Response to the "Notice of Disapproval, Pajarito Canyon Investigation Report, Los Alamos National Laboratory, EPA ID No. NM0890010515, HWB-LANL-08-035" Dated November 21, 2008

INTRODUCTION

This is the response to the New Mexico Environment Department's (NMED's) notice of disapproval (NOD) of the "Pajarito Canyon Investigation Report," dated November 21, 2008 (NMED 2008, 103803). To facilitate review of this response, NMED's comments are included verbatim. The comments are divided into general and specific categories, as presented in the NOD. Los Alamos National Laboratory's (LANL's or the Laboratory's) responses follow each NMED comment. This response contains data on radioactive materials, including source, special nuclear, and byproduct material. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with U.S. Department of Energy (DOE) policy.

GENERAL COMMENTS

NMED Comment

1. *Figures D-2.2-1 through D-2.2-207 (inclusive) show that several of the groundwater and surface water samples indicate concentration increases for various constituents in calendar year 2007. Concentrations of boron, barium, nitrate plus nitrite, perchlorate, tritium and uranium-234 increased the most frequently. Increased concentrations of chlorinated volatile organic compounds (VOCs) and/or 1,4-dioxane were also detected during various early-, mid-, or late-2007 timeframes at some sampling locations. The increases vary in magnitude by sample location and constituent.*

   The Report does not adequately discuss the data contained in the figures, especially its importance relative to canyon media impacts. Additional discussion of these data must be provided in Section 7.2.2 of the Report. The Permittees must include discussion of how the data do or do not provide support for future decisions at various Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) located within the Pajarito Canyon watershed.

LANL Response

1. The Laboratory provided additional discussion in Section 7.2.2, as appropriate, for those constituents that are identified as contaminants in the watershed. The following text was added to Section 7.2.2, paragraph 1: "Many of these constituents have been identified infrequently. Other constituents plotted in Appendix D, including barium and boron, show variations in concentrations over time, but the variability is within background for each groundwater zone and likely attributable to analytical variability. Constituents that are detected infrequently or at concentrations near background are not discussed further in this section."

The last two paragraphs of Section 1.1 discuss how data in this report provide support for future decisions at various SWMUs and AOCs located within the Pajarito Canyon watershed.

NMED Comment

2. *VOCs were not evaluated in the assessment; the stated rationale was that VOCs are not a significant pathway. Given the low detection frequencies and low concentrations of VOCs, the exclusion of VOCs appears acceptable. As noted in United States Environmental Protection Agency (USEPA) guidance for ecological risk assessments, VOCs can pose a potentially significant exposure pathway to wildlife through the inhalation of contaminated subsurface burrow air. In a recent study (Using Artificial Burrows to Evaluate Inhalation Risks to Burrowing Mammals, Integrated Environmental Assessment and Management Volume 4 Number 4, October 2008), artificial burrows can be used to assess burrow atmospheres to estimate risk for burrowing animals. The use of the artificial burrows was found to minimize uncertainty and was a cost effective way to collect data to assess this pathway. While VOCs are not a major concern for Pajarito Canyon, this study may be useful at other LANL sites where VOCs are a primary constituent of ecological concern. Other than considering the comment prior to developing future investigation reports for other LANL canyon watersheds, no response to the comment is required.*

LANL Response

2. No response to the comment is required.

NMED Comment

3. *A primary concern with the human health risk assessment in the Report is that risks were evaluated for the receptor at specific locations. The conclusion of the Report is that since a person would not be exposed to contaminant levels that represent an unacceptable risk at a specific location, no additional action or controls are required. However, the Report does not address exposure to a person across multiple locations. With the exception of location TWN-1E, all risks were within acceptable levels for a residential scenario. Discussion must be added to the Report concerning whether risks would be different if exposure areas were to include a larger area than just a specific sample location.*

LANL Response

3. To address this requirement, the Laboratory added the following text to Section 8.2.3.1:

> Exposures to the recreational user are evaluated at the scale of sediment investigation reaches or water-sampling location. This local-scale evaluation is protective compared with an assessment based on a more realistic scale encompassing numerous reaches and areas between reaches because it is biased to areas close to sources with the highest concentrations of contaminants. Average concentrations calculated over larger spatial scales and associated risk would be lower.

The Laboratory also added the following text to Section 8.2.3.3:

> The assessment is protective, and thus likely overestimates risks to the recreational user, by assuming that all exposures occur within sediment investigation reaches (roughly 200 m in length) and from specific water-sampling locations, including areas closest to contaminant sources. Risks calculated for more realistic exposures from multiple reaches or water locations within the watershed are therefore expected to be lower.

NMED Comment

4. For the recreational scenario, risks were determined separately for sediment and surface water. However, a recreational user could be exposed to contaminants in both sediment and surface water. While it is noted that exposure to sediment is the primary pathway of concern, cumulative risk must be assessed. The Permittees must revise the Report to include cumulative risk for the recreational scenario.

LANL Response

4. Cumulative risks from sediment and surface water were summed and included in the "Pajarito Canyon Investigation Report" (PCIR) (LANL 2008, 104909), presented as multimedia sums (see pp. 79 and 83 and Tables 8.2-7 and 8.2-10), but the text concerning this topic is brief. To clarify the text, the following statement is added to the first paragraph of Section 8.2.3.1: "Cumulative risks resulting from multimedia exposures to sediments and persistent surface water are evaluated." In addition, the first sentence of the third paragraph of Section 8.2.5 is revised to include "cumulative."

NMED Comment

5. The Work Plans discussed in various Specific Comments below may be combined into a single Work Plan that addresses all items discussed in the Specific Comments.

LANL Response

5. Work plans for specific media are discussed in responses to Specific Comments 20, 21, 22, 23, and 24.

SPECIFIC COMMENTS

NMED Comment

1. Section 3.4, Deviations from Planned Activities, third paragraph, page 13:

Permittees' Statement: *"The work plan calls for two characterization sampling rounds of the alluvial wells. The results from only one round of sampling from the seven newly installed alluvial wells are available for this report. The new alluvial wells will be sampled on a quarterly basis to provide sufficient data to support an evaluation of future monitoring needs."*

NMED Comment: *The Permittees must follow the monitoring schedules for the Pajarito Watershed proposed in the approved 2008 Interim Facility-Wide Groundwater Monitoring Plan (2008 IFGMP).*

LANL Response

1. Section 3.4 is modified to read, "Future sampling of the alluvial wells will follow the monitoring schedule in the most current update to the "Interim Facility-Wide Groundwater Monitoring Plan" (IFGMP).

NMED Comment

2. Section 5.2, Human Health Screening Levels, first paragraph, page 17:

It is noted that if New Mexico soil screening levels (NMED SSLs) were not available, either EPA Region 6 media-specific screening levels (MSSLs) or EPA Region 9 preliminary remediation goals (PRGs) were applied. It is assumed that these criteria were applied as the risk assessment portion of this Report was completed prior to July 2008. Note that for future risk evaluations and future updates to this risk assessment, the new Regional Screening Levels (RSLs) supersede the previously used MSSLs and PRGs. The RSLs are available at: http://www.epa.gov/region09/waste/sfund/prg/rsl-table.html. Other than acknowledgement and use of the RSLs in updating this risk assessment and future risk assessments prepared by the Permittee, no specific response to this comment is required.

LANL Response

2. The Laboratory acknowledges NMED's direction to update residential screening levels for future assessments using the most current EPA guidance. In addition, to clarify the source of screening levels used in this report, the following text is revised in Section 5.2: "For analytes for which NMED does not provide a soil screening level (SSL), the residential screening value from the EPA regional screening level tables (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) is used as the SSL." Note that the inserted text cites the EPA Region 6 URL only, and the reference to Region 9 URL was deleted.

