DEPARTMENT OF THE NAVY
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
101 STRAUSS AVE
INDIAN HEAD MD 20640-5035

5090
Ser 046C/46
26 MAR 1997

Mr. Elmer Biles
ARARAT
6315 Indian Head Highway
Indian Head, MD 20640

Dear Mr. Biles:

We are writing in response to your letter of November 27, 1996, concerning your comments on the Engineering Evaluation and Cost Analysis (EECA) for Installation Restoration (IR) Site 57. A copy of your letter has been provided as enclosure (1).

In your "Conclusion" section, you "strongly urge that careful attention be given to site monitoring during the removal operation." We would like to address this by saying that the Removal Action Contractor (RAC), OHM Environmental, has a complete staff of trained individuals that specialize in the removal of all types of contamination. It is a legal requirement in the Code of Federal Regulations (29 CFR 1710.120) that employees working at IR sites have 40 hours of Hazardous Waste Operations and Emergency Response (HAZWOPER) training. The RAC could not have been awarded the contract to perform Removal Actions without meeting this requirement.

Under the "Specific Concerns" section of your letter, paragraph A, you recommend certain requirements for worker safety, which are also legal requirements found in the Code of Federal Regulations. The EECA does not address these issues because, by definition, it must evaluate potential cleanup alternatives and recommend the alternative that is protective of human health and the environment, easily implemented, cost efficient, and consistent with final remedial goals and applicable or relevant and appropriate requirements. However, prior to any Removal Action field work, the RAC must prepare a work plan on how the work will be accomplished. The work plan also includes several other plans related to the work, as required, such as a Sediment and Erosion Control Plan, Quality Control Plan, and Sampling and Analysis Plan. In particular, every work plan must contain a Health and Safety Plan, by law. The Health and Safety Plan addresses worker personal protective equipment, decontamination procedures, site monitoring, etc. The final work plan for this effort will be placed in the Information Repositories when it becomes available.

In paragraph B, you discuss potential groundwater contamination. You may recall from the soil-gas survey that the shallow groundwater at the site does contain trichloroethylene (TCE). Only two groundwater samples were taken, one at the location of highest soil-gas contamination (25 feet from the building) and one at a very low level of contamination (approximately 200 feet from the building). The concentration of TCE in groundwater was 370 parts per million (ppm) at the former location and an estimated value of 2 parts per billion (ppb), which is below the detection limit of 10 ppb, at the latter. TCE is a Dense Non-Aqueous Phase Liquid (DNAPL). DNAPLs are heavier than water and sink down in the ground until they reach a point in which they can sink no further, for example, at a confining clay layer. At that point, the DNAPL will follow the contours of the clay layer and pool at low points in the clay layer. In order to "monitor" the movement of the TCE, a full blown Remedial Investigation (RI) will have to be performed to characterize the site. This will include determining the location of the clay layer, its contours, and finally the path of the TCE. The Removal Action that is planned for this site will address the TCE that is trapped in the soil-gas. The Soil Vapor Extraction (SVE) can be expanded in the future to include remediation of contaminated groundwater. As you can imagine, this will be an expensive and time consuming operation. This site is one of our top priorities, which is why we are going to perform a Removal Action at the site. A work plan for an RI at this site will be prepared while the Removal Action is occurring.

Paragraph B refers to animal testing. To date, no testing has been performed on the deer population in the area. The reason being, the deer are free to roam on and off our Activity, and they do. Sampling results may or may not be indicative of IR sites at our Activity. In addition, the same holds true for migratory birds and fish.

In response to your other comments in paragraph C, the Safety Department at our Activity has a great responsibility with respect to contractors that work on-site. First, during a preconstruction meeting, Safety Department personnel provide the contractor with all of the "dos" and "don'ts" to ensure they will be working safely at our Activity. Second, Safety Department personnel review the work to be performed and issue a work permit, which provides requirements to the contractor, to ensure his safety as well as the safety of others. Safety Department personnel also review the work plans to ensure all wastes generated will be disposed of properly.

