TA54

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August 31, 2007

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**RE: APPROVAL WITH DIRECTION
TECHNICAL AREA 54 WELL EVALUATION AND NETWORK RECOMMENDATIONS, LOS ALAMOS NATIONAL LABORATORY
EPA ID #NM0890010515
HWB-LANL-GROUNDWATER MISC**

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 *Technical Area 54 Well Evaluation and Network Recommendations* (hereafter, the Report) dated July 2007 and referenced by LA-UR-07-5042/EP2007-0443. NMED has reviewed the Report and hereby issues this Approval with the following direction:

1. **Locations of Regional Groundwater Monitoring Wells**

a. The Report proposed five new wells (R-37, R-38, R-39, R-40, and R-41) within and surrounding Technical Area (TA) 54 to monitor potential releases of contaminants to the regional groundwater from Material Disposal Areas (MDA) H, L and G. To position these new wells, a Monte Carlo simulation was used to address uncertainties of groundwater flow and contaminant transport resulting from regional aquifer

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heterogeneity. In terms of designing a regional groundwater monitoring network, however, the contaminant breakthrough area, including location and size, should be considered as another key factor with uncertainty because it plays a critical role in determining whether or not a monitoring network could capture potential releases with a high level of confidence.

A recent modeling investigation identified eight potential release locations representing the waste disposal regions at MDA G to minimize uncertainty regarding infiltration locations beneath MDA G (Stauffer, et al. 2005, 097432. *Groundwater Pathway Model for the Los Alamos National Laboratory Technical Area 54, Material Disposal Area G*, Los Alamos National Laboratory document LA-UR-05-7393). However, this Report assumed that the eastern end of MDA G was the sole breakthrough location for contaminants to reach the regional groundwater table. This assumption results in a breakthrough area that is much smaller in size compared to the overall dimensions of MDA G. Designing a groundwater monitoring network on the basis of such an assumption would increase the risk that the monitoring network may fail to capture contaminants released from areas other than the assumed breakthrough location. Investigation activities at MDA G have demonstrated that there are vapor-phase volatile organic compound (VOC) and tritium plumes immediately overlying the Cerros del Rio basalt (the basalt) beneath MDA G. In addition to the breakthrough location identified in the Report (as shown in Figure C-2.0-1), the vapor-phase VOC and tritium plumes were also observed at high concentrations in the northeastern end, the south-central portion, and the western portion of MDA G.

Many VOCs detected in the subsurface pore gas at MDA G have a relatively high solubility in water. The chemical characteristics of these contaminants imply that the vapor-phase VOCs immediately overlying the basalt can readily partition into the water pooled at the top of the basalt at a depth of approximately 300 feet below ground surface (6430 feet mean sea level) as indicated by Stauffer et al. (2005). Vapor-phase VOCs, such as trichloroethylene (TCE) and tetrachloroethylene (PCE), are present at concentrations high enough to result in liquid-phase concentrations greater than the drinking water standards when vapor concentrations approach equilibrium with pore water. As a result, there is a considerable amount of uncertainty in evaluating the fate and transport of the VOC- and tritium-equilibrated liquid phase. The fractured basalt likely provides preferential pathways for fast transport of the contaminant-equilibrated liquid phase to the regional aquifer, and the fracture characteristics of the basalt increase uncertainty regarding the breakthrough locations at the regional groundwater table.

As with tritium transport to the regional groundwater table as illustrated in the Report, the VOC-equilibrated liquid phase may also migrate laterally along the steep topographic gradient that directs water beneath MDA G southward. Contaminated pore water flowing southward along the gradient of the basalt topography may then mix with recharge water from Pajarito Canyon where infiltration generally occurs at a higher rate than through the mesa top. Compared to the downward transport beneath MDA G, this scenario may lead to the vapor-phase VOCs and tritium present immediately above the basalt migrating more rapidly to the regional aquifer south of MDA G. As recognized in this Well Evaluation Report, this transport mechanism will also result in complicated infiltration footprints of VOCs and tritium at the regional groundwater table. For this reason, the assumption of a single, small-sized infiltration location to predict potential plume transport pathways in the regional groundwater would increase the risk that the proposed monitoring network may fail to capture plumes originating from all of MDA G.