NMED Comment

3. Section 5.2, Human Health Screening Levels, second paragraph, penultimate and last sentence, page 17:

Permittees' Statement: *"The screening values for radionuclides in groundwater were calculated based on a target dose limit of 4 [millirem per year] mrem/yr, which is the radiation dose limit for a public drinking water supply in [Department of Energy] DOE Order 5400.5, Radiation Protection of the Public and the Environment. The screening values for radionuclides in surface water were calculated based on a target dose limit of 100 mrem/yr, which is the radiation dose limit for the general public from all sources in DOE Order 5400.5, Radiation Protection of the Public and the Environment."*

NMED Comment: *The target dose limit for the general public is 100 mrem/yr. While this value is based upon DOE Order 5400.5, this order also states (Section I.4) that "…doses to individuals be within the appropriate dose limits for the individuals and that all exposures be ALARA [as low as reasonably achievable]." The Permittees must clarify that in addition to evaluation of dose, an evaluation was conducted to ensure that the principles of ALARA are also being met.*

LANL Response

3. Because calculated dose to a recreational user is <3 millirem per year (mrem/yr) (maximum = 1.2 mrem/yr, Table 8.2-10), no quantitative as low as reasonably achievable (ALARA) evaluation is required per the Laboratory's Environmental ALARA Program. To address this comment, the Laboratory added the following paragraph to Section 8.2.5.3, Radiation Dose:

> The Laboratory's Environmental ALARA (As Low As Reasonably Achievable) Program states that "quantitative ALARA evaluations are not necessary for Laboratory activities that have a potential for public exposure that is less than a 3-mrem TEDE [total effective

dose equivalent] individual dose" (LANL Program Description PD410, p. 7). The maximum calculated radiation dose for the recreational user is 1.2 mrem/yr for exposure to sediment in reach THS-1E (Table 8.2-10). Consequently, no further quantitative ALARA evaluation of radiation exposure is required.

NMED Comment

4. Section 7.2.1 Hydrologic Conceptual Model, pages 40 through 44:

The Report does not include updated hydrogeologic cross sections reflecting currently available subsurface information. The Permittees must submit five west to east, and three north to south, hydrogeologic cross sections illustrating the geologic units and contacts, structures (e.g., faults), and areas of suspected or known infiltration and recharge to units beneath the canyon bottom. The cross sections must show zones of alluvial and intermediate saturation and the regional aquifer water table. COPCs detected at each sampling point within the intermediate aquifers and the regional aquifer, major-ion chemistry for each ground-water sampling point as represented by Stiff diagrams, canyon-bottom SWMUs and AOCs, and superimposition of material disposal areas (MDAs) C, H, L, and G must also be shown on the cross sections.

West to east transects must include: 1) from the topographic high of the watershed above PC Spring to R-18; 2) R-18 to R-17; 3) R-17 to TA-18; 4) TA-18 to PCAO-8; and, 5) PCAO-8 to the Rio Grande. North to south transects must include: 1) from MDA C to near the head of Threemile Canyon; 2) from MDA H to Potrillo Canyon; and, 3) from MDA G to Fence Canyon.

Additionally, the Permittees must revise the Report to include a more detailed description of the contaminant-transport and hydrochemical conceptual models with respect to the groundwater flow system. The description must include such items as contaminant behavior (e.g., water-rock interactions), mobility from the alluvial aquifer to intermediate aquifers (e.g., pathway analysis) and to the regional aquifer, dilution and dispersion, and ground-water mixing ratios. Analysis tools would include comparing major-ion and trace element chemical characteristics (e.g., Piper diagrams), compositional variability and distribution of tracers (e.g., stable isotope ratios), groundwater temperature variability, and groundwater age distributions and gradients. See also Specific Comment 31 below

LANL Response

4. Based on recent meetings with NMED, the Laboratory updated the existing longitudinal cross-section down the axis of Pajarito Canyon (Figure 7.2-1) with new well data collected since the original version of the report was issued. Stiff diagrams showing broad patterns of major ion chemistry were added to the longitudinal section. As agreed upon in recent meetings with NMED, four new north-to-south cross-sections were added to the report (Appendix O), and additional discussion was added throughout Section 7.2 about findings from new wells that were not available when the original report was prepared. Contaminant distributions and pathways are discussed throughout Section 7.2. The four new cross-sections, including Stiff diagrams, are included with supporting text in new Appendix O. Additional evaluation of geochemical data is anticipated in future reports related to Technical Area 54 (TA-54).

NMED Comment

5. Section 7.2.1.2 Alluvial Groundwater, first paragraph, first sentence, page 41:

Permittees' Statement: *"The shallow alluvial groundwater body in Pajarito Canyon extends from below the confluence with Twomile Canyon to approximately regional well R-23, a distance of 7 km."*

NMED Comment: *Though spatially restricted, alluvial ground water is present in Pajarito Canyon upstream of the Twomile Canyon confluence and extends up-canyon to the Starmer and Homestead source-water springs. The Permittees must revise the statement to more accurately reflect site conditions.*

LANL Response

5. The Laboratory revised Section 7.2.1.2 with the following replacement text:

> The primary alluvial groundwater body in Pajarito Canyon extends east from below the confluence with Twomile Canyon to approximately regional well R-23, a distance of 7 km (4.4 mi). Spatially restricted bodies of alluvial groundwater are also present west of the Twomile Canyon confluence and extend upcanyon to springs in the south fork of Pajarito Canyon (Upper Starmer Spring) and Pajarito Canyon above the south fork confluence (Homestead Spring).

NMED Comment

6. Section 7.2.1.5 Regional Aquifer Hydrology, first paragraph, fourth sentence, page 43:

Permittees' Statement: *"Groundwater flow and contaminant transport directions in this zone generally follow the gradient of the regional water table; the flow is generally northeastward beneath the eastern section of Pajarito watershed southeastward beneath the western section of Pajarito watershed (Figure M-1)."*

NMED Comment: *The reference to a Figure M-1 may represent a typographical error since Appendix M of the Report does not contain a Figure M-1. With respect to contaminant transport directions, the Permittees must provide a reference for the statement. Based on the regional water-table map as presented on Figure M-2.0-1, groundwater flow direction beneath the eastern and western sections of the Pajarito Canyon watershed would be to the southeast and east, respectively, not northeastward and southeastward as referenced in the statement. Revise the statement to reflect site conditions. See also Specific Comment 31 below.*

LANL Response

6. The reference to "Figure M-1" was a typographical error and is changed to Figure M-2.0-1 in Section 7.2.1.5.

   The Laboratory revised text in Section 7.2.1.5 to correct the direction of groundwater flow to the southeast and east.

NMED Comment

7. Section 7.2.1.5 Regional Hydrology, first paragraph, fifth sentence, page 43:

Permittees' Statement: *"The ambient regional groundwater flow gradients are relatively high to the east (close to the Pajarito Fault zone) and to the west (close to the Rio Grande), varying between 0.003 and 0.01 [meters per meter] m/m."*

NMED Comment: *The directional terms used in the statement have been reversed. Revise the statement to reflect site conditions and provide a reference for the stated gradient range.*

LANL Response

7. The Laboratory revised the indicated sentence in Section 7.2.1.5, as follows: "The ambient regional groundwater flow gradients are relatively high to the west (close to the Pajarito Fault zone) and to the east (close to the Rio Grande), varying between 0.003 and 0.05 m/m (the gradients are computed based on the water-level contours presented in Figure M-1.0-1)."

NMED Comment

8. Section 7.2.1.5 Regional Hydrology, first paragraph, penultimate and last sentences, page 44:

Permittees' Statement: "*The preliminary water-level data from R-37 indicate that the applied water-table map may need to be updated. The new water-level data from R-37 and other new regional monitoring wells should be applied to update the regional water-table map and characterize better the flow directions in the regional aquifer."*

NMED Comment: *NMED agrees that the regional map must be updated to include the new well information. These updates are required to be included in the annual update of the IFGMP due on March 31, 2009 in accordance with Section IV.A.2 of the Consent Order.*

LANL Response

8. The Laboratory added new Figure M-2.0-1 to Appendix M showing a revised regional water-table map that includes all new data that were available at the time the revised report was prepared. Water-table maps are updated annually in the Laboratory's "Hydrogeologic Site Atlas," rather than in the IFGMP. Updates of the water-table map for individual wells are ongoing as new wells are installed, and applicable updates will also be included in various reports concerning TA-54.

NMED Comment

9. Section 7.2.2.2 Organic Chemicals in Water; Toluene, Acetone, and Bis(2-ethylhexyl)phthalate, first paragraph, page 51:

During rehabilitation efforts at R-20, toluene was detected on ten occasions during 2006 and 2007 (see RACER database at http://www.racernm.com/). During 2008, dedicated pumps were installed at screens 1 and 2 and the well was sampled on two occasions. Results for these two sampling events are not presented in the Report, but are available in the RACER database. The Permittees must provide these results along with discussion concerning the presence or absence of toluene. Since the dedicated pumps were installed, collected samples have not shown the presence of toluene.

Additionally, as noted in the RACER database, toluene was detected at R-32 on December 14, 2007 and March 4, 2008. These results are not discussed in this Report section and the Permittees must provide additional discussion concerning the presence and significance of toluene at this location.

