

**Response to the Approval with Modifications for the
Groundwater Background Investigation Report, Revision 4,
Los Alamos National Laboratory, EPA ID No. NM0890010515, HWB-LANL-10-074,
Dated July 25, 2011**

INTRODUCTION

To facilitate review of this response, the New Mexico Environment Department's (NMED's) comments are included verbatim. Los Alamos National Laboratory's (LANL's or the Laboratory's) responses follow each NMED comment. 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.

NMED Comment

1. Section 2.1, Geologic Framework, page 6, last paragraph:

Correct the eruption ages for Tshirege and Otowi Members of Bandelier Tuff.

LANL Response

1. The ages of the Tshirege and Otowi Members were reversed in the previous version and have been corrected.

NMED Comment

2. Section 2.2, Hydrogeologic Framework and Groundwater Occurrence, page 7, next to the last paragraph:

The Permittees' statement that "[t]he regional water table occurs within the Puye Formation and Santa Fe Group beneath the Plateau" does not fully describe the geology at the water table. Provide an expanded description of the occurrence of the regional water table.

LANL Response

2. The description of the occurrence of the regional water table beneath the Pajarito Plateau in section 2.2 has been expanded.

NMED Comment

3. Section 2.3.2, General Compositional Trends, page 10, second paragraph of the section:

In the third sentence of the paragraph, the Permittees state that the concentrations of sodium increase from west to east in groundwater beneath the Pajarito Plateau. The fifth sentence of the paragraph states the opposite. Reconcile the discrepancy.

LANL Response

3. The fifth sentence has been corrected to reflect a west-to-east increase in sodium in perched-intermediate groundwater beneath the Pajarito Plateau.

NMED Comment

4. Section 3.1, Overall Steps in Process, page 12, third paragraph of the section:

The Permittees state that data preparation steps are listed in Table 3.1-1 and summarized in Table B-1 of Appendix B. However, although certain steps in these tables are the same (for example, removal of duplicates), it appears that these tables represent different stages of data preparation. Clarify the relationship between Table 3.1-1 and Table B-1, and clearly specify data preparation steps that are already reflected by the data sets in Tables B-4 through B-42 and those that were performed on these data sets in subsequent steps.

LANL Response

4. Table 3.1-1 applies to conditions placed on the query from the Water Quality Database in Phase I of the data preparation. Criteria that were applied later in Phase I to the data received resulted in additional data being removed before the outlier analysis. The data removed in this step are listed in section 3.1, Phase I, replacing the original Table B-1. The following clarifying statement was added to the text describing Phase II: "Tables B-4 through B-42 provide the final data set used in calculating statistical parameters for the update to Revision 4 after all the data preparation steps, including outlier removal, were performed. These tables also show the more than 1000 records that were removed in the update to revision 4 as a result of outlier identification."

NMED Comment

5. Section 3.1 Overall Steps in Process, page 12, third paragraph of the section:

Perform the following additional data-preparation steps (after completing the data preparation steps that are already listed in Tables 3.1-1 and B-1) in accordance with Chapter 5 and Section 15.1 of the Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance, EPA 530-R-09-007 (EPA Guidance):

1. *For wells R-2, R-6, R-17-P1A, R-17-P2A, R-24, and R-34, remove the early post-installation data for manganese and other constituents with elevated and decreasing concentration trends, which indicate lingering impacts from drilling and lack of well stabilization.*
2. *Remove all results for samples collected at Sandia Spring from September 25, 2000 through September 13, 2004. During that time, the spring was sampled from alluvial deposits located approximately 200 meters downstream of the actual spring source. Starting in 2005, samples were collected from the spring source. As noted in the time-series plots for Sandia Spring in Appendix C, the change in the sampling location had a significant impact on the chemistry of collected samples.*
3. *If a data set for any location, analyte and sample type (filtered or unfiltered) includes both quantified values and non-detects, remove all non-detect values higher than (sic) the highest quantified value that is not an outlier.*