To address the uncertainty relating to potential contaminant breakthrough locations beneath MDA G, the Permittees must move proposed wells R-39 and R-41 to the southeast and northeast of MDA G, respectively. R-39 should be located somewhere adjacent to PCI-2. R-41 should be placed northeast of MDA G to monitor any plumes that may migrate northeasterly beyond the Laboratory property. The presence of groundwater monitoring wells downgradient of MDA G, including the two new wells R-39 and R-41 and the existing well R-22, should be more effective at addressing the monitoring needs in the regional aquifer. To support such a network being able to detect a plume in a reasonable timeframe with a confidence level of 95% or higher following releases of contaminants to the regional aquifer from beneath MDA G, the Permittees must conduct a probability analysis using the stochastic fate and transport model to accurately position R-39 and R-41.

b. To eliminate any potential to contaminate the regional aquifer during installation and operation of a groundwater monitoring well, the Permittees must place R-38 to the northeast of MDA L outside the known vapor plumes. According to the Report, any plume originating from MDA L is projected to move east and northeast in regional groundwater. The Permittees must provide modeling evidence to document that new well R-38, along with existing well R-21, are able to intercept, with a confidence level of 95% or higher, a plume originating from MDA L as soon as possible.

c. Because the source of regional groundwater contamination may originate from MDA H or MDA J and both plumes may migrate toward the northeast, the Permittees must place the new well R-37 to the northeast of MDA J. R-37 must be placed in a position where modeling results show that potential releases of contaminants from either MDA H or MDA J can be detected at the earliest possible time with a confidence level of 95% or higher.

The distance between MDA H and the community drinking-water supply well PM-2 is approximately 500 meters. This distance is within the capture radius that extends as far as 1000 meters from the well (PM-2), as stated in the Report. It is plausible that a plume in the regional aquifer originating from MDA H could migrate toward PM-2 under pumping conditions. The groundwater table elevation beneath MDA H is either higher than, or similar to, that at PM-2, increasing the likelihood for PM-2 to capture a plume originating from MDA H. Therefore, the Permittees must place the new well R-40 to the northwest of PM-2 to help ensure that any contaminants released from MDA H will be detected prior to their impact on the drinking water supplied by PM-2.

2. **Location of Intermediate Well PCI-1**

The Report established a conceptual model to highlight a fast pathway through which contaminants at MDA G are likely to rapidly migrate to the regional groundwater to the south of MDA G. However, an intermediate well PCI-1 was proposed to be placed to the southwest of MDA G where intermediate groundwater is less likely to be directly impacted by contaminants that migrate through this pathway. Because there is limited knowledge about the hydrology of the intermediate groundwater surrounding MDA G, placing a monitoring well nearby the recharge locations will increase the probability of quickly detecting potential releases of contaminants to the intermediate groundwater. The Permittees must therefore place PCI-1 to the south of the central portion of MDA G in Pajarito Canyon to effectively monitor potential releases through this fast pathway.

3. **Conceptual Models**

The Report provided a conceptual model that describes fast downward transport of vapor-phase tritium that overlies the top of the basalt beneath MDA G. As pointed out in Comment 1a, the fast transport mechanism is valid not only for tritium in subsurface pore gas, but also for vapor-phase VOCs present at the top of the basalt under MDA G. Both tritium- and VOC-equilibrated pore waters will likely flow on the top of the basalt following the southward slope of the basalt topography, and then move rapidly downward to the south of MDA G after mixing with water infiltrating from Pajarito Canyon. The Permittees must add a similar conceptual model to illustrate potential fast transport of VOCs downward to the regional aquifer.

4. **Details about Hydraulic Parameters**

Appendix C of the Report provided details regarding the hydraulic analysis of a regional groundwater monitoring network for detecting contaminant releases to the regional aquifer. A Monte Carlo simulation of regional groundwater flow and contaminant transport was used as a quantitative means to address uncertainties in key hydraulic parameters and boundary conditions, whose spatial variations in the regional aquifer introduce flow field heterogeneity and uncertainty. In terms of the Monte Carlo simulations, the adequacy of the predicted results is primarily dependent on the input hydraulic parameters and boundary conditions that are randomly sampled within a given range of values according to a distribution type. However, no such information has been provided in the Report. The Permittees must list the key hydraulic parameters and boundary conditions that have undergone the stochastic analysis in the Report, including the parameter names, their given value ranges and distribution types, etc. The Permittees must also provide discussions to support that the input hydraulic parameters and their given ranges of values reasonably reflect the natural variability of the regional aquifer.

The Permittees must incorporate the above comments into a revised Report, and submit it to NMED no later than October 5, 2007. To implement the recommendations that have been identified in Section 5.0 of the Report, the Permittees must submit a work plan to NMED for approval no later than November 12, 2007. The work plan must include all details for project implementation and a schedule for each action.

Should you have any questions or comments, please contact John Young at (505) 476-6038 or Hai Shen at (505) 476-6039.

Sincerely,

James P. Bearzi
Chief
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JPB:hs

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file: Reading and LANL TA-54 (MDAs G, H, L, Groundwater)