LANL Response

9. The Laboratory revised Section 7.2.2.2 to include additional discussion concerning detected toluene results at wells R-20 and R-32 in the second paragraph under the heading "Toluene, Benzene, Acetone, and Bis(2-ethylhexyl)phthalate."

NMED Comment

10. Section 7.2.2.3 Radionuclides in Water; Tritium in Vadose-Zone Pore Water and Perched Intermediate Zones, pages 51 - 53:

The Permittees must provide discussion concerning the migration of tritium releases at MDAs C, H, L and G with respect to the presence of anthropogenic tritium at wells R-23, R-23i and R-32.

LANL Response

10. The following text is added to paragraph 4 of Section 7.2.2.3: "Potential tritium sources in the upper watershed include TA-03, TA-09, and atmospheric releases from the TA-16 tritium facility. In the middle and lower portions of the watershed, tritium has been measured in pore water and in the vapor phase in the vadose zone beneath MDA C at TA-50 and MDAs H, L, and G at TA-54. Also, there may have been unknown sources of tritium at TA-18." Because of its multiple possible sources in Pajarito and nearby watersheds, tritium in wells R-23, R-23i, and R-32 cannot be uniquely tied to specific release sites such as MDAs C, H, L, and G. Site-specific investigations are being conducted to assess contaminant migration (including tritium) from MDAs C, H, L, and G.

NMED Comment

11. Section 7.2.2.3 Radionuclides in Water, Tritium in Vadose-Zone Pore Water and Perched Intermediate Zones, second paragraph, page 52:

The Permittees must provide discussion concerning the source(s) of tritium detected in the vadose zone at R-17 and R-20.

LANL Response

11. Text was added to paragraph 4 of Section 7.2.2.3 to discuss potential tritium sources. Also, Section 7.2.2.3, "Tritium in Vadose-Zone Pore Water and Perched Intermediate Zones," was revised to include additional discussion of tritium detected in the vadose zone during drilling of well PCI-2, which is adjacent to well R-17. As discussed with NMED, the source of tritium in the vadose zone at wells R-17 and R-20 is not known from available data. Ongoing investigations at TA-54 and for the aggregate areas will provide additional data that should help identify potential tritium sources.

NMED Comment

12. Section 7.2.2.3 Radionuclides in Water, Tritium in the Regional Aquifer, fourth paragraph, page 53:

Permittees' Statement: *"One liter or killigram of water contains 55.6 moles of water, with 6.17 moles comprising two hydrogen atoms, which are 3.72 × 1024 atoms of hydrogen."*

NMED Comment: *Replace "killigram" with "kilogram".*

LANL Response

12. The paragraph containing this typographical error was deleted as part of the revision of this investigation report.

NMED Comment

13. Section 8.1.1.2, Literature for Known Ecological Effects, pages 58 and 59:

As noted in the Pajarito Canyon Biota Investigation Work Plan (Table D-6.0-1, COPECs by Analytical Suite), polynuclear aromatic hydrocarbons (PAHs) are identified as contaminants of potential ecological concern (COPECs) for several receptors including the American robin, plants, Montane shrew, earthworm, and deer mouse. Table D-6.0-1 indicates that PAHs are a preliminary COPEC, pending evaluation of additional data from sampling of TWN-1E. The discussion of PAHs provided in Section 7.1.2.2 (pages 30 and 31) of the Report indicates that PAHs were detected. While there is some uncertainty associated with the average concentration of PAHs due to infrequency of detection, there are suspected sources for PAHs due to site activities; PAHs must be included in the ecological assessment for appropriate receptors. The Permittees must clarify the rationale used to determine how PAHs were or were not retained as a COPEC for the above receptors.

LANL Response

13. The Laboratory added more discussion in Section 8.1.1.1 (Refinement of COPEC List) to explain that resampling of one anomalous location for polycyclic aromatic hydrocarbons (PAHs) demonstrated that PAH levels in the Pajarito watershed were within the range observed in the Los Alamos, Pueblo, and Mortandad watersheds, and further evaluation in the baseline ecological risk assessment was not needed. The Laboratory directly compared results with the original sample, the resample, and other samples from this geomorphic unit. The Laboratory added key text from the NMED-approved "Pajarito Canyon Biota Investigation Work Plan" (LANL 2006, 093553) that addresses this topic to the revised report, specifically from p. B-5, second paragraph, and p. D-2, second full paragraph, of the biota plan.

The following text is added to Section 8.1.1.1, after the third paragraph:

> As discussed in Appendix D of the approved biota investigation work plan (LANL 2006, 093553, p. D-2), no PAHs were retained as COPECs for the purpose of developing the biota studies. All of the PAHs identified as COPECs in soil (acenapthene, benzo[a]anthracene, benzo[a]pyrene, chrysene, fluoranthene, fluorene, and naphthalene) were found at concentrations exceeding 3 times the ESL associated exclusively with one sample in reach TWN-1E, sample CATW 05-61617 from coarse-grained sediment in the c1 geomorphic unit (LANL 2006, 093553, p. B-5). The concentrations of these PAHs

detected in this sample are approximately 100-fold higher than in all other samples within this reach, including the deeper sample from the same location; the detected concentrations also exceed the highest concentrations detected in canyon bottoms in the watersheds of Mortandad, Los Alamos, and Pueblo Canyons. Therefore, these concentrations are potentially anomalous results, and the nature of PAH contamination within reach TWN-1E was considered uncertain, pending resampling of this location. As discussed in the "Summary of Pajarito Canyon Phase 2 Sediment Investigations" (LANL 2007, 095408, p. 4), the resample and two additional samples from this unit in 2006 yielded much lower results for benzo(a)anthracene and benzo(a)pyrene, and naphthalene was not detected. Reach TWN-1E is below large paved areas in TA-03, and the anomalous results from 2005 may have included analysis of a fragment of asphalt. These results indicate that no additional analyses for PAHs are required to evaluate potential for ecological risk from sediments in TWN-1E, and no PAHs were retained as study design COPECs in soil.

NMED Comment

14. Section 8.1.1.3, Conceptual Exposure Model, pages 59 and 60:

The evaluation of the surface water pathway is unclear as presented in the Report. As noted in Section 8.1.1.1 (page 56, second paragraph) "No study design COPECs were retained for the evaluation of surface water data because most aquatic COPECs…are also sediment COPECs..." However, Section 8.1.1.3 of the Report indicates that alluvial groundwater mixes with surface water and that surface water COPECs would also include alluvial groundwater COPECs. While COPECs for both surface water and sediments may be similar, various receptors are exposed to both sediment and surface water. It appears that while surface water was identified as a complete pathway, the pathway was not qualitatively assessed. Sufficient justification for exclusion of surface water has not been provided. The Permittees must revise the Report to include uptake and ingestion of surface water or provide additional justification for the exclusion of this pathway.

LANL Response

14. The Laboratory added text to the end of Section 8.1.1.3 to enhance discussion of surface water (which is a complete pathway) and justify its exclusion. The additional text cites previous reports to support this justification, with reference to specific page numbers (e.g., p. D-2 of the Pajarito biota plan; the plan did not call for studies of wildlife drinking water, only sediment, and PCIR is therefore consistent with it). Footnote "c" is added to Table 8.1-1 concerning surface water, referencing the biota plan: "Sediment media: Because the aquatic ecosystem in this watershed consists primarily of sediment-dwelling organisms, the field and laboratory studies that address these COPECs in sediment are considered adequate to address potential ecological risk from these COPECs in water."

    The following text is added to the end of Section 8.1.1.3:

    The screening of water data from stations in the Pajarito watershed against aquatic ESLs in Appendix B, Section B-7.0 of the approved biota investigation work plan (LANL 2006, 093553, p. B-7), showed HQs greater than 3 for several inorganic chemicals. As discussed in the biota plan, aluminum and barium are unlikely to be Laboratory-related COPECs in water, based on their ubiquitous distribution (LANL 2006, 093553, p. B-7); these COPECs were not used to select the reaches for aquatic studies. Manganese and iron also had HQs greater than 3 in a more limited area; these COPECs were retained as study design COPECs for water. Because the aquatic ecosystem in this watershed

consists primarily of sediment-dwelling organisms, the field and laboratory studies that address these COPECs in sediment are adequate to address potential ecological risk from these COPECs in water (LANL 2006, 093553, pp. D-2-D-3). Two radionuclides were retained as study design COPECs in water (radium-226 and radium-228) but are not sediment COPECs. The minimum ESLs for these radionuclides in water are based on green algae, an organism that inhabits the water column. However, the concentrations of these two radionuclide COPECs in water are the same or less than their concentrations in water from the Mortandad watershed that was used in algal toxicity tests. Therefore, the results of the Mortandad toxicity tests were used to document the lack of ecological effects from radium-226 and radium-228 in the Pajarito watershed (LANL 2006, 093553, p. D-3). In summary, although surface water represents a complete exposure pathway to biota, additional field and laboratory studies of surface water are not needed to quantity the potential for ecological risk from this pathway.

