STATE OF NEVADA

Jim Gibbons, Governor

Department of Conservation & Natural Resources

Allen Biaggi, Director

DIVISION OF ENVIRONMENTAL PROTECTION

Leo M. Drozdoff, P.E., Administrator

ndep

NEVADA DIVISION OF ENVIRONMENTAL PROTECTION

protecting the future for generations

December 10, 2008

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Re.   **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
      Guidance on the Development of Summary Statistics Tables

Dear Sirs and Madam:

All of the parties listed above shall be referred to as "the Companies" for the purposes of this letter. Attachment A provides guidance on the development of summary statistics tables. Please utilize this guidance in the development of all future Deliverables.

Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov).

Sincerely,

Brian A Rakvica, P.E.
Supervisor, Special Projects Branch
Bureau of Corrective Actions

BAR:s

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Attachment A

Tables of summary statistics have been presented by the Companies in various risk assessment reports, sampling and analysis plans (SAPs), and other relevant documents. These tables provide statistical summaries, but they often provide different specific information. The purpose of this guidance is to ensure greater consistency in the presentation of summary statistics.

Summary statistics are helpful for supporting background comparisons and calculation of exposure point concentrations (EPCs), usually in the form of upper confidence limits (UCLs) or maximum reported concentrations. These two cases require different presentation of summary statistics because of the different roles that non-detects play. Background comparisons involve direct comparison of two datasets that, in general, include detected data and non-detects. The intent is to determine if contamination exists; that is to determine if the site data are greater than the background data. Aspects of the site and background data that are important include the frequency of detection (FOD), the range of detection limits, and the concentration values. That is, summary statistics are needed for all three aspects to provide an adequate comparison. Background comparisons and their associated summary statistics tables apply only to those chemicals for which background data have been collected. For the Companies, this chemical list is currently limited to metals and some radionuclides.

Statistics for risk assessment are aimed at calculating an UCL for the mean concentration. If the UCL is greater than the maximum reported concentration, then the maximum value might be used instead. Summary statistics for this purpose are aimed primarily at the mean concentration. Substitution rules are used for the non-detects so that the mean can be estimated, and the mean and standard deviation are then estimated from detected concentrations and substituted values for non-detects. The needs are different than for background comparisons, hence the summary statistics should focus on different aspects of the data.

In addition, for background comparisons non-parametric statistics are used, for which substituted values for non-detects are not necessary. Although the parametric *t*-test is also run for background comparisons, the focus is largely on the non-parametric tests, especially for chemicals with a high frequency of non-detects. For risk assessment, estimation of the mean concentration involves parametric methods subsequent to substitution for non-detects.

As noted above, background comparisons apply to metals and radionuclides. However, radionuclides do not involve use of censored (non-detect) data, in which case the summary statistics needs for radionuclides are different than for metals. Summary statistics needs for risk assessment also vary by class of chemicals. Again, radionuclides risk assessment does not involve censoring of the data. Most metals and organic chemicals involve the same type of data, but the data for asbestos are markedly different. Requirements for each of these different cases are laid out below.

Although summary statistics should be presented according to this guidance, this does not by itself provide any guarantee that the summary statistics are reasonable in the context of the decisions to be made. For example, the mean concentration for risk assessment might not be reasonable if there are many non-detects in the data. This guidance indicates which summary statistics should be presented, but does not directly address how they will be used.

Background Comparisons – Metals

Summary statistics described below should be provided for both site and background data separately, preferably, for each metal, with one line for the site data followed by another line for the background data. Table A provides an example. The highlighted columns represent the required fields. Please note that the summary statistics in Table A do not necessarily match any data from the Companies – they are presented purely as an example of the type of information that should be presented in the background comparisons summary statistics tables for metals.

Required fields

Number of samples
Number of detected concentrations
Minimum non-detected value (SQL[1])
Maximum non-detected value (SQL)
Minimum detected concentration
Median detected concentration
Mean of the detected concentrations
Maximum detected concentration

Optional fields

25th percentile non-detect
median non-detect
mean of the non-detects
75th percentile non-detect
standard deviation of the non-detects
25th percentile of the detected concentrations
75th percentile of the detected concentrations
standard deviation of the detected concentrations

Note that the summary statistics for the detected concentrations in this case apply to the detected data only. It is also expected that the statistical plots for background comparisons will match these data. This includes box plots, probability plots and any other summary plots that are deemed useful for comparison of site and background data. That is, non-detects will be shown at the detection limit, and with different symbols than for the detected values where appropriate.