Considering that TCE is a volatile organic compound (VOC), OHM will most likely propose air monitoring by their Industrial Hygienist during the Removal Action, especially during the drilling of extraction wells. OHM is responsible for the health and safety of its employees and is liable if an employee is exposed to chemical contamination. Therefore, we do not see the need to have an independent source to monitor air. However, as a check, we may have our Industrial Hygienists periodically monitor the air. As mentioned previously, the air monitoring program is part of the Health and Safety Plan. This plan is reviewed by a Navy Industrial Hygienist.

Although there has been no in-depth briefing as to the potential volatility or health risks that may result from exposure to TCE, a document provided to us by the EPA, *Common Chemicals Found at Superfund Sites* (EPA 540/R-94/044) were placed in the IR Information Repositories in August 1995. This document was discussed in the meeting minutes from the April 6, 1995, RAB meeting and contains fact sheets on various chemicals that are typically found at Superfund sites. A copy of the fact sheet for TCE is included for your information.

It is worth mentioning that another document from the EPA was made available in the IR Information Repositories at the same time. It is *Common Cleanup Methods at Superfund Sites* (EPA 540/R-94/043). Two informative and applicable fact sheets in the document are Groundwater Monitoring and Pump-and-Treat. A copy of these fact sheets are also being provided for your information.

Your final comment involves the results of the SVE pilot-scale study. Although the work was scheduled for November 1996, this work has been delayed until the end of March 1997, due to the construction of the oven pad and dock extension at Building 292. As soon as the results of the pilot-scale test are received, a summary of the results will be mailed to the RAB members, per your suggestion.

We hope that our responses to your questions and comments are satisfactory. We truly appreciate you taking the time to review IR documents and provide your comments and concerns. If you have any additional questions or comments, please do not hesitate to let us know.

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As always, if you do have additional comments or questions, you may contact Mr. Shawn Jorgensen on (301) 743-6745. In addition, you may FAX your comments/questions to (301) 743-4180 or submit them in writing to the address above, attention Code 046.

Sincerely,

SUSAN P. ADAMS
Head, Safety Department
By direction of the Commander

Encl:
(1) E. Biles ltr of 27 Nov 96
(2) EPA Facts About Trichloroethylene
(3) EPA Facts About Groundwater Monitoring
(4) EPA Facts About Pump-and-Treat

Copy to:
RAB Members

ARARAT

6315 Indian Head Highway
Indian Head, Maryland 20640

FAX 743-4180
Ms. Susan P. Adams, Head
Safety Department
Indian Head Division
Naval Surface Warfare Center
101 Strauss Avenue
Indian Head, MD 20640-5035

November 27, 1996

REF: IR Site 57 EECA

Dear Ms. Adams:

Following are my comments with respect to IR Site 57 EECA as requested in your letter of November 18, 1996.

CONCLUSION: From the information provided and pending the results of the SVE pilot-scale test (which was to have been done the first week of November 1996) SVE is recommended as the best alternative for restoration of site 57, the former drum loading area (TCE). Although from the options presented the SVE appears to be the best it is not without risk and it is strongly urged that careful attention be given to site monitoring during the removal operation.

SPECIFIC CONCERNS

A. Human Exposure. The Engineering Evaluation Cost Analysis (EE/CA) prepared by Brown & Root Environmental, October 1996 identifies on pages 3-2 to 3-3 the potential for worker exposure to TCE. The report does not mention what safeguards, if any, the contractor will take to minimize the worker exposure during the removal action.

Recommendation: Each employee or worker at the site should be given and sign a statement as to the health risks involved. Appropriate clothing and decontamination procedures should be posted and monitored.

B. Groundwater Contamination. The Brown & Root report states on page 3-2 that "..TCE may migrate from the shallow subsurface...to deeper layers of soil and groundwater".

