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Mr. Steve Hurff
C/o Commanding Officer
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #28
Lester, Pennsylvania 19113

Re: South Weymouth Naval Air Station
Phase II EBS – Data Analysis Update
RTN# 3-2621

July 7, 1999

Dear Mr. Hurff:

The Department of Environmental Protection has received and reviewed the NAS SOUTH WEYMOUTH PHASE II EBS – DATA ANALYSIS UPDATE (DAU). The Department recognizes that the use of inferential statistics can be an effective tool in evaluating environmental data. Additionally, the comparison of maximum Review Item Areas (RIAs) contaminant values to the mean values of the background data set, as original planned in the EBS work plan, is likely to be overly conservative. The work plan developed this approach to address screening of composite samples. Thus this work plan approach should be modified. To assist the Navy in determining which (RIAs) will require further evaluation and/or additional sampling, the Department offers the following comments and recommendations:

1. The Department is concerned that the primary step in using inferential statistics was not taken at this site. The sampling program for the installation was not developed with the intent of using inferential statistical compressions of background data sets to RIAs data sets. The after the fact use of inferential statistics may not yield the most appropriate "fit" (highest statistical power) prescribed in Section 1.4 of the Navy's PROCEDURAL GUIDANCE FOR STATISTICALLY ANALYZING ENVIRONMENTAL BACKGROUND DATA. The use of a limited number of samples in areas of suspected releases and composite sampling in other RIAs would reduce the power of any of the proposed inferential comparisons. The Department recommends including summary (descriptive) statistics, including minimum,

maximum, mean, median, standard deviation, and coefficient of variability as a screening tool for comparisons of RIA data to background data.

2. The DAU states that data from RIA designated as clean may be added in to the background set at a later date. This practice may bias the background data set by including data that may be elevated, albeit by a statistically insignificant amount. Only areas with no history of hazardous material use or release should be designated as background areas. The very nature of the RIAs precludes this. Additionally, for consistent background determinations throughout the site, all background comparisons should employ the same background data set.

3. Table 2 proposes to use six surface water/sediment data points for developing the background data set. As discussed in comment 1, for the purposes of inferential comparisons (such as t-Test) seven is a very small sample size. The power of the test is likely to be inadequate unless the variability in the data is extremely low. Additionally, the physical and chemical characteristics of the background sediment samples need to be compared to the RIA samples as a component of the screening process. The concentration of analytes included in and/or adsorbed to the sediment is influenced heavily by such factors as the geological nature, particle size, and organic content of the sediments.

4. The DAU states that the initial assumption will be that both data sets are normally distributed. The Department's experience is that distributions of soil background concentrations tend to be roughly log-normal. Sediment and/or water distributions may be closer to normal, thus all assumption will need to be substantiated.

5. The DAU states that summary (descriptive) statistics, including minimum, maximum, mean, median, standard deviation, and coefficient of variability will be produced. However, there is no indication of how comparison of summary statistics will be used in the decision process, particularly of circumstances under which the summary statistics might be given more weight than formal inferential techniques.

6. There appear to be two discrepancies between the text and Figure 2; 1) The treatment of non-detects as described does not appear to be consistent with the decision process depicted in Figure 2, and 2) The DUA states that if either the background or the RIA data set is not normally distributed, a non-parametric inferential method will be used. Figure 2 indicates that if the data sets are neither normal nor log-normal, a non-parametric method will be used. Please clarify.

7. The rationale for the values used for background Type I and Type II error rates needs to be substantiated. The values provide in the EBS Phase II Work Plan were specific to determining appropriate sample sizes, not inferential statistical comparisons of background data to RIA data. Please provide supporting information for independently developed background/RIA Type I and Type II error rates.

8. The DAU states that Satterthwaite's t-Test be used if the variances of the background and RIA data sets are unequal. If the site and background distributions are consistent, however, the variances should be the same. Finding unequal variances suggests that the distributions are in fact different. A compression of the central tendency and range of distribution may be

a more useful screening method when the background and RIA data sets have unequal variances.

9. Statistical power calculations of the sample size necessary to achieve a specified power should be presented for each proposed test using estimated variance values. The Department recommends relying heavily on descriptive summary statistics in cases where it is not feasible to collect and analyze enough samples to meet the goals for statistical power.

   For comparisons of RIA data sets to background distributions that are known or believed to be log-normal, the Department recommends comparing both the central tendency and range of distributions. The median is often a more reliable indicator than the mean of the central tendency of a skewed distribution, such as a log-normal distribution. The mean may be very heavily influenced by high values in the data set.

The Department appreciates your continued cooperation. If you have any questions regarding this letter, please contact Albe Simenas, Project Manager at (617) 292-5507.

Very truly yours,

Anne Malewicz,
Bureau of Waste Site Cleanup
Federal Facilities Section Chief

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cc:

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