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CERTIFIED MAIL – RETURN RECEIPT REQUESTED

April 9, 2007

David Gregory
Federal Project Director
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David McInroy
Remediation Services Deputy Project Director
Los Alamos National Laboratory
P.O. Box 1663, Mail Stop A100
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RE: DIRECTION TO MODIFY
WELL SCREEN ANALYSIS REPORT, REVISION 1
EPA ID #NM0890010515
HWB-LANL-05-022

Dear Messrs. Gregory and McInroy:

The New Mexico Environment Department (NMED) is in receipt of the United States Department of Energy (DOE) and Los Alamos National Security, LLC (collectively, the Permittees) document entitled *Well Screen Analysis Report, Revision 1* (hereafter, the Report) dated February 2007 and referenced by LA-UR-07-0873/EP2006-0979. NMED has reviewed the Report and the response to NMED's September 18, 2006 Notice of Disapproval (NOD), and hereby issues this notice of direction to modify. NMED imposes the following requirements for the Permittees to revise the Report.

1. The Permittees use a qualitative rating system (Very Good, Good, Fair and Poor) to describe the overall status of the evaluated screens in the Report. The Permittees believe that a screen being ranked as Very Good is able to provide technically defensible water-quality data. According to the information provided in Table 6-3, however, several screens (e.g., CdV-R-15-3-screen 4, R-2, R-4, R-6, R-10-screens 1 and 2) that are ranked as Very Good are also identified to be

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unable to provide reliable and representative samples for volatile organic compounds (VOCs) and 2,4,6-trinitrotoluene (TNT). In addition, other screens (CdV-R-15-3-screen 4, CdV-R-37-2-screen 3, R-19-screen 4 and R-31-screen 5) that are also ranked as Very Good do not provide reliable samples for nitrate, chromium, zinc, cesium-137, strontium-90, barium and/or plutonium (Table 6-3). Most of the listed analytes, such as VOCs, explosives, metals and radioactive elements, are potential contaminants of concern (COCs) that may specifically be targeted at these well screen locations in a monitoring program. Other well screens (CdV-R-15-3-screen 6, MCOBT-4.4, R-6i, R-8-screen 2, R-9, R-10a, R-12-screens 2 and 3, R-14-screen 1, R-16-screen 3, and R-19-screens 2 and 3) that are ranked as Good also do not provide reliable data for an even broader range of COCs as shown in Table 6-3.

As indicated above, it appears that the dependence on the overall rating system in the assessment of a well screen may lead to inaccurate or even misleading conclusions regarding whether the screen is capable of providing reliable data to meet monitoring objectives. The Permittees must therefore remove the overall rating system from the Report to minimize confusion, such that a well screen can be effectively evaluated with respect to data quality objectives in a monitoring program.

2. The Permittees establish a protocol using six categories (A, B, C, D, E and F) of indicators to assess whether a well screen is able to provide reliable data. Each category is used to assess a series of physical, chemical and biological mechanisms that potentially occur in impacted zones and influence the quality of water samples. In particular, the Categories C and D of indicators are used in the Report to determine the potential influence on the quality of water samples due to changes in *in situ* redox conditions and the alteration of the mineral adsorption, respectively, in the aquifer adjacent to impacted screens. The Permittees further indicate that whether a screen is able to provide reliable data for VOCs (excluding acetone) and high explosives is solely dependent on the evaluation results of the indicators that are included in Categories C and D (Tables A-4 and A-8). In other words, if a well screen can pass the evaluations using the Categories C and D of indicators, the screen would provide reliable data for VOCs (possibly excluding acetone) and high explosives. However, the Report presents some contradictory results for several screens.

   Specifically, despite that a majority, or even all, of the indicators that are included in Categories C and D passed the evaluation for several screens, the Report still designated these screens as being unable to provide reliable data for VOCs and TNT. For example, R-10-screen 2 passed the evaluations of all indicators that are included in Categories C and D (Table E-1), suggesting that the screen be able to provide reliable data for VOCs and high explosives according to the protocol established in the Report. However, the Permittees conclude that no reliable data

could be provided for VOCs and TNT in water samples collected from R-10-screen 2 (Table 6-3). The contradictions observed in R-10-screen 2 and possibly other screens (CdV-R-15-3-screen 4, R-2, R-4, R-6, and R-10-screens 1 & 2) imply that the Permittees also used other criteria to perform further evaluation of the screens that had passed based on the indicators that are included in Categories C and D.

If there are any additions to the protocol other than the six categories of indicators for evaluating the well screens, the Permittees must document them in the Report. In order to justify the use of any additional methodology that has not been presented in the Report, the Permittees must discuss the conceptual model, rationale and criteria with NMED prior to revising the Report. In addition, the Permittees must discuss the uncertainties to use the six categories of indicators in assessing VOCs, semi-VOCs, high explosives, pesticides and other potential organic contaminants of concern in Section 6.3 of the Report.

3. In Section 4.6 Category C - Modification of In situ Redox Conditions, the Permittees claim sulfate reduction being the final geomicrobial process for metabolism of the residual organic drilling fluids, such as hydrocarbons, alcohols, and various polymers, in the conceptual model. However, it is well-known that following microbial depletion of sulfate, carbon dioxide is subsequently used as an electron acceptor to promote anaerobic digestion of these organic drilling fluids under methanogenic conditions. The groundwater beneath the Pajarito Plateau naturally contains limited amounts of sulfate, and thus the microbial reduction of sulfate for degradation of the residual organic drilling fluids likely terminates after depletion of sulfate in groundwater. On the other hand, methanogenesis can be continuous until microbial activity depletes all residual organic drilling fluids.

