MEETING MINUTES
TECHNICAL RESTORATION ADVISORY BOARD
NAVAL AIR STATION BRUNSWICK, MAINE
5 NOVEMBER 1997

1. INTRODUCTION

A technical Restoration Advisory Board (RAB) meeting was held in Building 8 at Naval Air Station (NAS) Brunswick on 5 November 1997 from 0830 to 1100 hours. Meeting attendees included:

Emil Klawitter, Remedial Project Manager	Northern Division, NAVFACENGCOM
Jeff Dale, Remedial Project Manager	Northern Division, NAVFACENGCOM
Jim Caruthers, Coordinator IR Program	NAS Public Works - Environmental
Claudia Sait, Project Manager	Maine Department of Environmental Protection
Richard Heath, Lead Geologist	Maine Department of Environmental Protection
Robert Lim, Project Manager	U.S. Environmental Protection Agency, Region I
Carolyn LePage, TAG Consultant	LePage Environmental Services
Ed Benedict	Citizen, Town of Brunswick
Peter Nimmer, Project Manager	EA Engineering, Science, and Technology
Bruce Muchmore, Scientist	EA Engineering, Science, and Technology

During introductions, Mr. Heath indicated he will be replaced as lead geologist for the Maine Department of Environmental Protection (MEDEP) for this project.

2. TREATMENT PLANT EFFLUENT

MEDEP expressed concerns about the discharge concentrations of volatile organic compounds (VOC), particularly three compounds which have reported exceedances of Maximum Exposure Guidelines/Maximum Contaminant Levels (MEG/MCL) in the plant effluent. The MEDEP is concerned that use of re-injection without additional treatment could result in the discharge of water above MEG/MCL. Mr. Heath provided a spreadsheet of effluent chemistry showing the dates and compounds which have been reported above MEG/MCL (attached). The addition of an extraction well near MW-311 (EW-2A) was expected to increase VOC concentrations, although the amount of change was not known.

Mr. Caruthers indicated that additional treatment could be very expensive, and the use of re-injection may not be cost effective, if this is required. Ms. Sait indicated additional treatment should be considered for compounds which are not destroyed by the existing ultraviolet oxidation system. Mr. Klawitter indicated that the Navy will look into the potential cost impact for additional treatment, and the effect of EW-2A on the effluent concentrations before making a final decision.

Mr. Heath indicated that the currently used analytical method to test for vinyl chloride reports concentrations to 1.0 μg/L, which are not sensitive enough to detect concentrations at the MEG of 0.15 μg/L. He indicated that this compound is likely affected by the ultraviolet oxidation system, although occasional testing using a more sensitive analytical method should be considered. A testing program of plant effluent every 6 months using the more sensitive method was considered to be acceptable to RAB members. EPA indicated they were aware of a potentially acceptable method, and would followup on providing that to the Navy for possible use in future testing.

3. CESSATION OF PUMPING AT LANDFILL EXTRACTION WELLS

A letter was sent on 23 October 1997 to RAB members indicating the Navy will stop pumping at these locations. Mr. Heath indicated the MEDEP agreed the wells could be shut off, although an increase in the frequency of water elevation monitoring to monthly would be desirable to confirm whether water elevations continued to decrease inside the landfill. Mr. Heath also indicated that the letter did not provide sufficient detail on when pumping should be reinstated. He noted that a control chart should be made based on water elevation data, and that the trigger threshold would be defined explicitly. Mr. Heath indicated a letter would be forthcoming from MEDEP to the Navy further defining these issues.

4. 70% COMPLETE GEOSTATISTICAL ASSESSMENT OF THE EASTERN PLUME

Mr. Nimmer led a discussion on the 70% complete geostatistical assessment package sent on 23 October 1997. The package contained five hypotheses which have been defined for testing using geostatistics (attached). The preliminary results of the geostatistical assessment indicate that data gaps and areas of data surplus may be present. He provided an example of the decision matrix which might be used to determine when a monitoring point would be recommended for removal from the plan (attached). A discussion of the considerations to be used for data gap analysis was also presented (attached).

Questions were raised regarding the use of directional or omni-directional variograms. Mr. Muchmore noted that only omni-directional variograms were used to date, although the use of directional variograms would be explored before the assessment was completed. These results would be included in the final summary report. Mr. Nimmer noted that the model will be defined for a separated northern and southern lobe in an attempt to more accurately fit the model to the northern lobe data points. These results will be presented in the final summary report. Ms. LePage questioned whether other hypotheses were developed but not tested. Mr. Nimmer indicated that these five hypotheses were the only ones developed.

The RAB was in general agreement with the approach of the geostatistical analysis. Mr. Lim and Mr. Heath indicated they would look over the results and provide any further comments by 7 November 1997.

