STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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February 7, 1997

Mr. Fred Evans
Department of the Navy
Northern Division
Naval Facilities Engineering Command
Code 1823/FE
10 Industrial Highway, Mailstop 82
Lester, PA 19113-2090

RE: Work Plan for the Geostatistical Assessment of the Eastern Plume, Naval Air Station, Brunswick, Maine

Dear Mr. Evans:

The Maine Department of Environmental Protection (MEDEP) has reviewed the January 1997 Draft Work Plan for the Geostatistical Assessment of the Eastern Plume, Naval Air Station, Brunswick, Maine prepared by EA Engineering, Science and Technology on behalf of the Navy. MEDEP's comments on the draft document are as follows:

General Comments

The work plan does not specifically discuss the Exploratory Data Analysis (EDA) or conceptual model development portion of the geostatistical assessment. The usefulness of this geostatistical assessment is dependent on the proper assessment of the statistical character of the data (e.g. normal vs log-normal distributions) and proper identification of separate data populations. Equally important is the construction of a conceptual model which clearly defines the physical nature of the aquifer system.

It was indicated at the January 30, 1997 RAB meeting that the ABB numerical model would be the basis for the conceptual model. Both the EDA and the conceptual model should be summarized in the geostatistical assessment report.

The Work Plan does not identify the monitoring points to be included in the analysis. To assure that all parties have the same understanding, this information should be included in the work plan, both in a tabular summary and shown on figures. Any data points rejected must be identified and the rationale must be provided and discussed.

The Work Plan mentions the extraction system but does not discuss the impact of pumping on the geostatistical analysis or whether data from the extraction wells is to be included. Please provide a rationale for including or not including this information.

Specific Comments

1.) 2.3 Variography, Page 7, Para 4

a.) "Upon computation of sample variograms, four iterative steps are taken:

1. Select an acceptable mathematical model to fit the sample variograms
2. Visually determine a reasonable sill value for the model
3. Determine the nugget value
4. Visually select a reasonable range."

Based on MEDEP's understanding of variography, this appears to describe the construction of the omni-directional variogram. Are the terms sample variogram and omni-directional variogram synonymous?

b.) "Using the chosen parameter values, the variogram is superimposed on the sample variogram values. At this stage, the analyst modifies the parameter values until a satisfactory visual fit is achieved."

It is the MEDEP's understanding that the model, which is determined using the procedures described in Comment 1 a.), is superimposed on the directional variograms. Only the model range is adjusted to achieve a "best fit" with the directional variogram. Please clarify your discussion on the use of variograms.

2.) 2.5 Objectives, Page 8, Para 4

"1. ***To evaluate the existing ground-water chemical data from various wells and layers***. The existing data include chemically analyzed ground-water samples collected at various multi-layer monitoring wells situated throughout the site. Lateral and vertical distribution of sampled wells requires a spatial approach, such as geostatistics."

As the geostatistical analysis proceeds, the conceptual model should be continually revisited and refined.

"2. ***To quantify relative changes in the observed concentrations of contaminants of concern which have occurred during the past six sampling events.*** This evaluation is aimed at comparing the distribution of parent compounds and daughter compounds to assess the degree to which natural attenuation may be occurring at the Eastern Plume."

The MEDEP appreciates the Navies efforts in assessing the effect of natural attenuation on the Eastern Plume. However, this is a secondary concern relative to the primary objective of this particular work plan; which the MEDEP understands is to assess the adequacy of the monitoring well network using geostatistics. This should be reflected in the order the tasks are listed in this section of the text.

Natural attenuation encompasses a number of processes including biodegradation. It would be more accurate to confine this discussion to biodegradation. Comparison of parent and daughter compounds is a useful first step in the assessment of the occurrence of biodegradation in the Eastern Plume. However, this must be viewed as a preliminary assessment. Demonstration of the effectiveness of natural attenuation as a remedial option requires a rigorous investigation of the geochemistry of the impacted aquifer. Technical protocol are currently being developed for this purpose. Please refer to the attached article.

3.) 3.1 Selection of Signature Compounds, Page 10, Para 2 & 3

a.) "Geostatistics will be performed on the signature compounds, which are commonly detected, rather than the complete list of contaminants of concern, many of which are detected with low frequencies. These compounds include trichloroethene, tetrachloroethene, and total dichloroethene."

The MEDEP is concerned that the Navy is not considering 111-Trichloroethane (111-TCA) and it's daughter products as part of the geostatistical assessment. As a quick comparison, the MEDEP tabulated draft ethene and ethane data from the Eastern Plume and Sites 1 & 3 (see attached table). The table, which includes groundwater data from 1988 through Quarter 5 of the LTM program, was tabulated prior to the availability of the Navy's current database and may contain minor inaccuracies. The table was sorted by TCE values in descending order and only contained sites with detectable concentrations of ethenes or ethanes.

In general, ethene and ethane contamination was coincident. However, 111-TCA contamination typically exceeded ethene contaminations. The far right column of the attached table contains the percent difference of TCE vs. 111-TCA values (TCE/TCA x 100). The variability observed in these percent differences demonstrates differences in relative abundance of these contaminants at different locations and during different sampling events. The foundation of variography is based on the difference in values between two points. Given, the difference in relative abundance between the ethanes and ethenes, the results of the variography for these compounds should be distinct and may produce separate conclusions regarding the distribution of these contaminants. Therefore, the MEDEP believes it is important to include the ethanes in the geostastistical assessment of the eastern plume.

b.) "Total dichloroethene was selected because this compound is a breakdown product (daughter product) to be used to assess the effect of natural attenuation."

The MEDEP suggests the isomers of dichloroethene be considered when assessing natural attenuation. This suggestion is based on the following quote from the attached article by Wiedemeirer et al:

> "During reductive dechlorination, all three isomers of dichloroethene can theoretically be produced; however, Bower (24) reports that under the influence of biodegradation, *cis*-1,2-dichloroethene is a more common intermediate than *trans*-1,2-dichloroethene, and that 1,1-dichloroethene is the least prevalent intermediate of the three dichloroethene isomers."

4.) 3.4 Reporting, Page 13, Para 3 thru 5

It would be helpful for the reviewer if geostatistical assessment results were reported in the format presented by Dr. Rouhani during his geostatistical course. This would include the following sections.

1. Exploratory Data Analysis (EDA)
2. Structural Analysis
3. Cross Validation
4. Kriging
5. Conclusions and Decisions

Please include figures, summary statistics, and graphs to support the conclusions drawn from each of these steps.

If you have any questions, feel free to call me at (207) 287-2651.

Sincerely,

Denise Messier

Denise Messier
Bureau of Remediation and Waste Management

Attachments

cc Richard Heath, DEP (w/o attachment)
Robert Lim, EPA
Jim Caruthers, NASB
Carolyn Lepage, Lepage Environmental Associates
Susan Weddle, Brunswick
Michael Battle, EA Engineering, Science and Technology
Jeff Brandow, ABB Environmental Services