4. *If both filtered and unfiltered samples were collected for any location and analyte during the same sampling event, and the filtered result is higher than the unfiltered result, remove both filtered and unfiltered values that meet one of the following conditions:*
 - a. *Both filtered or unfiltered values exceed five times (5x) the quantitation limit, and the relative percent difference between filtered and unfiltered values exceeds 20%, or*
 - b. *Either filtered or unfiltered value is lower than five times (5x) the quantitation limit, and the difference between filtered and unfiltered values is greater than the quantitation limit. If a quantitation limit is not available, a value equal to three times (3x) the lowest method detection limit must be used in its place. For radionuclides, the minimum detectable activity (MDA) must be considered equivalent to a quantitation limit.*

LANL Response

5. The four requirements above were applied to the original Appendix B data set and are listed as part of the data preparation steps in section 3.1. The resulting final data set is included in Appendix B with records removed by these criteria identified.

NMED Comment

6. Section 3.4, Analytical Methods, page 15:

According to information in Table 3.1-1, low-level tritium results submitted by ARSL were screened-out before performing statistical analyses of the data. Add a statement to that effect.

LANL Response

6. Table 3.1-1 was in error with respect to this point. Low-level tritium data from both the University of Miami Tritium Laboratory (UMTL) and ARS Laboratory were included in the data set in Revision 4. In the update to Revision 4, all tritium data were removed from the data set. One reason is that after Revision 4 of the Groundwater Background Investigation Report was submitted in August 2010, the Laboratory was directed by DOE not to use UMTL for tritium analyses. UMTL was not able to provide relevant documents in compliance with DOE quality assurance/quality control requirements for analytical data. In addition, several data quality issues arose with ARS Laboratory. In light of these data issues, tritium background values have not been updated from Revision 3.

NMED Comment

7. Section 3.4.1, Methods, page 15, second paragraph of the section:

In the second sentence of the paragraph, the Permittees state that perchlorate was analyzed by EPA Method 300, Revision 2.1. In the next sentence, they state that it was analyzed by EPA Method 314.0, Revision 1. Resolve the discrepancy.

LANL Response

7. Perchlorate was measured by U.S. Environmental Protection Agency (EPA) Method 314.0, Revision 1, for samples from Barbara Spring and Campsite Springs, as stated in the report. Reference to its measurement by EPA Method 300, Revision 2.1, has been removed.

NMED Comment

8. Section 3.7, Statistical Methods, Outlier evaluation, page 19:

The methodology used by the Permittees to identify outliers was inadequate to properly perform this task. Numerous apparent outliers were not identified. For example, in the data set for manganese in G-1A production well, the value of 220 µg/L was not identified as an outlier, despite all other concentrations ranging from 0.382 to 16 µg/L. Perform outlier screening separately for each location, analyte and sample type using the box plot procedure described in Section 12.2 of the EPA Guidance. If a box plot for raw data shows highly asymmetric distribution, the outlier screening must be performed on transformed data that is roughly symmetrically distributed (mean and median approximately equal) in a box plot. Non-detects or negative radionuclide data must be plotted as reported by the laboratory. Values greater than 1.5 x IQR (where IQR is the interquartile range) above the upper edge of the box plot, or lower than 1.5 x IQR below the lower edge of the box plot must be identified as outliers. All box plots used for outlier screening must be included in the report.

LANL Response

8. The outlier analysis was expanded to include the procedure described in the comment. Box plots are shown in Appendix C. The points removed as a result of the outlier analysis are colored red on these plots.

NMED Comment

9. Section 3.7, Statistical Methods, UTL Calculation methods, page 20:

If the statistical criteria for UTL calculations are not met for a constituent, establish the screening value for that constituent in the following manner, in accordance with Section 17.2.2 and Table 17.4 in Appendix D of the EPA Guidance:

1. *Set the second largest measurement in the data set as the screening value if the total number of observations, including non-detects, is at least 94 (in order to achieve at least 95% coverage at 95% confidence level). Otherwise, set the largest measurement in the data set as the screening value.*
2. *If the largest or second largest measurement, as set above, is a non-detect, the lowest quantitation limit for the data set must be used as the screening value. If a quantitation limit is not available, a value equal to three times (3x) the lowest method detection limit for the data set must be used in its place. For radionuclides, the MDA must be considered equivalent to a quantitation limit.*

LANL Response

9. The guidance, as stated above, was followed and this information was added to the report for developing screening values.