5. SCHEDULE OF FUTURE ACTIVITIES

Mr. Klawitter indicated a schedule is being developed for work planned for 1998. The schedule will note the approximate delivery dates for planning regulators work loads. Mr. Klawitter noted the direct-push work scheduled for November 1997 is not likely to be completed until Spring 1998 due to the onset of inclement weather. Mr. Klawitter wondered what sort of work plan would be required for these direct-push investigations. Mr. Heath and Ms. Sait indicated a simplified letter work plan would be sufficient.

Attachments

Effl[redacted]emistry
11/15/[redacted]hru 9/2/97
Groundwater Extraction Treatment Plant
Brunswick Naval Air Station

Parameter	MCL	MEG	Treatment Plant Effluent (µg/L)																	
			11/15/96	12/1/96	1/15/97	2/3/97	2/17/97	3/3/97	3/17/97	4/1/97	4/15/97	5/1/97	5/15/97	6/2/97	6/16/97	7/2/97	7/15/97	8/1/97	8/15/97	9/2/97
Arsenic Total	50	NA	<10U	<10U	<2.1U	<2U	4B	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2U
Chromium Total	100	100	<10U	<10U	3.9B	1B	<3U	<2U	<2U	<3U	<3U	<2U	<3U	<3U	<1U	<1U	<2U	<2U	5.8B	<3U
Cyanide, Total	200	154	<1.3U	<1.3U	2.0B	<1U	<10U	<10U	<10U	<10U	<10U	<10U	<10U	<10U	<10U	<10U	<10U	<10U	<10U	<10U
Nickel, Total	100	150	<10U	<10U	18.6B	<1U	<4U	<7U	<7U	<4U	<8U	<7U	<8U	<8U	<5U	<8U	<5U	<5U	<8U	<8U
Lead, Total	15	20	<10U	<10U	<1.3U	<1U	8.2	7E	2.5E	2B	<2U	<2U	<2U	<2U	<2U	<2U	2.9B	<2U	<2U	<2U
Zinc, Total	5000*	NA	21.8	28.2	22.9	18B	26.6	13B	14.5B	24	13	29.3	18.7	21.6	<8U	19.4B	23.9	20.5	16.6B	18.4
1,1,1-Trichloroethane	200	200	***220***	170	***200***	170	160D	180	180D	***210***	120D	160	120D	99	160D	140D	190D	***210D***	***200D***	190D
1,1-Dichloroethane	NA	5	2.5	1.5	***5.6***	3.5	***7.6***	3.8	***8***	***7.5***	4	1.5	1.1	<3U	1	<1U	1.8	1.4	3	***5***
1,1-Dichloroethene	7	7	<1U	<1U	<1U	<1U	<1U	<2U	<1U	<2U	<1U	<1U	<1U	<3U	<1U	<1U	<1U	<1U	<1U	<1U
cis-1,2-Dichloroethene	70	70	<1U	<1U	<1U	<1U	<1U	<2U	<1U	<2U	<1U	<1U	<1U	<3U	<1U	<1U	<1U	<1U	<1U	<1U
trans-1,2-Dichloroethen	100	70	<0.5U	<0.5U	<0.5U	<0.5U	<0.5U	<2U	<1U	<2U	<1U	<1U	<1U	<3U	<1U	<1U	<1U	<1U	<1U	<1U
Methylene chloride	NA	3	<2U	<2U	<2U	<2U	<2U	<2U	<1U	<2U	0.4JB	<1U	<1U	<3U	<1U	<1U	<1U	*4.1*	<1U	<1U
Tetrachloroethene	5	3	<0.5U	<0.5U	<0.5U	<0.5U	<0.5U	<2U	<1U	<2U	<1U	<1U	<1U	<3U	<1U	<1U	<1U	<1U	<1U	<1U
Trichloroethene	5	5	<0.5U	<0.5U	<0.5U	<0.5U	<0.5U	<2U	<1U	<2U	<1U	<1U	<1U	<3U	<1U	<1U	<1U	<1U	<1U	<1U
Vinyl chloride	2	0.15	*<0.5U*	*<0.5U*	*<0.5U*	*<0.5U*	*<0.5U*	*<2U*	*<1U*	*<2U*	*<1U*	*<1U*	*<1U*	*<3U*	*<1U*	*<1U*	*<1U*	*<1U*	*<1U*	*<1U*

Notes:

1.) Data transcribed by the MEDEP from Monthly Operating Reports for the Groundwater Extraction and Treatment System, BNAS.

2.) Values depicted with larger, bold, italic fonts equal or exceed MCL or MEG threshold concentrations.

3.) Values depicted in italics indicate analytical detection limit above MEG (i.e. vinyl chloride).

