to impacted screens. It has been well-documented that iron sulfides are able to reductively transform organics such as chlorinated solvents, and some oxidizing metals and ions (e.g., hexavalent chromium, perchlorate, nitrate). In addition, the change of mineralogical compositions may also increase the adsorption capability of aquifer materials adjacent to impacted screens. Thus, water samples collected from impacted screens where aerobic conditions have been re-established after rehabilitation may still produce biased concentrations for certain contaminants in comparison to formation water.

The Permittees must include new analytes as indicators in the tiered analysis to demonstrate that there has not been any impact on the quality of water samples resulting from changes in mineralogical composition. For example, perchlorate can be useful as another indicator for redox-sensitive contaminants, while isotopes of americium and plutonium can be utilized as indicators of strongly adsorptive radionuclides. The Permittees may identify other analytes as

indicators and discuss their suitability to reveal the potential influence on water samples by changes in the adsorptive capability and reactivity of aquifer solids adjacent to impacted screens.

In addition, in section 4.5.2 (Selection of Indicator Species and Test Criteria), the Permittees must divide all indicator species used in the tiered analysis into groups by their usefulness as an indicator targeting one or a series of contaminants of concern. The Permittees must include a discussion of the qualifications and adequacy of the selected species as indicators for evaluating the potential influence by residual drilling fluids and bentonite on water sample quality.

3. Additional Concerns

a. The Permittees must eliminate dissolved oxygen (DO) as an evaluation criterion in Tier 2-2 (Figure 4-10) from the tiered analysis or, alternatively, remove all suspicious DO data from the Report. The DO data collected from several wells apparently were affected by exposure of water samples to ambient air or were the result of instrument malfunction. For example, in Screen 2 of R-16, DO was reported at 9.9 mg/L along with ORP and total sulfide at -65 mV and 0.473 mg/L, respectively, on May 18, 2004. The clearly erroneous DO data provides misleading results about the quality of the water samples. The Permittees must discuss the field data quality assurance in section 1.4 (Quality Assurance) and ensure that all data used in the Report satisfy the QA/QC requirements.

b. Dissolved zinc is proposed for evaluating the condition of wells impacted by bentonite relative to the possible adsorption of cesium-137, cobalt-60, europium isotopes, and neodymium-147 onto residual bentonite solids adjacent to the impacted well screen (Criterion 2.1-2c). However, as EPA pointed out in their February 16, 2006 internal memorandum [Ford and Acree to Mayer], there are some published ion exchange selectivity series that indicate cobalt partitions more strongly than zinc to clay minerals (including bentonite). Thus, detection of zinc would not preclude loss of cobalt-60 on residual bentonite. The Permittees must re-evaluate Criterion 2.1-2 in an effort to identify a more reliable replacement than zinc or propose a supplemental indicator analyte. Barium presents a potential alternative or additional candidate (99% detect in area groundwater) and should be further evaluated for qualification as an indicator analyte.

c. The Permittees must evaluate physical damage to, and corrosion of, all well screens. This evaluation is also an important part of the well screen analysis to determine whether a screen can produce water samples representative of formation water. NMED suggests that the "Well Screen Analysis Report" become a "Well Analysis Report." A more comprehensive assessment of wells (for example, consideration of screen location(s), filter pack and screen lengths, etc.) is necessary and will be critical in determining which wells must be rehabilitated or replaced. Additionally, wells not considered useful for monitoring purposes because of location, must also be identified in order to make appropriate decisions regarding future monitoring and placement of new wells.

d. In Table B-4, explain "unreliable pressure" designated for R-31 (Screens 3-5) and "only used for pressure readings" for R-32 (Screen 2).

e. In section 4.1.2 Well Development Methods, specify the wells that have been developed using the new well development procedures.

f. Correct the inconsistency of 18 multiscreen wells stated in the text (page iv) and 17 multiscreen wells listed in Table B-1.

4. Comments on Multivariate Statistical Analysis Method:

a. Inclusion of Additional Analytes as Input Parameters

The principal component analysis (PCA) is a mathematical manipulation method used to group correlated analytes into a few principal components to describe most of the variability among samples. Each component may include one or several related analytes that would reflect changes in certain physical, chemical or biological processes associated with the drilling residuals around well screens that likely impact the quality of water samples. As a prerequisite, the data selected for the PCA must include the full range of analytes in order to reflect all the processes, such as adsorption, and biotic and abiotic transformations, that potentially influence water sample quality.

The analytes (nine metals and nine ions) used for the PCA in the Report provide useful information to identify certain screens that do not produce reliable and representative water samples; however, the selected analytes do not provide an adequate fingerprint to detect screens that may adsorb radionuclides. Therefore, the Permittees must include additional analytes, such as total organic carbon (TOC), and isotopes of uranium, americium and plutonium, as input data for the PCA to ensure that all screens that pass the multivariate statistical analysis can produce water samples representative of formation water.

b. List of Key Calculation Results

The Permittees must list key PCA results in the Report, including the correlation matrix of analytes, loadings of analytes on the three principal components, and the variance explained by each principal component. Observation of the correlation matrix is important to evaluate associations between analytes that can demonstrate the coherence of the data set. If significant correlations cannot be found, the Permittees should not proceed with the PCA. A new suite of analytes would then need to be identified and analyzed. Providing such information is also necessary to facilitate evaluation of the results summarized in Table 5-2.

c. Explanation of the Physical Significance of the Principal Components

The Permittees must interpret the physical significance of the three principal components presented in the Report. Such interpretations would explain the associations of the three

principal components with occurrences of the physical, chemical and biological processes that are associated with the drilling residuals, thereby providing justification that the analytes used in PCA are appropriate and sufficient to capture all processes that may impact the quality of water samples. The principal components identified in the PCA function the same way as the indicators identified in the tiered analysis. Therefore, the Permittees must specify each principal component corresponding to one or more mechanisms that may impact the quality of water samples. In addition, the identity of the wells and springs used as references or background for the regional aquifer in the multivariate statistical analysis must be provided.

The Permittees must address the comments contained in this letter and submit a revised Report within 60 days of receipt of this letter. As part of the response letter that accompanies the revised Report, the Permittees must include a table that details where all revisions have been made to the Report and cross-references NMED's numbered comments. All submittals must be in the form of two paper copies and one electronic copy in accordance with section XI.A of the Consent Order (Order). Should you have any questions or comments, please contact Hai Shen of my staff at (505) 428-2539.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

JPB:hs

cc: J. Young, NMED HWB
D. Cobrain, NMED HWB
H. Shen, NMED HWB
T. Skibitski, NMED DOE OB
S. Yanicak, NMED DOE OB, MS J993
B. Olson, NMED GWQB
L. King, EPA 6PD-N
D. Gregory, DOE LASO, MS A316
A. Phelps, LANL, ENV, MS J591
J. Dewart, LANL, EP-WSP, MS M992

file: Reading and LANL General (Groundwater, WSAR)