NMED Comment

10. Section 4.2.1, Spatial Trends in Water Chemistry, page 24, top paragraph, last sentence:

The reference to Figure 2.3-1b, regarding TDS concentrations is incorrect. Change the reference to Figure 2.3.1-a.

LANL Response

10. The correction to Figure 2.3-1a has been made.

NMED Comment

11. Section 4.2.1, Spatial Trends in Water Chemistry, page 25, second paragraph, fourth sentence:

The measurement unit for uranium-234 is incorrectly listed as $\mu\text{g/L}$. Correct the measurement unit to pCi/L .

LANL Response

11. The measurement unit for uranium-234 has been corrected to pCi/L .

NMED Comment

12. Section 4.4, Recommended Background Screening Values, page 28, third paragraph:

The Permittees mention EPA Secondary standards for nickel, tin, strontium, and vanadium. However, EPA secondary standards do not exist for these metals. Make the appropriate correction.

LANL Response

12. The sentence in question refers to a statement made in Revision 3 of the report, which cannot be changed.

NMED Comment

13. Section 4.4, Recommended Background Screening Values, page 28, last paragraph:

The Permittees incorrectly state that “[f]or radionuclides, the screening value is the highest minimum detectable activity.” In fact, UTLs have been calculated for some radionuclides, and these UTLs are their screening values. Make the appropriate corrections.

LANL Response

13. The sentence has been modified to indicate that when it was not possible to calculate an upper tolerance limit (UTL) for a radionuclide, the minimum detectable activity was selected as the screening value.

NMED Comment

14. Figures 2.3-1a through 2.3.3b, pages 45–47:

Provide information on the data set used to create the figures.

LANL Response

14. The note below the figure captions for Figures 2.3-1a through Figure 2.3-3b now includes the statement that the mean value was calculated from data in Appendix B.

NMED Comment

15. Table 1.2-1, page 59, right column, second row:

The wording "...they cluster into a separate group..." is erroneous. Correct the wording to state "...they do not cluster into a separate group..."

LANL Response

15. The table has been corrected to state "they do not cluster."

NMED Comment

16. Table 3.1-1, page 62:

1. *According to the table, tritium results from laboratories other than UMTL should have been eliminated before performing statistical analyses of the data. However, information in Tables 4.2.1 and 4.2.2 indicates that results from ARSL, with detection limits higher than those from UMTL, were also included in statistical analyses. Remove all tritium data submitted by ARSL before performing the statistical analyses.*
2. *According to the table, cesium-137 results obtained by EPA:901.1 should have been eliminated before performing statistical analyses of the data. However, information in Tables 4.2-1 and 4.2-2 indicates that cesium-137 data obtained by EPA:901.1 were included in the statistical analyses. Furthermore, based on information in Table 3.4-2, EPA:901.1 was the only method used to analyze cesium-137. Remove the limitation on cesium-137 data from Table 3.1-1.*
3. *According to the table, perchlorate results should have been limited to those obtained by methods with lower detection limits. However, information in Table 4.2-1 indicates that perchlorate results obtained by methods with high detection limits were included in the statistical analyses. Furthermore, the analytical method code 'SW846 6850 Modified', which is listed in Table 3.1-1 to identify perchlorate results with low detection limits, does not appear in the data sets in Tables B-4 through B-42. Instead, low detection limit results for perchlorate in Tables B-4 through B-42 were obtained by a method with codes 'SW846 6850' and 'SW-846:6850'. Resolve the discrepancy between analytical method codes for perchlorate in Tables 3.1-1 and B-4 through B-42. Remove perchlorate results with high detection limits before performing the statistical analyses.*

LANL Response

16. 1. All tritium data have been eliminated. See Comment 6.
2. Table 3.1-1 was correct in Revision 4 with respect to this point. The statement in the table “Any Meth Code NOT IN ‘EPA:901.1’ for ‘Cs-137’” meant that all other methods used to analyze cesium-137 were to be rejected. Only EPA:901.1 was to be used. The wording in the table has been modified to clarify.
3. Regarding perchlorate analyses, Method SW846 6850 is a synonym for SW-846:6850. This method was used for perchlorate analyses at all locations, except Barbara Spring and Campsite Springs, where method EPA:314.0 was used (Table 3.4-2).