23 October 1997

TO: Emil Klawitter and NAS Brunswick RAB LOCATION: Northern Division

FROM: Peter Nimmer LOCATION: EA Newburgh

SUBJECT: Preliminary Results (70% Complete) of Geostatistical Assessment of the Eastern Plume, NAS Brunswick

The geostatistical assessment of the Eastern Plume has been conducted to evaluate the current network of sampling points included in the long-term monitoring plan. The preliminary results of the 70% complete geostatistical assessment of the Eastern Plume are being provided to interested RAB members for the following purposes:

- To provide the statistical data and computer input files in advance of a technical meeting which has been scheduled to discuss the progress and goals of the geostatistical assessment.

- To allow RAB members to examine the geostatistical data prior to completion of the analysis so questions and issues can be raised and addressed in the final geostatistical evaluation.

- To provide discussion items related to the geostatistical assessment of the Eastern Plume based on the analyses which have been conducted to date.

These preliminary results should be considered a "work in progress." Additional statistical assessments of the data will be conducted based on the objectives of the assessment, and discussion between the RAB members.

The 70% complete data are focused on the statistical analyses which has been performed for the following data sets:

- Data from Monitoring Events 2 and 8. The results of a classical statistical analysis of Monitoring Events 1 through 8 indicated that the data for Monitoring Events 2 and 8 were representative of the remaining data sets.

- Chemical compounds, including 1,1,1-trichloroethane (1,1,1-TCA), which is the volatile organic compound (VOC) with the highest reported concentrations in the Eastern Plume; and trichloroethene (TCE), which is the VOC with the most widespread distribution above State Maximum Exposure Guidelines (MEGs) and Federal Maximum Contaminant Levels (MCLs) in the Eastern Plume.

- Statistical analysis was performed primarily on Layer 2 data. Due to the limited number of positive detections in Layer 1, Layer 2 data have been the focus of the 70% complete geostatistical assessment. Note that non-detections were assumed to be one-half the detection limit during statistical assessment.

The complete analysis for other compounds of concern (tetrachlorethane [PCE] and total 1,2-dichloroethene [1,2-DCE]) for Layers 1 and 2 will be presented in the Summary Report for the Geostatistical Assessment of the Eastern Plume, which will be issued following completion of the geostatistical analysis.

The preliminary data set being presented consists of statistical analysis to test hypotheses which have been developed based on the objectives for the geostatistics presented in the Final Work Plan for Geostatistical Assessment (EA 1997). These hypotheses were tested using a variety of statistical techniques, including geostatistics. The techniques used to assess each hypothesis are described below.

HYPOTHESIS 1: Layer 1 is relatively unaffected by VOC.

Statistical Analysis Conducted (Attachment A)

1. Generate histograms using GEO-EAS for Layer 1 wells.
2. Generate variograms using GEO-EAS for Layer 1 wells.

Results

1. Histograms indicate the majority of analytical results for ground-water samples in Layer 1 are at or near detection limit.

2. Variograms for Layer 1 represent pure nugget, which are devoid of any discernable structure.

Assessment of Preliminary Results

Layer 1 appears to be relatively unaffected by VOC as noted by low concentrations for both rounds, and based on the pure nugget effect shown in Layer 1 variograms.

HYPOTHESIS 2: Layer 2 concentrations have not changed significantly between Monitoring Events 2 and 8.

Statistical Analysis Conducted (Attachment B)

1. Test for normal distribution using SAS univariate procedure for Monitoring Events 2 and 8 data.

2. Conduct two-mean population test for Monitoring Events 2 and 8 data using Wilcoxon Rank Sums test.

3. Generate combined variograms for Monitoring Events 2 and 8 data. Fit model to this combined data set.

4. Generate separate variograms for Monitoring Events 2 and 8 and determine if previously used combined model is acceptable (if combined model fit is determined to be acceptable for the separate event variograms, then Monitoring Events 2 and 8 data sets can be considered to be similar). Data were run both including and excluding results from MW-311, which was assumed to be an outlier, to assess the effect of this well on model fit.

Results

1. Two-means test (Wilcoxon Rank Sum) indicated that sampling results from Monitoring Events 2 and 8 were similar with a high degree of confidence.

2. The model developed to fit the variogram for combined Monitoring Events 2 and 8 data also fits the individual variograms completed separately for Monitoring Events 2 and 8.

Assessment of Preliminary Results

The outcome of the rank sum test and variography indicate that Layer 2 concentrations have not changed significantly between Monitoring Events 2 and 8.

HYPOTHESIS 3: Data surplus may be present in some areas of the Eastern Plume with high well density, while a data gap may be present in the area of the Eastern Plume between EW-3 and EW-4.