NMED Comment

15. Section 8.1.2.2, Nest Box Studies, pages 61 and 62:

Due to small sample sizes, egg and insect samples were only analyzed for metals. In reviewing concentrations of various contaminants in insects as provided in the Pajarito Canyon Biota Investigation Work Plan, it is noted that metals represent a large percentage of detected concentrations. However, polychlorinated biphenyls (PCBs) and semi-volatile organic compounds (SVOCs) were also detected in insects. With only data for metals, there is no way to assess what contaminants have the greatest impact on the nest box studies. The Permittees must discuss the uncertainty associated with the nest box studies being based solely on a qualitative analysis for metals.

LANL Response

15. The Laboratory expanded discussion of this topic in the uncertainty section, 8.1.4.2. The Laboratory added the following discussion of specific chemicals of potential ecological concern (COPECs) without data for specific endpoints to the end of the second paragraph of Section 8.1.4.2:

    PCBs (Aroclor mixtures) were not measured in insects, but these analytes were measured in earthworms and the results were used in the exposure analysis for insect-eating birds and mammals. It is likely that the earthworm PCB results represent a protective estimate of exposure from eating insects, which are likely to represent a larger spatial area and therefore lower concentrations. The same situation exists for mercury; sample results were obtained from earthworms but not from insects. However, no sample results were obtained for perchlorate or 2,3,7,8-TCDD (dioxin) for earthworms or insects. The main uncertainty for perchlorate is the lack of toxicity information and is discussed further below. As discussed in Section 7.1.2.5, dioxin has both Cerro Grande fire and Laboratory sources and the area of greatest dioxin concentrations is of limited spatial extent in reach TW-1E. The potential of risks to insect-eating mammals is uncertain in this one reach but is based on the average concentrations of dioxins, and the potential for adverse effects on mammal populations is small.

    The last two sentences of Section 8.1.5 were revised and also address this uncertainty.

NMED Comment

16. Section 8.1.3.2, Concentrations of COPECs in Prey for the Southwestern Willow Flycatcher, pages 65 and 66:

The hazard quotients (HQs) for the insect or earthworm pathway generally predicted a lower potential adverse ecological effect than the screening against the ecological screening levels (ESLs). However, as noted in Section 8.1.2.2, insect samples from the nest box studies only included the analysis of metals. Thus, the calculated HQs for insects most likely are an underestimation of actual risk because the HQs do not take into account organics in insects. The Permittees must discuss this uncertainty and how the exclusion of organic data in insects may affect subsequent evaluation of HQs.

LANL Response

16. The Laboratory expanded discussion of this topic in the uncertainty section, 8.1.4.2. The Laboratory also added more discussion of specific COPECs without data for specific endpoints. See the new text in the response to Specific Comment 15 above.

NMED Comment

17. Section 8.2.1, Problem Formulation, pages 77 and 78:

A child recreational user was deemed not appropriate for the study area due to the steepness of many parts of the canyon and due to restricted access. However, unless controls are, or will be, in place limiting all access to a child recreational user, it is reasonable to assume that a child could gain access to areas of Pajarito canyon. The Permittees must revise the risk assessment to include a child recreational user.

LANL Response

17. The original report was incorrect. The child recreational user is incorporated in the assessment, by using the Laboratory's recreational SSLs (LANL 2007, 094496). The recreational SSLs include the child extended backyard exposure; the noncarcinogenic SSLs represent the child and the carcinogenic SSLs include the adult and child exposures over the exposure period. References to the recreational SSL document were added throughout Section 8.2. Also, throughout Section 8.2, text is added to clarify that the recreational user includes both the adult trail user and the child extended backyard exposures.

NMED Comment

18. Section 8.2.3.1, Exposure Scenario Description, page 80:

Exposure to storm water was not assessed since the frequency of exposure is not sufficient to sustain chronic exposures. Based upon a review of storm water data, significant concentrations of contaminants have been detected. The Permittees must discuss the potential for exposure to storm water and associated acute effects due to accidental or incidental ingestion and dermal exposure.

LANL Response

18. A new section, 8.2.6.4, was added to discuss stormwater data and potential acute effects. This section includes two new tables, Tables 8.2-15 and 8.2-16, that present and assess stormwater data. Text in Section 8.2.3.1, paragraph 1, is revised to state the following:

    > Stormwater concentration data are compared with applicable standards and summarized in Section 6. Arsenic, Aroclor-1254, and Aroclor-1260 have potential for acute human health effects based on exposure to stormwater. These analytes are assessed in a qualitative manner in Section 8.2.6.4. Stormwater is not included as part of the quantitative human health risk assessment because stormwater is transient and does not occur frequently enough to sustain chronic exposures.

    To support the assessment of potential acute effects, a new section is also added to Appendix E (E 2.5, Acute Stormwater Screening Levels). In addition, Section 6.5 was added, and it presents the process for screening analytical results obtained from stormwater samples.

NMED Comment

19. Section 8.2.4, Toxicity Assessment, pages 81 and 82:

It is noted in the text that screening levels applied for the risk assessment were taken from sources dated 2004 to 2006 and that updates to toxicity data may have occurred. It is the responsibility of the Permittees to evaluate the appropriateness of screening levels and to assess whether updated toxicity data should be applied. Available guidance provides equations for calculating site-specific screening levels or for updating levels with new data. The Permittees must provide a discussion of the appropriateness of using screening levels in this assessment that are based on outdated toxicological data. In addition, it was noted that the differences in slope factors and reference doses were to be provided in Tables 8.2-9 and 8.2-10. The tables do not contain these comparisons. The Permittees must provide these data.

LANL Response

19. The Laboratory retained the use of published media-specific screening values in this report but also reviewed EPA's Integrated Risk Information System (IRIS) to see if any changes have been made that have not yet been incorporated in NMED, EPA, or Laboratory documents. The Laboratory added a discussion of changes in IRIS to Section 8.2.4 (Toxicity Assessment) and added Section 8.2.6.3 (a discussion of toxicity assessment uncertainty). The Laboratory also deleted the incorrect reference to Tables 8.2-9 and 8.2-10 (a typographical error).

NMED Comment

20. Section 9.0, Conclusions and Recommendations, first paragraph, last sentence, page 86:

Permittees' Statement: "*However, additional monitoring of sediment, surface water, groundwater, and cavity-nesting birds and their food is recommended."*

NMED Comment: *NMED agrees with the appropriateness of continued monitoring and reporting of these media. In the case of groundwater, additional groundwater monitoring must be proposed in the annual updates to the IFGMP and the Pajarito Watershed Periodic Monitoring Report (PMR) are the appropriate documents in which to provide that data. The Permittees must submit a Work Plan which*

includes proposed sampling schedules, proposed sampling by media type, sampling methods, proposed analytical suites, and proposed means of periodically reporting data for all media types discussed above.

LANL Response

20. The Laboratory will submit a sediment sampling and analysis work plan to NMED by October 1, 2009, per the requirement in NMED's letter dated May 27, 2009 (2009, 106046).

    Monitoring of stormwater in the Pajarito watershed is currently addressed through an individual permit with EPA Region 6 (Authorization to Discharge under the National Pollutant Discharge Elimination System [NPDES], NPDES Permit No. NM0030759, February 13, 2009).

    Proposed monitoring of groundwater and persistent surface water will be included in the annual update to the IFGMP, and data will be reported in the Pajarito watershed periodic monitoring reports, as required.

    For cavity-nesting birds, results of plateauwide nest box monitoring were evaluated in support of the Sandia Canyon biota investigation and provide the best framework for further nest box monitoring and determination of data gaps. This evaluation is cited (Fair et al. 2009, 106686) in the revised PCIR, Sections 8.1.4.1 and 8.1.4.2. The need for additional nest box monitoring is discussed in Section 8.1.5 of the revised PCIR. Section 9 of the revised PCIR includes a schedule for submittal of a nest box monitoring plan by December 31, 2009.

