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JOHN D'ANTONIO, Jr.
SECRETARY

General: Site-wide Background.

MEMORANDUM

TO: John Young

THROUGH: David Cobrain

FROM: Daniela Bowman *DKB*

SUBJECT: Inorganic and radionuclide background data for soils, canyon sediments and Bandelier tuff at Los Alamos National Laboratory (Sep 1998); HWB-LANL-99-039

DATE: October 3, 2002

After reviewing the document the following deficiencies were found. Some additional information is also needed as stated:

- 1) In Section 2.0 (pg 2) LANL stated that the data must be inspected for suspect values. In Section 3.3.3 (pg 17) LANL dismissed a large number of data based on its subjectivity. Section 3.1.4 stated that LANL used the "weight-of-evidence" approach to evaluate suspect values.

LANL should state in this section how exactly the data will be inspected. EPA recommends outlier tests, which are not mentioned in this document. LANL cannot remove data for reasons that they find suitable or by internal LANL approaches. Even if outliers are present in a set of data they are rarely dropped from the statistical evaluation. When outliers are identified using statistical tests and no explanation for the suspect data is found, the outlier must be used in the statistical evaluation or the background location should be disregarded as such.

- 2) In Section 2 (pg 3) LANL stated that the background data must be fitted to a standard distribution and that Appendix A shows the fits of the data to normal distribution.

Appendix A shows standard normal probability plots. However, constructing probability plots is not sufficient to check for normality of the data. EPA recommends performing statistical tests at the 95 (or 99 for multiple tests) percent confidence limit in order to identify the distribution of each set of data. These tests are Shapiro-Wilk test ($n < 50$) and



Shapiro-Francia or Lilliefors test (for $n > 50$). Probability plot could be constructed only for graphical use in addition to the normality tests. Square-root transformation could be used only after LANL shows that the normality and log-normality tests fail.

LANL should show if these tests were performed and the results in the form of p-value. If the testing was not conducted, the background UTLs should be revised to incorporate this testing.

- 3) In Section 2 (pg 3) LANL explained how the non-detect values were represented in the analysis. In some later sections LANL takes as an UTL the detection limit for constituents with only two or three detections.
LANL did not explain how UTL values were calculated for data sets with high percent non-detects. According to EPA Guidance special adjustments (Cohen or Aitchison) should be performed when calculating the mean and standard deviation of the data for high percent non-detects and for more than 90 percent non-detects, Poisson UTLs should be calculated.
LANL did not explain how the estimated values were handled (J qualified). Estimated (J qualified) values are not non-detects, and should be treated as valid measurements for statistical purposes.
- 4) In Section 2 (pg 3) LANL stated that in order to calculate UTL for lognormal distributed data, first-order Monte Carlo simulation process was used in C-plus programming language, where the inputs are the lognormal mean (E) and the lognormal statistical deviation (V). This method of calculating UTL with these inputs is not specifically recommended in EPA Guidance. LANL can use different method only if it shows that this method gives similar or better results to the conventional method of calculating UTL for lognormal distributed data.
LANL should provide supporting data that shows that this method of calculating UTL for lognormal distributed data gives similar or better results. Otherwise, LANL should use the methods explained in the EPA Guidance.
- 5) In Section 3.1.2 (pg 7) LANL stated that the soil samples were passed through a 2-mm sieve to remove pebbles and roots. Screening of the samples (removing debris and rock larger than 2 mm) biases the sample. To determine if this is significant to the analytical results, LANL have to conduct a sampling study (analyze different size particles for specific constituent separately, and apply regression analysis) as a pilot study or as a double sampling during the investigation/study to determine the significance of the screening to the results.
- 6) In Section 3.1.2 (pg 7) LANL stated that the samples were either air-dried or dried in a forced-air circulation oven at 105°C for 24 hours before performing chemical analysis. Any preliminary mixing and homogenizing of the sample should be done in the form the sample is received. Drying of the soil is necessary only if the moisture content is high.
According to SW-846, Chapter 3, the samples may be oven-dried at 60°C or less. LANL's preparation of the samples is improper.

- 7) LANL should explain why Table 3.2-1, 5.3-4, 5.3-5, and 5.3-6 does not include other naturally occurring radionuclides as Potassium-40, Radium-226, -228, Thorium-228, -230, -232, Uranium-234, -235, -238.
- 8) In Section 3.3.2 LANL stated that the sample collection procedure involved collecting a composite samples for analysis. LANL did not list the sampling tools for collecting samples in this section.
The practice for collecting composite samples for background study is inappropriate. LANL should be collecting grab discrete samples using appropriate tools. LANL should describe the sampling tools and methods during the collection of samples.
- 9) In Section 3.3.3 LANL stated that data from 1970s to 1980s were excluded from the background fallout data because they were showing decreasing trend in the activity. LANL also stated that other suspect values were also removed from the data.
If the activity of the short-lived radionuclides was showing trend, this is indicative of locations that are not background. Values from the data cannot be excluded for reasons that are subjective to LANL. Any elimination of data from the statistical set should be conducted after carefully reviewing of the data and conducting statistical outlier test.
- 10) Table 3.3-2 and Table 4.3-4 do not include Uranium and Thorium (total and isotopic). LANL should explain why this data was not included in the summary tables.
- 11) In Section 4.3.3 LANL stated that "[t]he statistical evaluation of canyon sediment data showed that the major source of variability for these radionuclides was the sample grain size".
LANL should provide the statistical evaluation that shows this fact.
- 12) In Section 4.3.3 (pg 29) LANL stated that the results for americium-241 and plutonium-239,240 were elevated in one sample and that as a consequence these values were omitted in the statistical analysis.
LANL should provide the sample location of this sample and the elevated concentrations. Data cannot be dropped out for reasons subjective to LANL. Statistical outlier test has to be conducted to identify outliers. Even if values have been identified as outliers, the values cannot be always disregarded from the statistical evaluation.
- 13) In Section 4.3.2 (pg 25) LANL stated that UTL value for total thorium was not calculated because the data consist of seven samples only.
This approach is not appropriate. UTL values can be calculated for four or more samples per constituent with the difference that the uncertainty is larger if the number of samples is smaller. LANL should collect more samples or calculate UTL values for the existing seven values.
LANL stated that UTL value for total thorium in sediments was adopted from the soil

background value. According to LANL (LA-12913-MS) most of the soil samples represented horizon B (which showed higher concentrations for almost all metals) and the sediment samples consisted mostly of A- and C-horizon soils. Using surrogate values is inappropriate when conducting a background study.

- 14) In Section 3.1.3.2 (pg 11) LANL stated that several samples from the mesa top were excluded from the soil background data because of elevated concentration of uranium. This approach is inappropriate. If a specific location is a suspect of representing background, all of the data from this location should be excluded not only the data for uranium.
- 15) General comment. LANL should provide the values for each data set including the rejected data, with the date, location, horizon, depth, qualifier (as assigned by the laboratory), and explanation about why the data was rejected (if applicable).
- 16) General comment. The summary tables provided by LANL should contain additional information about the data set: the number of non-detects (in percent), the type of distribution, and the mean calculated on basis of the distribution (for example for lognormal data, the geometric mean).
- 17) General comment. The count number for each data set is different. This fact suggests that many values were omitted, rejected, or discarded from the background study. This approach is totally inappropriate. All values for each constituent from the same sample have to be included in the data set. Values can be rejected only if an error is identified (typographical, sampling, QA/QC reject) or if a location is dismissed as a background.