   As a result, the exclusion of methanogenesis as the final mechanism for microbial degradation of these organic drilling fluids may lead to a misunderstanding that the impact of the residual organic drilling fluids on the quality of water samples would diminish after sulfate in groundwater is depleted. More importantly, many chlorinated VOCs, such as trichloroethylene and tetrachloroethylene, are subject to reductive dechlorination predominantly under methanogenic conditions. The reductive dechlorination is an important redox reaction that may cause chlorinated VOC concentration changes given that there are residual organic drilling fluids surrounding a screen. The exclusion of methanogenesis as the final mechanism will underestimate the importance of this mechanism in evaluating the influence on the quality of water samples. In order to facilitate a comprehensive evaluation of all potential mechanisms that may impact the quality of water samples, the Permittees must modify the conceptual model with inclusion of methanogenesis as the final mechanism for microbial degradation of the residual organic drilling fluids.

4. In Section 4.7 Category D - Modification of Surface-Active Mineral Surfaces, the Permittees only discuss the contribution of the change of the mineral surface on adsorption characteristics in the conceptual model. However, certain surface changes due to precipitation of newly-created minerals may also change the reactivity of the minerals in the aquifer adjacent to impacted screens. For example, the availability of organics contained in drilling fluids likely stimulate sequential microbial metabolism, including iron reduction and sulfate reduction. As a result, it is likely that iron sulfides are produced as precipitates, thereby enhancing reactivity of the aquifer solids adjacent to impacted screens. It has been well documented that iron sulfides are able to reductively transform such organics as chlorinated solvents, and certain redox-sensitive metals and ions (e.g., hexavalent chromium, perchlorate and nitrate). The redox-sensitive indicators included in Category C seem suitable to identify the potential impact of the reactivity changes on the quality of water samples. The Permittees must discuss the potential reactivity change on the mineral surfaces as part of the conceptual model to reveal all the potential mechanisms that may impact the quality of water samples.

5. In Section 3.0 Assumptions, the Permittees assume that the residence time of an organic analyte in an impacted zone is generally expected to be short relative to its biodegradation half-life. This assumption may be generally true under pumping conditions during sampling. This is evidenced by the observations of aerobic water after purging even if the water in the vicinity of the screen normally would be anaerobic prior to purging. However, this assumption couldn't be validated under natural groundwater flow conditions. If this assumption were generally true, the groundwater surrounding an impacted screen wouldn't become anaerobic due to the relatively rapid movement of groundwater through the impacted zone. The observations of anaerobic water in many screens strongly indicate that the residence time of groundwater in the impacted zone is long enough for bacteria to carry out a sequence of metabolisms, thereby causing the aerobic groundwater to become anaerobic. Due to retardation effects, an organic compound is commonly expected to have a longer residence time than the groundwater itself in the impacted zone. The Permittees must revise this assumption to minimize the potential underestimating of the impact of the residual drilling fluids on the quality of water samples.

6. In NMED's September 18, 2006 Notice of Disapproval, it was recommended that the Permittees utilize isotopes of americium and plutonium as indicators for evaluation of very strongly adsorptive radionuclides. For the six categories of indicators that may be used to discover the impact from strong adsorptive behavior, uranium does not appear to be a good indicator to assess the influence on strongly adsorptive radionuclides. This is because uranium forms carbonate complexes in most natural groundwaters, and thus is not expected to strongly

adsorb onto bentonite or other minerals. Zinc is considered to be an appropriate indicator for the adsorption behavior of metal cations and certain radionuclides (cesium-137, cobalt-60, europium isotopes, lanthanum-140 and neodymium-147) in the Report (Table D-2).

However, there are uncertainties using zinc as an indicator to disclose the adsorptive impact on water samples that are collected for measurements of certain radioactive elements, such as plutonium, thorium, americium, radium and cerium. These radionuclides seem to have stronger adsorption behaviors in the impacted zone than zinc based on Table A-11 in the Report. NMED notes that the groundwater background values cannot be adequately established for the isotopes of both americium and plutonium since these isotopes were not detected in most samples that represent groundwater background conditions beneath the Pajarito Plateau. Consequently, this excludes the potential use of these isotopes as indicators. The Permittees, however, must discuss the limitations and uncertainties in Section 6.3 with respect to the use of the six categories of indicators in identifying the potential impact of the residual drilling fluids on strongly adsorptive radioactive elements.

The Permittees must incorporate the above comments in the Report and submit a revised Report to NMED within 30 days of receipt of this letter. All changes to the text, tables, figures and any required clarifications must be submitted concurrently. As part of the response letter that will accompany the revised Report, the Permittees must also include a table that details where all revisions have been made to the Report that cross-references NMED's numbered comments. The Permittees are required to submit two hard copies of the revised Report, as well as one electronic (searchable PDF) copy of the updated document by the due date. If the Permittees fail to implement the modifications or provide the required additional information, the approval for this document will be automatically rescinded.

Should you have any questions or comments, please contact Hai Shen at (505) 476-6039.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

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