NMED Comment

21. Section 9.0, Conclusions and Recommendations, fifth paragraph, last sentence, page 87:

Permittees' Statement: *"However, monitoring of [chemical of potential concern] COPC concentrations transported in sediment should continue, particularly in fine-grained sediment deposited after large flood events that have the highest potential for erosion and downcanyon transport."*

NMED Comment: *NMED agrees with the appropriateness of continued collection and reporting of sediment sample data, including discussions of any contaminant trends. The Permittees must submit a Work Plan which includes proposed sampling schedules, sampling areas by media type, sampling methods, proposed analytical suites, and proposed means of periodically reporting the data and data trends.*

LANL Response

21. The Laboratory will submit a sediment sampling and analysis plan to NMED by October 1, 2009, per the requirement in NMED's letter dated May 27, 2009 (2009, 106046), as discussed in Section 9.0, paragraph 5.

NMED Comment

22. Section 9.0 Conclusions And Recommendations, seventh paragraph, first sentence, page 87:

Permittees' Statement: *"The configuration of wells in the existing monitoring network is considered sufficient to meet the groundwater-monitoring objectives for the watershed for the most part."*

NMED Comment: *The Permittees must install one single completion well intersecting the perched intermediate aquifer penetrated during the drilling of R-17. The aquifer is present at an approximate depth interval of 500-520 feet below ground surface. The Permittees' response must include a proposed schedule for installation, development and completion of the new well such that the well completion report is submitted to NMED on or before July 31, 2009. It is understood that the Permittees' drilling contractor will contact NMED (from the field) in the event subsurface conditions are significantly different than those described above. The Permittees shall sample the new well in accordance with the approved IFGMP.*

LANL Response

22. Well PCI-2 was drilled at the well R-17 location to satisfy this requirement per the "Drilling Work Plan for Intermediate Aquifer Well PCI-2, Revision 1" (LANL 2009, 105409), which was submitted to NMED on March 20, 2009, and approved on March 25, 2009 (NMED 2009, 105359). The Laboratory also drilled a core hole adjacent to well PCI-2 as described in the work plan to investigate tritium (and other contaminants) reported in the original PCIR. Installation of well PCI-2 was completed April 9, 2009 and the well completion report will be provided to NMED in September 2009. Results of these new investigations are summarized in the revised investigation report in Sections 3.2.1, 7.2.1.4, 7.2.2, and Appendix H. Future sampling of well PCI-2 will be conducted in accordance with the approved IFGMP.

NMED Comment

23. Section 9.0, Conclusions and Recommendations, seventh paragraph, third through fifth sentences, pages 87 and 88:

Permittees' Statement: "*However, more work is needed to test the assumption that water-supply wells, in particular PM-4, are adequately protected. This assumption is based on the conceptual site model that contaminated surface water does not infiltrate to deeper groundwater in those parts of Pajarito Canyon that are upgradient of water-supply well PM-4 (e.g., between monitoring well R-17 and water-supply well PM-2). This conceptual model should be tested by collecting additional core in the upper vadose zone near well R-17 to assess whether the reported tritium values for the R-17 core hole (Appendix H) are representative or are in error (possibly the result of sample contamination at the analytical laboratory). In addition, potential infiltration in the canyon segment between well R-17 and supply well PM-2 must be further evaluated by collecting water level data for the new alluvial wells that are installed upstream of well 18-BG-1."*

NMED Comment: *NMED agrees with the statements. The Permittees must submit a Work Plan which describes proposed field work and associated schedule, sampling methods, proposed analytical suites, and proposed means of reporting the collected data. See also Specific Comment 31 below.*

LANL Response

23. The "Drilling Work Plan for Intermediate Aquifer Well PCI-2, Revision 1" (LANL 2009, 105409) was submitted to NMED on March 20, 2009, and approved on March 25, 2009 (NMED 2009, 105359). This work plan included a core hole to address the question of potential tritium reported from the vadose zone during drilling of well R-17. These investigations were recently completed, and the results are included in the revised investigation report (Sections 3.2.1, 7.2.2, and Appendix H; see LANL response to Specific Comment 22). This recommendation was deleted from Section 9 because the work has now been completed.

NMED Comment

24. Section 9.0, Conclusions and Recommendations, last paragraph, page 88:

Permittees' Statement: "*The monitoring well network evaluation will be improved when the analytical data from the new monitoring wells and water-level data are obtained from wells R-37, R-38, R-39, R-40, and R-41, which are currently being installed at or adjacent to TA-54. After the wells are installed, the monitoring well network efficiency may be reevaluated if an updated water table map indicates a groundwater flow direction different from the previous analysis. Flow and transport models supporting the network evaluation will also benefit from an updated geologic model of the area based on observations made at the newly installed wells."*

NMED Comment: *NMED partially agrees with the statements; see Specific Comment 31 below. The Permittees must submit a Work Plan for the evaluation to include a proposed schedule(s) for completing the evaluation and proposed means of reporting the updated information.*

LANL Response

24. An updated water-level map (Figure M-2.0-1) that includes data from newly installed wells R-37, R-38, R-39, R-40, R-41, and R-49 is included in Appendix M of the revised investigation report. As additional water-level and analytical data from the newly installed wells become available over the next year or two, additional evaluations will be necessary to support corrective measures evaluations and, ultimately, remedy selection. Evaluations of the adequacy of groundwater monitoring to support remedy selection and performance monitoring will be presented within the various reports associated with the corrective measures process for MDAs H, L, and G. Water-table maps are updated annually in the Laboratory's "Hydrogeologic Site Atlas." Future sampling and reporting of analyses from the new wells will be conducted in accordance with the approved IFGMP.

NMED Comment

25. Figures 7.1-16 and 7.1-17/Associated Text Descriptions, pages 127 and 128:

Permittees' Statements: *"Plot of uranium-238 vs. uranium-235 concentrations in Threemile Canyon sediment samples; the red line indicates values expected in natural uranium, and values plotting below the line indicate depleted uranium." and, "Spatial variations in benzo(a)pyrene concentration between [Technical Area] TA-03 (reach TWN-1E) and TA-08 (reach AW-1) and the Rio Grande. Error bars indicate upper and lower bounds based on replacing nondetect values with either the detection limit or zero."*

NMED Comment: *The text descriptions for the two figures are apparently reversed. Review the figures and text descriptions throughout the Report and revise as needed to ensure the text descriptions correspond to the correct figures.*

LANL Response

25. The Laboratory reversed Figures 7.1-16 and 7.1-17 to correct a compositing error. The Laboratory also reviewed other figures and associated text references and found no additional errors.

NMED Comment

26. Appendix E, Statistics and Risk Information, Table E-2.1-1, pages E-82 and E-83:

The Permittees must change the number format for target cancer risk from a date to scientific notation, reflecting a 1E-05 risk level.

LANL Response

26. The Laboratory changed the number format for target cancer risk in Table E-2.1-1.

NMED Comment

27. Appendix E, Statistics and Risk Information, Table E-2.1-5, page E-85:

An oral reference dose (RfD) is listed as not available (na) for chloroform and [hexahydro-1,3,5-trinitro-1,3,5-triazine] (RDX). However, the Integrated Risk Information System (IRIS) provides RfDs for both of these constituents (1.0E-02 mg/kg-day for chloroform and 3.0E-03 mg/kg-day for RDX). The Permittees must include these data in the table.

LANL Response

27. The Laboratory included the updated chloroform and RDX oral reference dose (RfDo) values in Table E-2.1-5.

NMED Comment

28. Appendix E, Statistics and Risk Information, Table E-2.1-5, page E-85:

The table lists the oral slope factor (SF_o) for chloroform as 8.05E-2 $(mg/kg\text{-}day)^{-1}$ (reference IRIS). However, IRIS lists the SF_o for chloroform as 1.0E-02 $(mg/kg\text{-}day)^{-1}$. The Permittees must explain the SF_o applied for chloroform.

LANL Response

28. Per the current IRIS (as of January 2009), there is no oral slope factor for chloroform, just an oral reference dose (RfDo) (0.001 mg/kg-d). The Laboratory made corrections to Table E-2.1-5 to reflect this change.

