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DEPARTMENT OF TOXIC SUBSTANCES CONTROL

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MEMORANDUM

TO: Tom Lanphar, Project Manager
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FROM: James M. Polisini, Ph.D.
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Office of Scientific Affairs (OSA)
Human and Ecological Risk Section (HERS)

DATE: September 18, 1995

SUBJECT: METHODOLOGY FOR DETERMINING 'BACKGROUND' OF INORGANIC CONSTITUENTS AT NAS ALAMEDA
[PCA 14740, SITE 200004-45 OC 2:4]

Background

You have requested participation by OSA at a meeting scheduled for September 18, 1995 to discuss the methodology for determining 'background' for inorganic constituents at NAS Alameda. The enclosed methodology for determining 'background' has been employed at other U.S. Navy sites in California and is appropriate for NAS Alameda. Please forward a copy of this memorandum to the Navy to focus the discussion at the meeting scheduled for September 18,1995.

Naval Air Station (NAS) Alameda occupies the western third of Alameda Island and has been a military installation since 1930. NAS Alameda occupies 2842 acres of land, water and airspace easement, including 1734 acres of land. The majority of the land at NAS Alameda was created by filling existing tidelands with dredged material from San Francisco Bay and the Oakland Inner Harbor.

Determination of Inorganic 'Background'

We recommend that metals be eliminated as COPC as early as possible in the risk assessment. This is most easily accomplished by comparing the highest concentration detected to a value which represents the upper range of the ambient concentrations for that metal. For this purpose we recommend here a procedure which we have previously recommended for other sites in California. The crux of the method is the use of plots of the log of concentration vs. cumulative probability.

a. **Expand the data set.** The largest data set possible is desirable for describing ambient conditions. If the number of 'background' samples planned is not sufficiently large, the population size for 'background' analysis can be expanded by a technique used successfully at several other sites. Samples of soil collected because of suspected contamination with petroleum products often are found negative for these mixtures upon assay. If these same samples were assayed for metals, the basewide data set can be augmented. This method

1245

worked well for Marine Corps Air Ground Combat Center Twentynine Palms. At Naval Station Long Beach, data sets from several investigations were combined to good effect.

b. **Display summary statistics for the expanded data set.** Construct a table showing the following for each metal: frequency of detection, range of detected values, range of sample quantitation limits, arithmetic means and standard deviations, and coefficients of variation (CV). If ranges of values for a metal exceed two orders of magnitude or if the coefficient of variation exceeds 1.00, then data from contaminated samples may be present..

c. **Plot logarithm of concentration vs. cumulative probability.** Sort concentration data for a metal from the lowest to the highest value, using one-half the sample quantitation limit for non-detects. Assume that ambient concentrations of metals are lognormally distributed. Our experience at other sites in California has shown lognormality to be a robust and useful assumption for the distributions of ambient concentrations of metals, even at frequencies of detection much less than 100%. Construct a plot of cumulative probability vs. log of concentration. Equal distances on the probability axis represent equal numbers of standard deviations. If the sample population numbers 100, then the cumulative probability is 0.05 when the lowest five values have been plotted.

d. **Define ambient conditions as the population with the lowest concentrations.** If data are drawn from just one population, then the log-probability plot will be a straight line. Inflection points suggest multiple populations, possibly as a result of differing soil types or anthropogenic influences (contamination). For the purpose of identifying COPC for risk assessment, we recommend defining ambient conditions as the range of concentrations associated with the population nearest the origin in the plot . This definition may be performed by inspection or via commercially available computer software. The population with the lowest range is selected to minimize the chance of erroneously eliminating a metal whose concentrations are actually due to contamination. The population with the highest range of concentrations might represent contamination, especially if the summary statistics show that the range of detected values exceeds two orders of magnitude and/or if the CV exceeds 1.00. Professional judgment is sometimes required to conclude that some portion of the data intended to represent ambient conditions actually represents contamination.

e. **Calculate a value to represent the upper range of ambient conditions.** Using only the data from the population with the lowest concentrations (with one-half sample quantitation limits substituting for non-detects), calculate the 80% lower confidence limit on the 95th quantile. A lower confidence limit on a quantile is used in preference to an upper confidence limit, because it is self-correcting with respect to sample size. By this is meant that small sample sizes will yield restrictive comparators (lower values) and metals will tend to retained as COPC, while larger sample populations will yield less restrictive comparators and COPC may be eliminated more easily. Statistical tables for calculating lower confidence limits on quantiles may be obtained from OSA. If the 'background' population size exceeds 50 use the 95th quantile itself, rather than a lower confidence limit on the 95th quantile.

f. **Include or exclude metals as COPC.** If the highest concentration of a metal detected at a site is less than the comparator selected to represent the upper range of ambient conditions, then eliminate the metal as a COPC. If concentrations higher than the comparator are found, then include the metal in the risk assessment as a COPC. For those metals retained, it is often useful to examine the spatial distribution of the elevated concentrations to determine if a "hot spot" is present.

The U.S. EPA Region IX Regional Toxicologist has reviewed and agreed with the enclosed methodology.

Reviewed by : John P. Christopher, Ph.D., DABT
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cc: Deborah J. Oudiz, Ph.D., Senior Toxicologist, Northern California Liaison, HERS

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