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CERTIFIED MAIL - RETURN RECEIPT REQUESTED

September 12, 2007

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David McInroy
Remediation Services Deputy Project Director
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RE: NOTICE OF DISAPPROVAL
CORRECTIVE MEASURES EVALUATION PLAN FOR MATERIAL DISPOSAL AREA G AT TECHNICAL AREA 54, REVISION 1
LOS ALAMOS NATIONAL LABORATORY
EPA ID #NM0890010515
HWB-LANL-07-022

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 *Corrective Measures Evaluation Plan for Material Disposal Area G at Technical Area 54, Revision 1* (hereafter, the Plan) dated July 2007 and referenced by LA-UR-07-4591/EP2007-0393. NMED has reviewed the Plan and hereby issues this Notice of Disapproval. The Permittees must revise the Plan based on the following comments:

1. **Conceptual Site Model for Material Disposal Area (MDA) G**

   The Plan established a conceptual site model for MDA G and identified several primary transport pathways that potentially distribute contaminants released from the disposed waste to the environment. One of the primary purposes of the conceptual site model is to guide identification and delineation of contaminant migration pathways in the corrective measures evaluation (CME) report, so that appropriate remedies can be evaluated and selected for MDA G. However, the Permittees stated in the Plan that there is a very limited potential for contaminant transport to the regional aquifer. No further information was provided in supporting this conclusion.

Moreover, this conclusion is contrary to recent findings derived from investigation activities conducted at MDA G, and may result in the inappropriate evaluation of contaminant migration pathways. A recent modeling investigation by the Permittees indicates that contaminants released from MDA G will reach the regional groundwater in less than 500 years with peak breakthrough at about 750 years (Stauffer, et al. 2005, *Groundwater Pathway Model for the Los Alamos National Laboratory Technical Area 54, Material Disposal Area G*, LA-UR-05-7393).

It should be emphasized that the breakthrough time predicted by Stauffer, et al. was based on liquid-phase transport of non-volatile contaminants (such as metals, radionuclides etc.) that is driven by infiltration from the mesa top, and, thus, may not be valid to project the fate and transport of the vapor-phase contamination that has migrated to, and currently resides at, the top of the Cerros del Rio basalt. The current presence of the vapor-phase VOC and tritium plumes immediately at the top of the basalt implies that these contaminants may break through at the regional groundwater table much earlier than the predictions by Stauffer, et al.

In terms of migration of VOCs and tritium in the vadose zone, both liquid-phase and gas-phase transport can become dominant pathways dependent on the subsurface conditions, particularly with soil moisture content. The importance of both transport mechanisms in the unsaturated zone has been recognized by the Permittees (LANL 2005, *Los Alamos National Laboratory's Hydrogeologic Studies of the Pajarito Plateau: A Synthesis of Hydrogeologic Workplan Activities 1998-2004*, LA-14263-MS). For liquid-phase transport that is driven by infiltration, the Bandelier Tuff (including the Tshirege and Otowi Members) plays a critical role in controlling the breakthrough time for contaminants to reach the regional groundwater table. The Cerros del Rio basalt is generally credited with limited capability to further delay liquid breakthrough times, even if the basalt comprises over 50% of the unsaturated zone beneath MDA G. For gas-phase transport, vapor diffusion is considered as the major mechanism in the unsaturated zone, as stated in the Permittees' July 13, 2007 letter of submittal for the Plan.

Investigation activities have demonstrated that vapor-phase VOCs and tritium are present at high concentrations immediately overlying the basalt in the northeastern end, the south-central portion, and the western portion of MDA G. As indicated by Stauffer, et al. (2005), water is also pooled at the top of the basalt at a depth of approximately 300 feet below ground surface (6430 feet mean sea level) due to reduction in permeability at the interface between the Guaje Pumice and the Cerros del Rio basalt. According to Henry's law, the vapor-phase VOCs and tritium in the subsurface will partition into the liquid phase until equilibrium is achieved. The unique characteristic of phase exchanges for volatile contaminants during their transport in the vadose zone creates a worst-case scenario, under which the vapor-phase VOCs and tritium that currently overly the basalt may quickly migrate downward toward the regional aquifer.

Many VOCs detected in the subsurface pore gas beneath 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 Cerros del Rio basalt. Vapor-phase VOCs, such as trichloroethylene (TCE) and tetrachloroethylene (PCE), are currently 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. There is a considerable amount of uncertainty in evaluating the fate and transport of the VOC- and tritium-equilibrated liquid phase. A bromide tracer test conducted by the Permittees at the Los Alamos Canyon low-head weir has demonstrated that fracture flow and transport occurs through the Cerros del Rio basalts under pooled conditions (LANL 2005). This indicates that the fractured Cerros del Rio basalt provides preferential pathways for fast transport of the contaminant-equilibrated liquid phase to the regional aquifer.

In addition, as recently recognized by the Permittees (LANL 2007, *Technical Area 54 Well Evaluation and Network Recommendations,* LA-UR-07-5042), the VOC- and tritium-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 Cerros del Rio 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 more rapid transport of vapor-phase VOCs and tritium to the regional aquifer south of MDA G.

Consequently, as long as VOCs and tritium reach the top of the basalt, even in the vapor phase, the worst-case scenario as described above is likely to occur, resulting in quick transport of these contaminants downward to the regional aquifer. The vapor-phase monitoring data measured from BH-15-2 and BH-15-3 confirm that certain VOCs and tritium have already migrated to as deep as 700 feet beneath MDA G. The regional groundwater table is projected to be located within the basalt approximately at 900 feet beneath MDA G. Furthermore, the groundwater samples collected from wells R-22, R-20, R-32 and R-23 provide direct evidence that tritium, toluene and benzene, as well as nitrate, have reached regional groundwater in the vicinity of MDA G.