NMED Comment

29. Section K-1.0 Upper Pajarito Canyon Springs, second paragraph, second sentence, page K-1*:*

Permittees' Statements: *"For example, Hanlon and Anderson Springs in Twomile Canyon (elevations 2263–2281 m [7423–7482 ft]), Peter Canyon, sanitary wastewater system, and Burning Ground Springs in Cañon de Valle (elevations 2261–2268 m [7417–7440 ft]) discharge at about the same elevations and issue from the same geologic unit as those in upper Pajarito Canyon."*

NMED Comment: *Peter Canyon and sanitary wastewater system are not spring names that NMED recognizes. The Permittees must provide some reference for, or documentation of, the location and existence of these springs.*

LANL Response

29. The Laboratory revised the text describing these springs as follows: “For example, Hanlon and Anderson Springs in Twomile Canyon (elevations 2263–2281 m [7423–7482 ft]) and Peter, SWSC, and Burning Ground Springs in Cañon de Valle (elevations 2261–2268 m [7417–7440 ft]) discharge at about the same elevations and issue from the same geologic unit as those in upper Pajarito Canyon.”

NMED Comment

30. Section K.2.0 Springs In Threemile Canyon, fourth paragraph, third sentence, page K-2*:*

Permittees’ Statements: *"Therefore, the “TA-18 Spring” probably represents alluvial groundwater rather than a discrete spring discharge point."*

NMED Comment: *TA-18 Spring discharges from an elevation higher than the canyon-bottom alluvium, suggesting that the spring discharges from the Bandelier Tuff, not from the alluvium as stated above. One hypothesis is that the groundwater at TA-18 Spring is supplied by shallow infiltration in Pajarito Canyon followed by lateral flow to the south or southeast beneath the mesa, (e.g., along the vapor phase notch). The Permittees must revise the Report to include additional discussion concerning the source(s) of the TA-18 Spring.*

LANL Response

30. A previous surface geophysical survey suggested that TA-18 Spring discharges from a buried pipe connected to a water collection cistern upcanyon in alluvium. The Laboratory completed a new radiofrequency survey that traced the source of the buried pipe upcanyon before losing signal under thick alluvium. The new survey confirms the earlier results. Results of the new survey are included in the revised investigation report in Section K-2.0. The discussion notes that while the source of TA-18 spring water appears to be alluvial water from upcanyon sources, the alluvial water in Threemile Canyon includes a significant component of spring water discharged from bedrock sources.

NMED Comment

31. Appendix M, Evaluation of Existing Monitoring Well Locations for the Purpose of Detecting Potential Contaminants from the Pajarito Canyon Watershed*:*

NMED does not accept the use of modeling to evaluate the adequacy of the Pajarito Canyon monitoring network; rather, NMED requires data and field observations to demonstrate that the network is sufficient. Revise the Report to remove the Appendix and references to the Appendix. If the Permittees believe site data supports the concept of “breakthrough locations” as illustrated on Figure M-2.0-1, add discussion in Section 7.0 of the Report concerning data which support the concept.

LANL Response

31. Section 7.2.1 was modified throughout to discuss infiltration zones. Appendix M was modified to remove all modeling results and discussion of breakthrough locations. Appendix M was renamed “Water-Table Map of the Regional Aquifer beneath the Pajarito Canyon Watershed” and presents an additional water-table map (Figure M-2.0-1) that illustrates the updates made to the conceptual water-table map based on new data collected from recently installed wells in the TA-54 area. Updates to the water-table map are ongoing and will be further advanced with additional work, especially in the TA-54 area.

REFERENCES

Fair, J.M., R.T. Ryti, M.D. Jankowski, and S.L. Reneau, August 10, 2009. "Sex Ratio and Contaminant Impacts on Reproduction: Adaptive and Environmental Constraints," Los Alamos National Laboratory document LA-UR-09-05092, Los Alamos, New Mexico. (Fair et al. 2009, 106686)

LANL (Los Alamos National Laboratory), July 2006. "Pajarito Canyon Biota Investigation Work Plan," Los Alamos National Laboratory document LA-UR-06-4106, Los Alamos, New Mexico. (LANL 2006, 093553)

LANL (Los Alamos National Laboratory), January 2007. "Technical Approach for Calculating Recreational Soil Screening Levels for Chemicals," Los Alamos National Laboratory document LA-UR-06-8828, Los Alamos, New Mexico. (LANL 2007, 094496)

LANL (Los Alamos National Laboratory), September 2008. "Pajarito Canyon Investigation Report," Los Alamos National Laboratory document LA-UR-08-5852, Los Alamos, New Mexico. (LANL 2008, 104909)

LANL (Los Alamos National Laboratory), March 2009. "Drilling Work Plan for Intermediate Aquifer Well PCI-2, Revision 1," Los Alamos National Laboratory document LA-UR-09-1661, Los Alamos, New Mexico. (LANL 2009, 105409)

NMED (New Mexico Environment Department), November 21, 2008. "Notice of Disapproval, Pajarito Canyon Investigation Report," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2008, 103803)

NMED (New Mexico Environment Department), March 25, 2009. "Approval of Drilling Work Plan for Intermediate Aquifer Well PCI-2, Revision 1," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2009, 105359)

NMED (New Mexico Environment Department), May 27, 2009. "Direction to Prepare a Sediment Sampling Work Plan; Pajarito Canyon," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2009, 106046)

Cross-Reference of NMED NOD Comments and Revisions to Pajarito Canyon Investigation Report, Rev.1

NMED NOD Comment No.	Summary of NOD Comment Requirement	Section(s)/Page(s) in Original Report	Section(s)/Page(s) in Revised Report	Nature of Revision
General Comments				
1	Provide more discussion to section 7.2.2 about surface water and groundwater trends found in Figures D-2.2-1 through D-2.2-207	Section 7.2.2	Section 7.2.2 Section 1.1	Discussion of additional contaminant data is added to Section 7.2.2, paragraph 1, as appropriate. Existing text in Section 1.1 (last two paragraphs) discusses how data in this report provide support for future decisions at various solid waste management units and areas of concern located within the Pajarito Canyon watershed.
2	VOCs can pose a potentially significant exposure pathway to wildlife through the inhalation of contaminated subsurface burrow air. Consider this comment prior to developing future investigation reports for other LANL canyon watersheds. No response to the comment is required.	General ecological risk comment	n/a*	No revision to the investigation report is required.
3	Discussion must be added to the Report concerning whether risks would be different if exposure areas were to include a larger area than just a specific sample location.	Risk Assessment	Sections 8.2.3.1 and 8.2.3.3	Discussion is added to clarify that exposures to the recreational user are evaluated at the scale of sediment investigation reaches or water-sampling location and that these evaluations likely overestimate risks.
4	The Permittees must revise the Report to include cumulative risk for the recreational scenario.	Risk Assessment	Sections 8.2.3.1 and 8.2.5	The requested information is presented in pp. 79 and 83 and Tables 8.2-7 and 8.2-10 of the original report, but the accompanying text is brief. The following statement is added to the first paragraph of Section 8.2.3.1: “Cumulative risks resulting from multimedia exposures to sediments and persistent surface water are evaluated.” In addition, the first sentence of the third paragraph of Section 8.2.5 is revised to include “cumulative.”

NMED NOD Comment No.	Summary of NOD Comment Requirement	Section(s)/Page(s) in Original Report	Section(s)/Page(s) in Revised Report	Nature of Revision
5	The Work Plans discussed in various Specific Comments below may be combined into a single Work Plan that addresses all items discussed in the Specific Comments.	General Comment	n/a	Work plans for specific media are discussed in the responses to the specific comments.
Specific Comments				
1	The Permittees must follow the monitoring schedules for the Pajarito Watershed proposed in the approved 2008 Interim Facility-Wide Groundwater Monitoring Plan	Section 3.4, Deviations from Planned Activities, third paragraph, page 13	Section 3.4	In Section 3.4, a sentence is added stating that future sampling of the alluvial wells will follow the monitoring schedule in the most current update to the "Interim Facility-Wide Groundwater Monitoring Plan."
2	Other than acknowledgement and use of the Regional Screening Levels in updating this risk assessment and future risk assessments prepared by the Permittee, no specific response to this comment is required.	Section 5.2, Human Health Screening Levels, first paragraph, page 17	Section 5.2	In Section 5.2, the source of screening levels used in this report was revised.
3	The Permittees must clarify that in addition to evaluation of dose, an evaluation was conducted to ensure that the principles of ALARA (As Low As Reasonably Achievable) are also being met.	Section 5.2, Human Health Screening Levels, second paragraph, penultimate and last sentence, page 17	Section 8.2.5.3, Radiation Dose	In Section 8.2.5.3, text is added summarizing as low as reasonably achievable (ALARA) requirements. No further quantitative ALARA evaluation of radiation exposure is required because the maximum calculated radiation dose for the recreational user falls below dose limits in the Laboratory's ALARA program.

