

STATE OF NEVADA

Department of Conservation & Natural Resources

Jim Gibbons, Governor Allen Biaggi, Director

DIVISION OF ENVIRONMENTAL PROTECTION

Leo M. Drozdoff, P.E., Administrator

December 10, 2008

Mr. Mark Paris Basic Remediation Company 875 West Warm Springs Road Henderson, NV 89011 Ms. Susan Crowley Tronox LLC PO Box 55 Henderson, NV 89009 Mr. Curt Richards Olin Corporation 3855 North Ocoee Street, Suite 200, Cleveland, TN 37312

Mr. Joe Kelly Montrose Chemical Corp of CA 600 Ericksen Ave NE, Suite 380 Bainbridge Island, WA 98110 Mr. Brian Spiller Stauffer Management Co LLC 1800 Concord Pike Wilmington, DE 19850-6438 Mr. Craig Wilkinson Titanium Metals Corporation PO Box 2128 Henderson, NV 89009

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

CC:

Jim Najima, NDEP, BCA, Carson City

Marysia Skorska, NDEP, BCA, Las Vegas

Shannon Harbour, NDEP, BCA, Las Vegas

Todd Croft, NDEP, BCA, Las Vegas

Greg Lovato, NDEP, BCA, Carson City

Barry Conaty, Akin, Gump, Strauss, Hauer & Feld, L.L.P., 1333 New Hampshire Avenue, N.W., Washington, D.C. 20036

Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009

Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901

Ebrahim Juma, Clark County DAQEM, PO Box 551741, Las Vegas, NV, 89155-1741

Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801

Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011

Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015

George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409

Nicholas Pogoncheff, PES Environmental, Inc., 1682 Novato Blvd., Suite 100, Novato, CA 94947-7021

Lee Erickson, Stauffer Management Company LLC, P.O. Box 18890 Golden, CO 80402

Keith Bailey, Environmental Answers, 3229 Persimmon Creek Drive, Edmond, OK 73013

Susan Crowley, Crowley Environmental LLC, 366 Esquina Dr., Henderson, NV 89014

Mike Skromyda, Tronox LLC, PO Box 55, Henderson, Nevada 89009

Jeff Gibson, AMPAC, 3770 Howard Hughes Parkway, Suite 300, Las Vegas, Nevada 89109

Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727

Cindi Byrns, Olin Chlor Alkali, PO Box 86, Henderson, Nevada 89009

Paul Sundberg, Montrose Chemical Corporation, 3846 Estate Drive, Stockton, California 95209

Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110

Deni Chambers, Northgate Environmental Management, Inc., 300 Frank H. Ogawa Plaza, Suite 510, Oakland, CA 94612

Robert Infelise, Cox Castle Nicholson, 555 California Street, 10th Floor, San Francisco, CA 94104-1513 Michael Ford, Bryan Cave, One Renaissance Square, Two North Central Avenue, Suite 2200, Phoenix, AZ 85004

Dave Gratson, Neptune and Company, 1505 15th Street, Suite B, Los Alamos, NM 87544

Paul Black, Neptune and Company, Inc., 8550 West 14th Street, Suite 100, Lakewood, CO 80215

Teri Copeland, 5737 Kanan Rd., #182, Agoura Hills, CA 91301

Paul Hackenberry, Hackenberry Associates, 550 West Plumb Lane, B425, Reno, NV, 89509

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 (SQL¹)
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

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.

Required fields

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

Optional fields

Number of detects²
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.

_

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.

Required fields

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

Optional fields

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.

Required fields

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

Optional fields

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.).

Required fields

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.