

Naval Air Station, Brunswick, ME

Eastern Plume Ground Water Monitoring

Summary

The Navy has been spending approximately \$550,000 a year for the ground water monitoring of an existing plume of chlorinated organic compounds at the Naval Air Station (NAS) in Brunswick, Maine. The Navy, the Environmental Protection Agency (EPA) Region I, Maine Department of Environmental Protection (DEP), and the Restoration Advisory Board (RAB) reduced the number of wells to be sampled and the sampling frequency, which will cut annual spending nearly in half. They employed statistics and Data Quality Objective (DQO) principles to achieve this price reduction and efficiency.

1.0 Site Background

1.1 Site History

The "Eastern Plume" at NAS Brunswick has been attributed to past solvent disposal practices from three Installation Restoration Program (IRP) Sites: a former fire fighter training area, a Defense Reutilization and Marketing Office (DRMO) Area scrap yard, and a former acid/caustic waste pit. The plume consists primarily of chlorinated organic compounds including trichloroethene (TCE), perchloroethene (PCE), 1,1,1-trichloroethane (TCA), and limited breakdown products. The Eastern Plume is in the Remedial Action Operations (RAO) phase. An interim record of decision (ROD) for extraction and treatment was signed in June 1992, and a Final ROD for No Further Action for soils and continued pump and

treat operation for ground water was signed in February 1998.

Preliminary subsurface investigations were completed at the Fire Training Area (FTA) in 1989. The FTA reportedly has been active since the 1950's. Various fuels, oils, and miscellaneous solvents have been used for multiple annual burns during this 40- to 50-year period. These contaminants have percolated into the unsaturated soils and leached downward to the ground water table, forming a plume of contaminated ground water. Ground water contamination consists primarily of volatile organic compounds (VOCs). Total VOCs detected in four wells at the FTA range from 137 to 821 $\mu\text{g/L}$. Fire training exercises have been discontinued at the Base.

The DRMO Area was added to the IRP upon completion of the 1988 Remedial Investigation (RI) field work. Ground water contamination consists of elevated levels of chlorinated VOCs and trace levels of BTEX (benzene, toluene, ethylbenzene, and xylene) compounds. Ground water contamination appears to have resulted from leaking underground storage tanks (USTs) used for waste solvents and fuels. Two former waste-liquid USTs were removed within the past several years.

The Acid/Caustic Disposal Pit is located beneath the eastern end of the active DRMO. The Acid/Caustic Disposal Pit was a small hole in the ground into which liquid wastes were disposed of from approximately 1969 to 1974. Wastes reportedly included

transformer oils, petroleum products, paints, and solvents. No soil contamination has been detected in borings near the former pit, and only low levels of TCE have been detected in the ground water immediately downgradient of the pit, which is no longer a significant source of contamination.

Ground water from the Eastern Plume site has been extracted and treated since 1995 and discharged to the local sewer authority. Five extraction wells were installed along the eastern perimeter of the Eastern Plume site to provide hydraulic control of the VOC plume and remove dissolved-phase VOC from ground water. The extraction wells are screened through the shallow and deep zones of the overburden aquifer and are plumbed to a central treatment plant located north of the Eastern Plume site.

1.2 Site Geology and Hydrogeology

The geology underlying the Eastern Plume area consists of three overburden units overlying bedrock. The shallow sand unit is approximately 10 to 20 feet thick and consists of fine sand. The transition unit separates the shallow sand unit from the underlying clay, and is composed of interbedded sands, silts, and clays. Sands within the transition unit, which ranges in thickness from 5 to 80 feet, act as preferential flow paths for ground water. The Presumscot clay formation is a low permeability clay unit, ranging from 20 to 60 feet thick, overlying the bedrock surface. Bedrock in the area consists of micaceous schist, which does not appear to be heavily fractured.

Ground water occurs beneath the site in both the overburden units and the bedrock. Monitoring wells in the Eastern Plume area

are completed at two different intervals within the overburden units. Shallow wells are installed in the shallow sand and upper transition unit (up to 40 feet below ground level). Deep wells are installed in the lower transition unit. Potentiometric surface information from the monitoring wells indicates that the shallow overburden aquifer is unconfined, whereas the deep overburden aquifer is semi-confined. Ground water in the shallow overburden aquifer generally flows to the east-southeast, and is influenced by surface water drainages. Ground water in the deep overburden aquifer flows generally to the south.

2.0 Program Status

NAS Brunswick is a National Priorities List (NPL) site on the EPA 2000 list, with a goal to have all Final RODs signed by the year 2000. A Final ROD has been in place for the Eastern Plume since February 1998.

Monitoring has been conducted tri-annually since 1995 throughout the Eastern Plume site. However, starting in 1999, the sampling will occur on a semi-annual basis. Annual reports have been completed for NAS Brunswick for calendar years 1995, 1996, and 1997.

3.0 LTM Program Summary

3.1 Initial Program

The initial ground water monitoring program included 36 monitoring wells. Of these, 30 were located within the plume, and six were sentinel wells. The monitoring wells were sampled on a tri-annual basis for VOCs and tentatively identified compounds (TICs).