NMED Comment

17. Tables 4.2-1 and 4.2-2, pages 71–77:

Provide units of measurement for all analytical data.

LANL Response

17. Units of measurement have been provided for the analytical data in Tables 4.2-1 and 4.2-2.

NMED Comment

18. Table 4.3-1, pages 79–81:

1. *Several arithmetical and typographical errors are present in the table. Correct cadmium, thallium and TDS column 8 values to negative; correct TOC column 5 value to negative; recalculate incorrect specific conductance-field value in column 5; correct uranium-234 column 7 value to 1.00 and recalculate its value in column 8.*
2. *Recalculate percent differences in screening levels to make them relative to the Revision 3 screening levels.*

LANL Response

18. As a result of the expanded outlier analysis, all screening levels were recalculated and Table 4.3-1 was completely revised. The percent differences were calculated relative to Revision 3 screening levels.

NMED Comment

19. Tables 4.4-1 and 4.4-2, pages 87–90:

1. *Make table titles more descriptive.*
2. *EPA Primary MCLs for radium-226, strontium-90, and tritium do not exist. Change the wording ‘EPA Primary MCL’ in the ‘Standard Type’ column to ‘EPA Ra-226+228 Primary MCL’ for radium-226, and to ‘EPA 4 mrem Primary MCL’ for strontium-90 and tritium.*

LANL Response

19. 1. Part of the title for Tables 4.4-1 and 4.4-2 was inadvertently omitted in Revision 4. The title for Table 4.4-1 is "UTLs, Maximum Values, and Screening Values for Perched-Intermediate Groundwater." Table 4.4-2 has the same title with respect to regional aquifer groundwater.
2. In Tables 4.4-1 and 4.4-2, the wording for standard type has been modified.

NMED Comment

20. Appendix B, Table B-1, page B-3:

Information in the 'Laboratory' row implies that all analytical data from EES-6 had been removed from the original data set. However, based on information in Sections 3.1, 3.4, and 3.5, data from EES-6 for Barbara and Campsite Springs were included in the data set. Reconcile the discrepancy.

LANL Response

20. The discrepancy has been reconciled. Data from Earth and Environmental Sciences (EES) 6 for Barbara Spring and Campsite Springs were included in the data set.

NMED Comment

21. Appendix B, Tables B-4 through B-42, pages B-9 to B-608:

Mark (by using italics, gray shading or other means) data that were removed from the data sets during data preparation and outlier screening before performing statistical analyses.

LANL Response

21. An extra column has been added to Tables B-4 through B-42 to distinguish data that were removed from the data sets during data preparation and outlier analysis.

NMED Comment

22. Appendix C, page C-1:

The description of figures in the Appendix is incorrect. For example, Figures C-1 to C-64 are described as box plots by location, although they are time-series plots. Make the appropriate corrections.

LANL Response

22. Appendix C has been revised in its entirety as a result of removing outliers and other data points; the figures, captions, and table of contents are now consistent.

NMED Comment

23. Appendix E, Tables E-1 and E-2, pages E-3 to E-8:

1. *Provide units of measurement for the UTL data.*
2. *The 'Note' under the tables incorrectly states that the UTLs were calculated for constituents with more than 10 detections. Correct the wording to '10 observations'.*

LANL Response

23. 1. Units of measurement for the UTL data in Appendix E have been provided.
2. The note has been removed since all UTLs calculated with ProUCL 4.1 are provided in Appendix E.