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MEMORANDUM

TO: Darlene Goering

FROM: Daniela Bowman DKB

SUBJECT: Phase III RFI Report for SWMU 16-021(c)-99
Appendix I-1 "Statistical Analysis of Data for the SWMU 16-021(c)-99 Source Area and Canon de Valle Alluvial Area"

DATE: December 17, 2003

Comment 1
LANL described 7 steps of the approach of identifying COPCs. Three of these steps are not acceptable (Step 5,6, and 7) for the following reasons. The evaluation of the inorganic COPCs in alluvial and surface water (for which no background values were established) performed by geochemical analysis in Step 5 is not EPA-acceptable method for analysis, and mush less for eliminating COPCs.

Soil, tuff, and sediment maximum concentrations were compared to SSL in Step 6, and if these maximum concentrations were below the SSL, the corresponding COPC was eliminated from further consideration. Similarly, for surface and alluvial ground water, the maximum concentrations were compared to MCLs or other standards and eliminated as COPCs if these concentrations were lower than the standards. This approach is not acceptable because according to EPA and NMED guidance, all COPCs above background (not SSL) must be included in the evaluation in order to determine the cumulative effect of all COPCs.

Some chemical data was not included in the evaluation process at all, such as anions, cations, and essential nutrients. This approach is not acceptable because, certain chemical in this group may be indicative of the waste managed. Evaluation of these chemicals must be performed in connection with the identifying of "hot" spots, or area with "unusually high" (in comparison to the rest of the area) concentrations of other COPCs.

Comment 2.
In Step 3 of the evaluation process from section 2.0, LANL used multiple statistical procedures to eliminate COPCs when some results in the sets of data exceeded the background value (BV) for

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the corresponding constituent. The BV were calculated based on the background data collected facility-wide, evaluated by statistical procedures and established as being the upper tolerance limit (UTL) for the background population of each constituent. According to the definition of UTL, any exceedance of the UTL is indicative of a release. No further statistical tests are necessary to establish that a particular value does not belong to the background population because the calculation of the UTL itself incorporates this information.

Comment 3.
In Step 3, LANL performs statistical tests (section 2.0). However, the prerequisite is analysis of the summary statistics and graphical presentation of the data. Such analysis serves two purposes: first, it indicates "well" and "poor" behaved data set, including the need for additional samples and distribution; and secondly, it checks all assumptions necessary to conduct any further statistical tests. For example, the WRS and Quantile tests assume that the collected samples are independent, collected using systematic or random sampling, and that both distributions (the site and background) are identical (in shape and dispersion). However, preliminary review of the data sets revealed insufficient samples sizes (of the populations), and inconsistent distribution of the site and background data sets. There is no information on how independent, and random the samples were. The WRS test is also not recommended if the number of non-detects is more than 40 percent. Therefore, the performing of the listed tests is statistically *invalid* for some constituents in this Appendix.
LANL must include an additional step to their evaluation process, which step will analyze the parameters of the data, and its suitability for conducting statistical tests.

Comment 4.
In section 2.2, LANL performs non-parametric tests for all data sets, without consideration of the distribution of the data. Parametric tests are preferred whenever possible, in comparison to non-parametric tests. Therefore, LANL must perform the normality test in order to determine which sets display normal or log-normal distribution, and for these that indicate parametric distribution, LANL must conduct t-test, rather than the WRS test. It appears that all data sets for tuff contained 4 samples only. Such small sample size is not sufficient. LANL must conduct additional sampling of the tuff (8 samples minimum) in order to perform any statistical tests. If the number of samples taken from background were similar to the samples taken from the site, four samples could have been sufficient. However, the background sets contain between 15 to 170 results.
As the previous comment, the recommendation here is that LANL must perform analysis of the data itself for each constituent before plunging in wrong statistical testing.

Comment 5.
It appears that the comparisons to background tuff was performed using the background values for the tuff Qbt 2, 3, 4, which values are higher for 12 (out of 23) inorganic constituents in comparison to the tuff Qbt 1v background, and these include arsenic, barium, cadmium, chromium, copper, iron, magnesium, manganese, nickel, sulfate, tantalum, and vanadium. LANL did not provide a rationale for choosing these particular BV.

Comment 6.
In section 4.0, LANL calculates upper confidence limit (UCL). However, LANL pools the data for soil and tuff, which two sources were considered separate in the earlier evaluation. Such pooling "dilutes" the data and thus the corresponding UCLs are lower (resulting in lower risk calculations).

Comment 7.
In section 4.0 LANL calculates UCLs (Table I1-7 and I1-8) of the identified COPCs in Table I1-5 and I1-6. However, all identified COPCs from Table I1-5 and I1-6 do not appear in the UCL tables. LANL does not give an explanation why some (9 constituents for soil and tuff, and 8 constituents for sediments) COPCs were dropped, and UCLs for these COPCs were not calculated.

Comment 8.
In section 4.3, LANL explains that for the log-normally distributed data, the corresponding UCL was calculated using the bootstrap procedure. This approach is not acceptable. There are multiple choices for calculating UCL for log-normally distributed data, and the bootstrap method is not one of them.

Comment 9.
In section 4.2.2, LANL states that the *standard bootstrap procedure* is used to calculate UCLs for data that indicated non-parametric distribution, which method gives the lowest possible UCL (and thus the calculated risk is decreased). The ProUCL Manual (which program LANL uses for this evaluation) describes as preferred method for calculating non-parametric UCL, the Chebyshev's method, which may yield up to 50 percent higher UCL.