3.2 Current Program

The current Long-Term Monitoring (LTM) program at NAS Brunswick includes 22 monitoring wells. Of the 22 monitoring wells, 13 are located within the plume and nine are sentinel wells. These wells are monitored for seven VOCs, which represent the contaminants of concern for the site. Starting in calendar year 1999, these wells will be sampled on a semiannual basis.

4.0 Contaminants

The current ground water monitoring plan requires monitoring for the following constituents:

- 1,1-Dichloroethane (DCA)
- 1,1-Dichloroethene (DCE)
- cis-1,2-Dichloroethene
- trans-1,2-Dichloroethene
- Tetrachloroethene
- 1,1,1-Trichloroethane (TCA)
- Trichloroethene (TCE)

5.0 Ground Water Monitoring Network

A total of 73 wells and piezometers have been installed within the Eastern Plume site. All wells at the site are gauged to determine potentiometric surface, and a subset of these wells is used to track the effectiveness of the pump and treat system and plume movement. Figure 1 shows the distribution of deep and shallow wells at the site.

6.0 Contract Type

The contract under which the ground water monitoring program is performed is a Navy CLEAN contract, cost plus award fee.

7.0 Cost of Ground Water Monitoring

The annual cost for LTM for 1996 and 1997 was approximately \$550,000. It is anticipated that with the implemented changes to the

LTM, there will be several cost reductions throughout the monitoring procedure. These reductions include a 33 percent cost reduction in sampling mobilizations and events and a 40 percent cost reduction in sample collection, analyses, and reporting. In addition, the number of reports will be reduced from seven to four per year, which will reduce the cost of paper by 80 percent. Overall, the LTM program is expected to cost approximately \$250,000 per year (down from \$550,000). The other IRP sites are smaller in scale, but are also estimated to have a cost reduction of approximately 50 percent.

8.0 What Prompted Review of LTM at the Site?

Review of annual reports and results of geostatistics showed redundant and predictable data. The amount of public participation at this Base also increased the number of copies for distribution (23) for each draft and final report. Comments requiring responses are generally received from at least three entities.

9.0 Actions Taken to Reduce Long Term Ground Water Monitoring Costs

The Navy performed a geostatistical analysis of the monitoring program for the Eastern Plume. It identified a number of data surplus areas and some data gaps. The Navy, EPA, and DEP met for 3 days and reviewed each sampling location. Trends of each well were analyzed and discussed using the DQO process. This meeting also discussed similar LTM issues at three other sites, which are not discussed here. The results of the meeting will be included in the rewritten LTM program for each site.

The following actions have been taken to increase the cost effectiveness of the LTM program:

- Monitoring was reduced from three to two times per year. The number of wells to be sampled was reduced from 36 to 22. Of those 22 monitoring wells, 13 will be in-plume wells and 9 will be sentinel wells.
- Monitoring reports will contain data only; limited discussion will detail field changes from the LTM program.
- Only the annual reports will contain a discussion of contaminant trends. With this presentation, comments on monitoring reports should be limited or non-existent. This will eliminate the need for comment resolution and consequently a draft report.
- In addition, the option was proposed to deliver the monitoring reports on CD-ROM versus hard copy. This was well received by the community, and will reduce hard copies from 23 to 5.
- Five new monitoring wells will be installed and sampled to fill data gaps. These five wells are included in the 22 total to be sampled.
- The analysis and reporting of TICs has been eliminated.

10.0 Regulator Interface

Regulator involvement was part of the process from the very start. The Navy suggested that a geostatistical analysis be accomplished on the Eastern Plume. Since some of the regulators were unfamiliar with the process, they were invited to attend the same geostatistical training that the Navy personnel had attended. This fostered familiarity and trust with the process.

Because there was still some hesitancy on the part of the regulators to accept the changes recommended for the LTM program on the basis of the geostatistical analysis, the DQO and decision-making processes were discussed in further detail. The regulators' concern continued, stemming from the perception that it was the Navy's goal only to reduce the LTM program without regard to its quality. A data review meeting was held with the single goal of improving the LTM program. The Navy was confident that the end result would be a net reduction in LTM.

At the meeting, the DQO process was used to assess the purpose of each well. Questions regarding the necessity and purpose of the data, as well as what decisions the data would support, were asked for each well. If no reasonable answers could be given for a well, it was eliminated from the LTM program. The same process was applied to additional wells proposed by regulators or the RAB. If a new well was deemed appropriate, using this process, it would be installed and added to the program.

Although initially hesitant, regulators kept an open mind in revising the LTM plan. By the end of the 3-day meeting, all attendees involved were properly implementing the DQO process to suggest wells to be removed from the LTM program. Whether meeting attendees agreed with the formal DQO process, or considered it to be simply common sense, the result was an improved LTM program at NAS Brunswick.

11.0 Other Actions Being Considered

The following additional actions are being considered to further optimize the LTM program:

- The geostatistics showed the plume to be stable. The Navy may consider a discus-

sion of natural attenuation for a 5-year review. This would, however, increase the short term sampling/analysis needs.