NMED NOD Comment No.	Summary of NOD Comment Requirement	Section(s)/Page(s) in Original Report	Section(s)/Page(s) in Revised Report	Nature of Revision
4	Update hydrogeologic cross sections to reflect currently available subsurface information. Include hydrochemical data in cross sections. Provide additional north-south cross sections. Provide a more detailed description of the contaminant-transport and hydrochemical conceptual models with respect to the groundwater flow system.	Section 7.2.1 Hydrologic Conceptual Model, pages 40 through 44	Section 7.2 Figure 7.2-1 Appendix O with figures (new)	Section 7.2 and Figure 7.2-1 are updated to include information from new wells that were not available when the original report was prepared. Additional north-south cross-sections with accompanying discussion of hydrochemical conceptual models are added to the report as new Appendix O. Hydrochemical data in the form of perched water occurrences and Stiff diagrams are included in the cross-sections. More detailed descriptions of the contaminant transport and hydrochemical conceptual models with respect to the groundwater flow are added throughout Section 7.2.
5	More accurately reflect the extent of perched alluvial groundwater in Pajarito Canyon upstream of the Twomile Canyon confluence.	Section 7.2.1.2 Alluvial Groundwater, first paragraph, first sentence, page 41	Section 7.2.1.2	Section 7.2.1.2 is revised to more accurately reflect the extent of perched alluvial groundwater in Pajarito Canyon.
6	Correct typographical errors concerning Figure M-2.0-1 and groundwater flow directions in Section 7.2.1.5.	Section 7.2.1.5 Regional Aquifer Hydrology, first paragraph, fourth sentence, page 43	Section 7.2.1.5	The reference to “Figure M-1” is a typographical error and is changed to “Figure M-2.0-1.” Groundwater flow directions are corrected in Section 7.2.1.5.
7	The directional terms used in the groundwater gradient statement are reversed. Provide a reference for the stated gradient range	Section 7.2.1.5 Regional Hydrology, first paragraph, fifth sentence, page 43	Section 7.2.1.5	The directional terms used in the groundwater gradient statement are corrected. Text is added clarifying that the gradient range is measured from the regional water-table map (Figure M-1.0-1).
8	Update regional water table map to include the new well information.	Section 7.2.1.5 Regional Hydrology, first paragraph, penultimate and last sentences, page 44	Appendix M, Figure M-2.0-1 (new)	Figure M-2.0-1, a new water-table map incorporating new well information, is added to Appendix M.
9	Provide data and additional discussion concerning the presence or absence of toluene at wells R-20 and R-32.	Section 7.2.2.2 Organic Chemicals in Water; Toluene, Acetone, and Bis(2-ethylhexyl)phthalate, first paragraph, page 51	Section 7.2.2.2	Additional results and discussion about detected toluene results are added to Section 7.2.2.2, second paragraph under the heading, “Toluene, Benzene, Acetone, and Bis(2-ethylhexyl)phthalate.”

NMED NOD Comment No.	Summary of NOD Comment Requirement	Section(s)/Page(s) in Original Report	Section(s)/Page(s) in Revised Report	Nature of Revision
10	Provide discussion concerning the migration of tritium releases at MDAs C, H, L and G with respect to the presence of anthropogenic tritium at wells R-23, R-23i and R-32.	Section 7.2.2.3 Radionuclides in Water; Tritium in Vadose-Zone Pore Water and Perched Intermediate Zones, pages 51–53	Section 7.2.2.3	Section 7.2.2.3, paragraph 4, was modified to better address distribution and potential sources of tritium contamination.
11	Provide discussion concerning the source(s) of tritium detected in the vadose zone at R-17 and R-20.	Section 7.2.2.3 Radionuclides in Water, Tritium in Vadose-Zone Pore Water and Perched Intermediate Zones, second paragraph, page 52	Section 7.2.2.3	Text was added to paragraph 4 of Section 7.2.2.3 to discuss potential tritium sources. In Section 7.2.2.3, “Tritium in Vadose-Zone Pore Water and Perched Intermediate Zones,” discussion of tritium detected in the vadose zone during drilling of wells R-17 and R-20 is expanded to include vadose-zone data from well PCI-2.
12	Replace "killigram" with "kilogram".	Section 7.2.2.3 Radionuclides in Water, Tritium in the Regional Aquifer, fourth paragraph, page 53	Section 7.2.2.3	The paragraph containing this typographical error was deleted as part of the revision of the investigation report.
13	Clarify the rationale used to determine how PAHs were or were not retained as a Contaminants of Potential Ecological Concern (COPEC).	Section 8.1.1.2, Literature for Known Ecological Effects, pages 58 and 59	Section 8.1.1.1	Paragraph 4 was added to Section 8.1.1.1 to clarify how polycyclic aromatic hydrocarbons were evaluated as chemicals of potential ecological concern (COPECs).
14	Revise the Report to include uptake and ingestion of surface water or provide additional justification for the exclusion of this pathway.	Section 8.1.1.3, Conceptual Exposure Model, pages 59 and 60	Section 8.1.1.3 Table 8.1-1	Text was added as the last paragraph of Section 8.1.1.3 about the role of surface water in risk and its exclusion as a pathway. Table 8.1-1 was revised to reference the biota plan.
15	Discuss the uncertainty associated with the nest box studies being based solely on a qualitative analysis for metals.	Section 8.1.2.2, Nest Box Studies, pages 61 and 62	Section 8.1.4.2 and 8.1.5	Discussion of uncertainty associated with the nest box studies is expanded in Section 8.1.4.2, second paragraph, and at the end of Section 8.1.5. More discussion of specific COPECs without data for specific endpoints is added to report.

NMED NOD Comment No.	Summary of NOD Comment Requirement	Section(s)/Page(s) in Original Report	Section(s)/Page(s) in Revised Report	Nature of Revision
16	Discuss the uncertainty of excluding organic data in insects on the subsequent evaluation of HQs	Section 8.1.3.2, Concentrations of COPECs in Prey for the Southwestern Willow Flycatcher, pages 65 and 66	Section 8.1.4.2	Discussion of uncertainty is expanded in Section 8.1.4.2, second paragraph. More discussion of specific COPECs without data for specific endpoints is added to report.
17	Revise the risk assessment to include a child recreational user	Section 8.2.1, Problem Formulation, pages 77 and 78	Section 8.2	Discussion is added throughout Section 8.2 text to clarify that the recreational user addresses both the adult trail user and the child extended backyard scenario.
18	Discuss the potential for exposure to stormwater and associated acute effects due to accidental or incidental ingestion and dermal exposure.	Section 8.2.3.1, Exposure Scenario Description, page 80	Section 6.5 (new) Section 8.2.3.1 Section 8.2.6.4 (new) Tables 8.2-15 and 8.2-16 (new) Appendix E (E-2.5, Acute Stormwater Screening Levels) (new)	Section 6.5 presents the process for screening analytical results obtained from stormwater samples Section 8.2.3.1 was modified to include discussion of the potential for exposure to water. A new section, 8.2.6.4, and Tables 8.2-15 and 8.2-16 are added to discuss stormwater data and potential acute effects. A new section is added to Appendix E to support the assessment of potential acute effects.
19	Provide a discussion of the appropriateness of using screening levels in this assessment that are based on outdated toxicological data. Provide slope factors and reference doses in Tables 8.2-9 and 8.2-10.	Section 8.2.4, Toxicity Assessment, pages 81 and 82 Tables 8.2-9 and 8.2-10	Section 8.2.4 Section 8.2.6.3 (new) Table 8.2-10	A discussion of changes in the U.S. Environmental Protection Agency's Integrated Risk Information System to the toxicity assessment and uncertainty sections is provided in Sections 8.2.4 and 8.2.6.3, and Table 8.2-10 is updated. Reference to slope factors and reference doses in Table 8.2-9 and 8-2-10 is a typographical error and is deleted.