The Permittees must therefore incorporate the worst-case scenario, as indicated above, to establish a conceptual site model for illustrating potential contaminant migration to the regional aquifer at MDA G. The conceptual site model must be used to direct development of the site-specific fate and transport models in the CME report to quantify the potential impact of contaminants at MDA G on regional groundwater, so that appropriate remedies can be evaluated and selected for MDA G.

2. **Position of the Regional Groundwater Table**

The Plan proposed the regional groundwater table being within the Puye Conglomerate as part of the conceptual site model for MDA G (Figure 2.7-1 in the Plan). This projection, however, is contrary to the water table data observed from regional wells R-22, R-21 and R-32, which are located, respectively, to the east, northwest and southwest of MDA G. All data measured from the three wells show that the regional groundwater table intercepts the Cerros del Rio basalt. Based on these data, the Permittees have already projected the regional groundwater table beneath MDA G within the basalt, as documented in all three references mentioned in Comment 1. The Permittees must correct the conceptual site model to make it consistent with the field observations. Alternatively, the Permittees must provide field evidence to support the proposed conceptual site model.

3. **Soil Vapor Extraction (SVE) Pilot Test**

The Plan proposed to conduct a SVE pilot test for evaluating the effectiveness of the system in removing organic vapor from the subsurface and providing data to design a final remedial system. The Plan listed several technical issues that will be addressed in the pilot study. To facilitate design of a full-scale SVE system for efficient and cost-effective removal of VOCs and tritium, NMED imposes the following additional requirements when the Permittees perform the pilot test:

a. *Zone of Capture*. The Permittees must collect data in the pilot test to define the zone of capture for an extraction well. The zone of capture is the volume enclosed within the maximum radial distance induced by vacuum imposed through an extraction well, where a minimal pore-gas velocity (such as 0.01 cm per second as defined by a Department of Energy report (Dixon and Nichols, 1996, *Soil Vapor Extraction System Design: A Case Study Comparing Vacuum and Pore Gas Velocity Cutoff Criteria,* Savannah River National Laboratory)) can be maintained. Site-specific air permeability data must be obtained at MDA G and used to estimate the zone of capture for an extraction well. Capture zone data are critical to adequately space extraction wells in designing a full-scale system for efficient and cost-effective removal of vapor-phase VOCs and tritium beneath MDA G. Determining the space between extraction wells is also a prerequisite to estimate the cost for implementing a full-scale SVE system at MDA G.

b. *Screen Interval*. The vapor-phase plumes beneath MDA G are distributed in various geologic strata. This is an important consideration because the Tshirege Member and Otowi Member of the Bandelier Tuff are characterized by air permeability significantly lower than the Cerro Toledo interval and Guaje Pumice Bed. Screening an extraction well across two strata having significantly different permeabilities will result in gas flow being directed mainly through the strata with greater permeability, thereby limiting removal of contaminants that are trapped within strata of lower permeability. Because the screened interval of an extraction well plays an important role in governing gas flow through geologic strata, the pilot test must be conducted by installing more than one extraction well in units of variable permeability. Each of the extraction wells must be used to induce vacuum in a distinct stratum to demonstrate the effectiveness of SVE in removing contaminants from different subsurface strata. The screened intervals must also be installed at appropriate depths to avoid short-circuiting of air flow.

c. *Observation Wells.* To adequately monitor vacuum influence and estimate removal efficiency of the pilot SVE, at least three monitoring wells are required for adequate monitoring of each extraction well, as suggested by U.S. EPA (1992, *Evaluation of soil Venting Application*, EPA/540/S-92/004). At least one of these wells should be placed near the associated extraction well because of the logarithmic decrease in vacuum with distance.

d. *Operation Time.* The Permittees proposed that the extraction phase of the SVE pilot test will be operated for up to 30 days. This predetermined operation time may or may not be long enough to evaluate the mass transfer limitations that will ultimately determine the remediation time needed to meet the cleanup criteria. As demonstrated in the pilot test conducted by the Permittees at MDA L, an increase in vapor-phase concentrations was observed over time following termination of venting operation. Diffusive release from zones of lower permeability likely caused the concentration rebound because mass transfer is slow in comparison to vacuum-induced gas flow. The time required to lower the vapor contaminant concentrations below the cleanup criteria increases with the proportion of contaminants that are not exposed to direct bulk gas flow. To evaluate the influence of mass transport limitations on the remediation time, the Permittees must conduct the pilot test long enough until mass transport limitations are understood and their influence resolved.

e. *Tritium Contamination.* Because tritium is mixed with VOCs in the subsurface, and is present at significant concentrations in vapor phase beneath MDA G, exhaust gas extracted from the extraction wells in the pilot test will consist of not only organics, but also tritium. The Permittees should evaluate the anticipated emissions and any necessary methods for treatment of tritium in the pilot study. Tritium removal efficiency should also be evaluated and included as part of the pilot test to facilitate a full-scale system design.

The Permittees must incorporate the above comments into a revised Plan, and submit it to NMED no later than October 15, 2007. To implement the SVE pilot study that has been proposed in the Plan, the Permittees must submit a separate work plan for implementing the SVE pilot test to NMED for approval no later than October 25, 2007. The pilot test work plan must include all details to address the requirements listed in Comment 3.

Should you have any questions or comments, please contact Dave Cobrain at (505) 476-6055 or Hai Shen at (505) 476-6039.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

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file: Reading and LANL TA-54 (MDA G, SWMU 54-013(b))