- The treatment system at the plant is being reviewed. The UV-Oxidation system treats TCA only to a level suitable for discharge to the sewer. However, if the Navy can better treat the TCA, the water can be discharged to surface water streams or to infiltration galleries. Surface or subsurface discharge would be cost effective because the annual sewer discharge fee is \$300,000.
- New extraction wells are being considered. The existing wells are screened over the entire aquifer (60 feet), while the contamination is concentrated in the lower 20 feet. A new extraction well has been installed and is screened in the deep portion of the aquifer only. This well has greatly increased contaminant mass removal with limited flow increase.
- The EPA is also interested in discussing easing the required analytical precision for in-plume samples so that the Navy may explore the economic feasibility of installing an on-site VOC analytical capability. This could allow for more continuous, possibly in-line, sampling of plume and treatment plant conditions. This information could be used in a near real-time manner by the plant operators to optimize contaminant mass removal by the extraction/treatment system and thus more quickly achieve cleanup goals.

12.0 Contact Information

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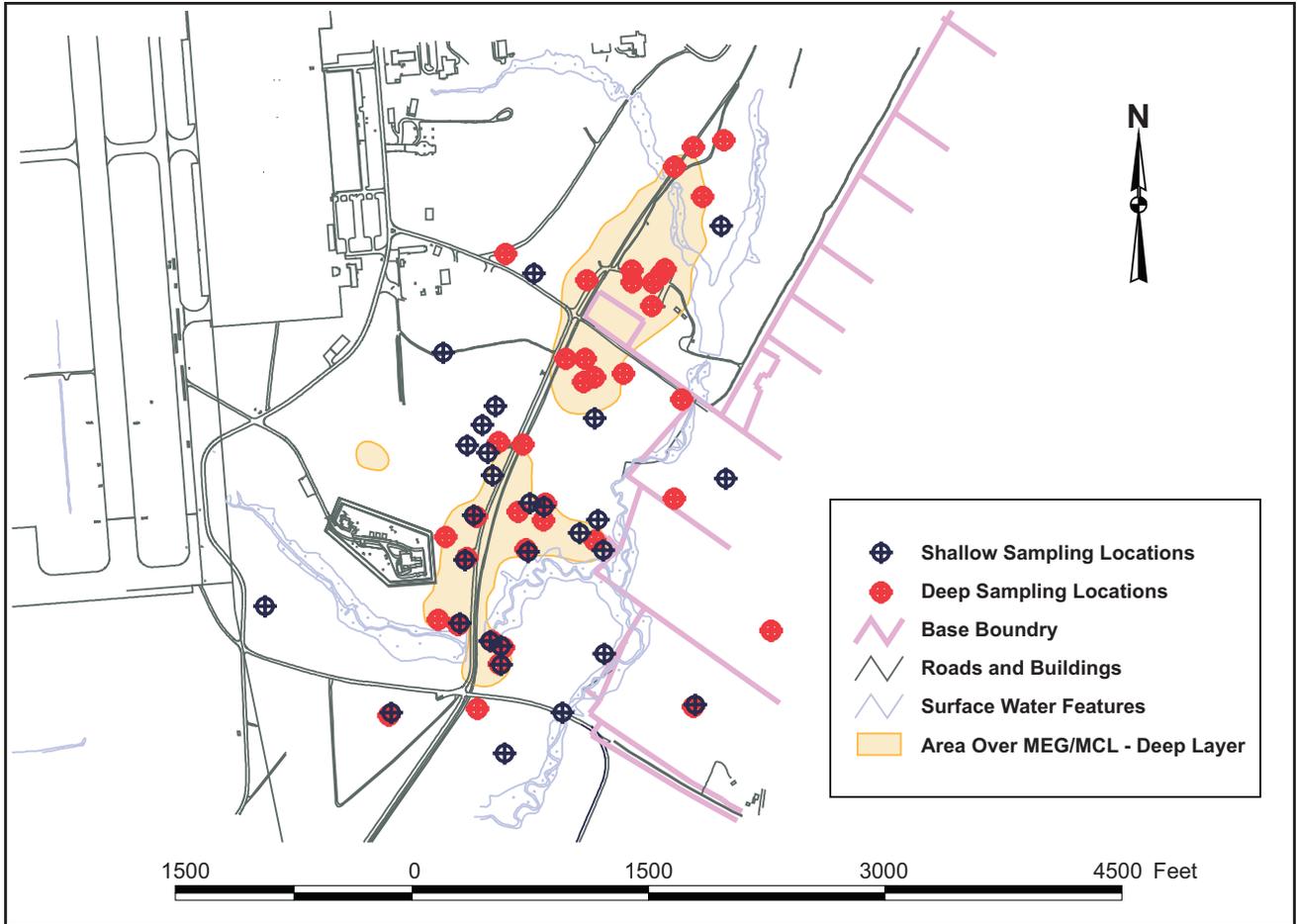


Figure 1. Eastern Plume Monitoring Well Network