Background Comparisons – Radionuclides

Summary statistics described below should be provided for both site and background data separately, preferably, for each radionuclide, with one line for the site data followed by another line for the background data. Examples of how to present the radionuclide information are presented in both Table A and Table B. In Table A, the non-detect columns are simply grayed out. In Table B only detect columns are presented. Either approach to presentation is acceptable. The highlighted columns represent the

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[1] SQL – sample quantitation limit, per NDEP's guidance to the Companies on use of detection limits dated December 3rd, 2008.

required fields. Please note that the summary statistics in Tables A and B do not necessarily match any data from the Companies – they are presented purely as an example of the type of information that should be presented in the background comparisons summary statistics tables for metals.

<u>Required fields</u>

Number of samples
Minimum concentration (radioactivity)
Median concentration (radioactivity)
Mean of the concentration (radioactivity)
Maximum concentration (radioactivity)

<u>Optional fields</u>

Number of detects[2]
25th percentile of the concentration (radioactivity)
75th percentile of the concentration (radioactivity)
standard deviation of the concentration (radioactivity)

Risk assessment – Metals and Organic Chemicals

Summary statistics described below should be provided for the site data that are used in a risk assessment. Table C provides an example. It is assumed that background comparisons will have been performed and will limit as appropriate inclusion of metals and radionuclides in this table. The highlighted columns represent the required fields. In Table C, it is assumed that ½ of the detection limit has been substituted for the non-detects. A substitution method is needed to provide data based on which an UCL can be estimated. It is assumed that the Companies will add columns to this table as necessary for UCLs, comparison to risk-based thresholds and other items that are deemed necessary for the respective reports. The focus of this guidance is purely summary statistics. Please note that the summary statistics in Table C do not necessarily match any data from the Companies – they are presented purely as an example of the type of information that should be presented in the risk assessment summary statistics tables for metals and organic chemicals.

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[2] Note that the number of detects is not a required field for radionuclides. This is because the radionuclide data are not considered censored. If the number of detects are included in the table, then it should represent the number of values that are greater than the minimum detectable activities.

<u>Required fields</u>

Number of samples
Number of detected concentrations
Minimum non-detected value (SQL)
Maximum non-detected value (SQL)
Minimum detected concentration
Maximum detected concentration
Mean of the detected concentrations
Standard deviation of the detected concentrations

<u>Optional fields</u>

Other summary statistics can be added, such as the median or other percentiles, however, it is not clear what their meaning might be if there are many non-detects for which a substitution of ½ of the detection limit has been used. Also, the basis of a risk assessment is the mean and the standard deviation, which are usually used together to estimate the exposure point concentration.

Risk Assessment – Radionuclides

Summary statistics described below should be provided for the site data that are used in a risk assessment. Tables C and D provide examples. In Table C, the columns that represent non-detected values are grayed out. In Table D, only summary statistics for detected data are included. Either approach can be used. It is assumed that background comparisons will have been performed and will limit as appropriate inclusion of metals and radionuclides in these tables. The highlighted columns in both tables represent the required fields. It is assumed that the Companies will add columns to this table as necessary for UCLs, comparison to risk-based thresholds and other items that are deemed necessary for the respective reports. The focus of this guidance is purely summary statistics. Please note that the summary statistics in Tables C and D do not necessarily match any data from the Companies – they are presented purely as an example of the type of information that should be presented in the risk assessment summary statistics tables for metals and organic chemicals.

<u>Required fields</u>

Number of samples
Minimum concentration (radioactivity)
Maximum concentration (radioactivity)
Mean of the concentrations (radioactivity)
Standard deviation of the concentrations (radioactivity)

<u>Optional fields</u>

Other summary statistics can be added, such as the median or other percentiles, however, the basis of a risk assessment is the mean and the standard deviation, which are usually used together to estimate the exposure point concentration.

Risk Assessment – Asbestos

Asbestos provides a unique case, because the data that are used as input to the risk assessment are the number of asbestos fibers counted in each sample. Considering the relationship between the raw counts and analytical sensitivity, both items should be reported for each sample and for each asbestos category measured (e.g., chrysotile, amphibole; long fibers, short fibers, etc.).

<u>Required fields</u>

Sample ID
Asbestos category (chrysotile or amphibole: long fibers, short fibers, all fibers, etc.)
Fiber count for the sample
Analytical sensitivity for the sample

Table E provides an example. Please note that the data presented in Table E do not necessarily match any data from the Companies – they are presented purely as an example of the type of information that should be presented in the risk assessment summary statistics tables for metals and organic chemicals.