Statistical Analysis Conducted (Attachment C)

1. Generate variograms in GEO-EAS for the Eastern Plume data for Monitoring Events 2 and 8.

2. Perform kriging for standard deviations. Generate contour maps to illustrate kriging results.

3. Identify areas of data surplus (i.e., areas of high predictive confidence) by using Z-score results. The Z-score indicates the number of standard deviations away from the mean. A monitoring well with a Z-score of +/- 1.0 can be accurately predicted with the variogram model. A monitoring well with a Z-score of +/- 2.0 indicates the model has an acceptable predictive confidence for that location. A monitoring well with a Z-score greater than +/- 3.0 is considered anomalous, which will not be accurately predicted by the model. Therefore, low Z-scores (i.e., less than +/- 2.0) can be used to identify areas of data surplus.

4. Identify data gap (i.e., areas of low predictive confidence) by using standard deviation results. Areas of high relative standard deviation are indicative of areas with insufficient data density. Therefore, areas with high relative standard deviation are be used to identify data gaps.

Results

1. For Monitoring Events 2 and 8 data, areas of high predictive confidence (i.e., Z-score of +/- 2.0) were identified in the southern lobe of the Eastern Plume (wells MW-225A, MW-310, MW-206A, MW-105A, MW-207, MW-319, MW- 229A, MW-231A, and MW-230A), and at selected wells in the northern lobe of the Eastern Plume (wells MW-303, MW-305, MW-NASB-212, and MW-1104).

2. Kriging standard deviation maps for both Monitoring Events 2 and 8 data indicate the areas of insufficient data density are present between MW-208 and MW-1104, where no monitoring points are located.

Assessment of Preliminary Results

A data surplus may be present in areas of the southern and norther lobes of the Eastern plume, based on the Z-score results for monitoring wells in this area.

A data gap may be present between the northern and southern lobes of the Eastern Plume based on the high relative kriging standard deviations.

Cross validation error maps indicate the largest modeled errors are generally present in the northern lobe of the Eastern Plume. Therefore, separate modeling of the northern and southern lobes may refine the predictive capability of the model in the northern lobe.

HYPOTHESIS 4: MW-311 concentrations of VOC are an anomalous and isolated condition.

Statistical Analysis Conducted (Attachment D)

1. Cross validation was performed for Monitoring Events 2 and 8 data, including MW-311 in the data set.

2. Contour maps of Z-scores were generated which included MW-311. These were compared to the Z-score contour maps which did not include MW-311 (included in Attachment C) to assess the relative change in predictive capability of the model.

Results

1. The Z-score results at MW-311 are generally less than -3.5, which indicates this is an anomalous point that is not characteristic of the other data.

Assessment of Preliminary Results

MW-311 can be considered an anomalous and isolated condition.

HYPOTHESIS 5: There is evidence to suggest natural attenuation may be occurring at the Eastern Plume (note that any discussion of natural attenuation will be based on hydrogeologic factors, although statistics may be useful in determining plume stability).

Statistical Analysis Conducted

1. This analysis has not been conducted. The analysis to test the natural attenuation hypothesis will include analysis of the remaining chemicals of concern (PCE and 1,2-DCE). This analysis will be completed following the technical meeting. The outcome of the statistical tests for the Hypotheses 1 through 4 will also be considered during this evaluation.

Results

None.

Assessment of Preliminary Results

None.

PLN/caw
Attachment

EXAMPLE MATRIX TO DETERMINE RECOMMENDATIONS BASED ON GEOSTATISTICAL ASSESSMENT OF EASTERN PLUME MONITORING WELLS

Well	Is Well in Area of High Predictive Confidence (Z-Score +/- 2.0)	Is Well in Perimeter Location	Is Well Relatively Unaffected by VOC	Are There Other Engineering Considerations to Prevent Removal from LTMP	Recommendation
LAYER 1 WELLS					
MW-01	YES	NO	YES	NO	Drop from Long-Term Monitoring Program
LAYER 2 WELLS					
MW-02	YES	NO	NO	YES - Well located near Plume source area	Maintain in Long-Term Monitoring Program

FACTORS TO BE CONSIDERED DURING DATA GAP ANALYSIS
GEOSTATISTICAL ASSESSMENT OF EASTERN PLUME
NAS BRUNSWICK, MAINE

- What portion of the Eastern Plume has low-predictive confidence? Do areas of low predictive confidence overlap for the 4 compounds of concern?

- Does predictive confidence increase in Event 8 data compared to Event 2 data, which might make additional monitoring points unnecessary?

- What is the minimum number of additional monitoring locations may be necessary to increase predictive confidence?

- Are there other data gaps in the area of low predictive confidence? If so, additional monitoring points may be recommended to fill multiple data gaps.

    Additional information needs
    Site lithology
    Other issues

- What logistical problems are present that will affect the placement of additional monitoring points in the data gap area?

    Physical problems for access (tree cover, buildings, access road locations).
    Base boundary location
    Where are the preferred locations for additional wells

- How does potential for natural attenuation affect potential for additional monitoring points?