NMED NOD Comment No.	Summary of NOD Comment Requirement	Section(s)/Page(s) in Original Report	Section(s)/Page(s) in Revised Report	Nature of Revision
20	Additional monitoring of sediment, surface water, groundwater, and cavity-nesting birds is appropriate.	Section 9.0, Conclusions and Recommendations, first paragraph, last sentence, page 86	Section 8.1.5 Section 9	For cavity-nesting birds, Sections 8.1.5 and 9 were revised to recommend additional nest box monitoring and preparation of a work plan.
21	Permittees must submit a Work Plan for monitoring sediments.	Section 9.0, Conclusions and Recommendations, fifth paragraph, last sentence, page 87	Section 9	Section 9, paragraph 5, describes submission of sediment sampling and analysis plan.
22	The Permittees must install one single completion well intersecting the perched intermediate aquifer penetrated during the drilling of R-17.	Section 9.0 Conclusions And Recommendations, seventh paragraph, first sentence, page 87	Sections 3.2.1, 7.2.1.4, 7.2.2 Appendix H	Well PCI-2 was recently installed adjacent to R-17, and results from that investigation are incorporated into the revised report in Sections 3.2.1 (paragraph 4), 7.2.1.4 (paragraph 3), 7.2.2 (throughout), and Appendix H.
23	Submit a Work Plan which describes proposed collection of additional core data at the R-17 site.	Section 9.0, Conclusions and Recommendations, seventh paragraph, third through fifth sentences, pages 87 and 88	Sections 3.2.1, 7.2.2 and 9.0 Appendix H	Additional core data near R-17 have been collected. The results from that investigation are incorporated into the revised report in Sections 3.2.1 (paragraph 4) and 7.2.2 (throughout), and in Appendix H. The recommendation in Section 9 was deleted because the work is completed.
24	Submit a Work Plan for evaluating the TA-54 monitoring well efficiency based on new water level and analytical data from the recently installed wells near TA-54.	Section 9.0, Conclusions and Recommendations, last paragraph, page 88	Appendix M, Figure M-2.0-2	Figure M-2.0-1, a new water-table map incorporating new well information, is added to Appendix M. In the notice of disapproval (NOD) response, reports associated with the corrective measures at Material Disposal Areas H, L, and G are identified as potential mechanisms for reevaluating monitoring well efficiency.
25	The text descriptions for the two figures are apparently reversed.	Figures 7.1-16 and 7.1-17/ Associated Text Descriptions, pages 127 and 128	Figures 7.1-16 and 7.1-17	The figures are reversed to correct the error.

NMED NOD Comment No.	Summary of NOD Comment Requirement	Section(s)/Page(s) in Original Report	Section(s)/Page(s) in Revised Report	Nature of Revision
26	Change the number format for target cancer risk from a date to scientific notation, reflecting a 1E-05 risk level.	Appendix E, Statistics and Risk Information, Table E-2.1-1, pages E-82 and E-83	Table E-2.1-1	In Table E-2.1-1, the target cancer risk is changed to 1E-05.
27	Provide updated oral reference doses for chloroform and RDX.	Appendix E, Statistics and Risk Information, Table E-2.1-5, page E-85	Table E-2.1-5	Updated oral reference doses (RfD_o) for chloroform and RDX are provided in Table E-2.1-5.
28	Explain the oral slope factor (SF_o) applied for chloroform.	Appendix E, Statistics and Risk Information, Table E-2.1-5, page E-85	Table E-2.1-5.	Because there is no SF_o for chloroform, an RfD_o (0.001 mg/kg-d) is used in Table E-2.1-5.
29	Clarify spring names used for upper Pajarito Canyon	Section K-1.0 Upper Pajarito Canyon Springs, second paragraph, second sentence, page K-1	Appendix K-1.0	The text in Appendix K-1.0, second paragraph, is revised to clarify the spring names in upper Pajarito Canyon.
30	Revise the Report to include additional discussion concerning the source(s) of the TA-18 Spring.	Section K.2.0 Springs In Threemile Canyon, fourth paragraph, third sentence, page K-2	Appendix K-2.0	Additional discussion about the possible source of the TA-18 Spring is added to Appendix K-2.0, paragraph 4. The discussion includes newly acquire radiofrequency survey data.
31	Revise the Report to remove the Appendix M and references to it in the main body of the report. In Section 7.0, discuss data that supports the concept of breakthrough locations as illustrated on Figure M-2.0-1.	Appendix M, Evaluation of Existing Monitoring Well Locations for the Purpose of Detecting Potential Contaminants from the Pajarito Canyon Watershed	Section 7.2.1 Appendix M (renamed to "Water-Table Map of the Regional Aquifer beneath the Pajarito Canyon Watershed")	Section 7.2.1 was modified throughout to discuss infiltration zones. Appendix M was modified to remove all modeling results and discussion of breakthrough locations. Appendix M was renamed "Water-Table Map of the Regional Aquifer beneath the Pajarito Canyon Watershed" and presents the water-table map from the original report and a new map showing the water table based on new well data.
Other Revisions to the Report Reflecting the Incorporation of New Data Obtained Since PCIR, Rev.0 was Released				
			Executive Summary, para. 1	"studies conducted from 2000 to 2008" is changed to "studies conducted from 2000 to 2009"

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			Executive Summary, para. 5	Number of wells is updated to include new wells installed and sampled since original“ Pajarito Canyon Investigation Report” (PCIR), was issued.
			Executive Summary, para. 10	New paragraph about data from new wells and updated geologic cross-sections replaces two paragraphs discussing monitoring well network efficiency.
			Section 1.1, para. 1	“studies conducted from 2000 to 2008” is changed to “studies conducted from 2000 to 2009”
			Section 1.1, para. 5	New paragraph is added to document the submittal of PCIR and its subsequent revision in response to NOD comments.
			Section 1.2, para. 2	In the revised investigation report, Appendix M presents two alternative water-table maps for the watershed.
			Section 3.2.1, general	Section is updated to include new perched intermediate and regional wells installed since PCIR was issued.
			Section 3.2.1, last para.	Future drilling activities described in PCIR were completed since the report was issued; the text was no longer relevant and it was deleted. Similarly, text referring to redevelopment activities at R-22 was out-of-date and updated to reflect current status.
			Section 3.2.2	Numbers of wells are updated to include new wells installed and sampled since PCIR was issued.
			Section 4.2.1	Numbers of wells are updated to include new wells installed since PCIR was issued. Additional reference citations are added for the TA-54 well network evaluation and PCIR NOD.

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			Section 4.2.5, para. 1	PCI-2 is added to list of new core holes installed.
			Section 7.2, last sentence	In the revised investigation report, Appendix M presents two alternative water-table maps for the watershed. Reference to new cross-sections in Appendix O is added.
			Section 7.2.1.2, para. 1	The word “transiently” added to describe infiltration into the Cerros del Rio basalt. Reference to Figure 7.2.1 is added to discussion of infiltration near R-23.
			Section 7.2.1.2, para. 2	Text added describing lateral downcanyon flow of groundwater in alluvium. Text added describing groundwater levels at R-23i in the spring of 2008.
			Section 7.2.1.3, para. 1	Paragraph was modified to discuss potential infiltration through fractured, welded tuff in western part of watershed and through fractured basalts near R-23i.
			Section 7.2.1.3, para. 2	Paragraph modified to discuss potential infiltration near R-17 and R-20.
			Section 7.2.1.4, para. 1	Figure 7.2.1 and Appendix O are cited as sources of information about geologic units beneath the watershed. R-17 and R-23 are cited as examples of perched intermediate groundwater near areas suspected of greater infiltration. R-37 is cited as a possible example of perched groundwater resulting from regional water-table decline.
			Section 7.2.1.4	New paragraphs are added describing perched groundwater encountered in wells PCI-2, PCI-1/R-49, R-37, R-40, and R-40i.
			Section 7.2.1.5, last para.	The last paragraph in this section that referred to numerical models and monitoring well efficiency was removed.

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			Section 7.2.2, throughout	Geochemical data from new wells are included in discussions of chemicals of potential concern in water
			Section 9.0, last two paras.	The last two paragraphs referring to the monitoring well network and network evaluation were replaced with two new paragraphs describing the need for continued surface water and groundwater monitoring under the IFGMP and a summary of new information compiled for this investigation report.
			Plate 1	Added new wells installed since PCIR was issued.
			Figure 3.2-1	Added new wells sampled since PCIR was issued.
			Table 3.2-1	Added new wells sampled since PCIR was issued.
			Appendix C	New tables are added for groundwater and core analytical data collected since PCIR was issued.
			Appendix H	New PCI-2 core data are added to the discussion.
			Appendix L	Discussion is updated to include recently collected data.
			General	Minor misspelling and grammatical corrections made throughout the report and its appendixes.

*n/a = Not applicable.