1. What steps are being taken to monitor this potential?
2. Although the report may be correct in suggesting that "future residential use is not considered likely" the potential migration to deeper soils and groundwater should be monitored. What plans are being taken to do this? Please provide specifics.
3. Although future residential use may not be considered likely what potential risk does the contamination of water impoundment's and soils have on the food chain and to the

wildlife in the area? Specifically have any tests been done on the deer population and if the resident herd is culled-out from time-to time is the meat considered safe for human consumption?

C. Other.

1.Over and above what may be considered the "health and safety" responsibilities of the contractor and the site review by EPA and other agencies, what overview will the NSWC's Safety Department take?

2. During the removal operation will any monitoring of air quality in the area be conducted? By whom? Any monitoring should be done by an independent source (not the contractor).

3. The RAB committee members were never given any in-depth briefing as to the potential volatility or health risks that may result from exposure to the chemical TCE. Copies of the "Material Safety data Sheet" should be made available.

4. Page ES-1 of the Brown & Root report indicates a SVE pilot-scale test was scheduled for the first week in November, 1996 to evaluate IR site 57. It is suggested that a summary of the results of this pilot test be mailed to RAB members as soon as possible.

Thanks for the opportunity of commenting. Call me if you have any questions.

Sincerely,

Elmer S. Biles
283 6298

EPA Facts About *Trichloroethylene*

June 1992

What is trichloroethylene?

Trichloroethylene (TCE) is a colorless liquid with an odor similar to ether. It is man-made and does not occur naturally in the environment. TCE is used mainly as a solvent to remove oils and grease from metal parts.

How might exposure to trichloroethylene occur?

Trichloroethylene has been found in approximately 745 of the 1,300 hazardous waste sites on the *National Priorities List (NPL)*. Various federal and state surveys indicate that between 9 and 34% of the water supply sources in the United States may be contaminated with trichloroethylene. In addition, TCE present at disposal sites is released to the air by evaporation and to underground water as *leachate*.

Trichloroethylene can also be released to the environment through evaporation from adhesive glues, paints, coatings, and other chemicals; and during their production. Releases can also occur during air-cleaning processes at treatment facilities that receive wastewater containing TCE, and during incineration of municipal and hazardous wastes.

Is there a medical test to identify trichloroethylene exposure?

Recent or ongoing exposures to trichloroethylene can be determined by measuring TCE in the breath. Another way of determining whether exposure to trichloroethylene has occurred is by measuring a number of *breakdown products* (metabolites) of TCE in the urine or blood. Because one of the breakdown products, trichloroacetic acid, is removed very slowly from the body, it can be measured in the urine for up to about one week following exposure. Exposure to other chemicals can produce the same breakdown products in the urine and blood as TCE. Therefore, these methods cannot be used to indicate conclusively that exposure to trichloroethylene has occurred.

How can trichloroethylene affect human health?

Dizziness, headaches, slowed reaction time, sleepiness, and facial numbness have occurred in workers breathing trichloroethylene or in people using trichloroethylene products in small, poorly ventilated areas. These effects are also caused by ingestion of several ounces of undiluted TCE. Irritation of the eyes, nose, and throat can also occur under these conditions. More severe effects, such as unconsciousness or possibly death, can occur from drinking or breathing higher amounts of TCE. Generally, the less severe central nervous system effects that result from one or several exposures to trichloroethylene disappear when exposure ends.

Results of a few studies of pregnant animals exposed to trichloroethylene in air or in food showed effects on unborn animals or on newborns. Current information based on animal studies is not sufficient to determine whether cancer, or the effects seen in animal embryos following exposure to TCE, may also occur in humans.

Some harmful health effects may persist following long-term exposure to trichloroethylene. This information is based largely on animal studies. These studies show that ingesting or breathing levels of TCE that are higher than typical *background levels* can produce nervous system changes; liver and kidney damage; effects on the blood; tumors of the liver, kidney, lung, and male sex organs; and possibly cancer of the tissues that form white blood cells (leukemia). Alcohol consumption can heighten susceptibility to liver and kidney injury caused by trichloroethylene exposure.

How does trichloroethylene enter the body?

Trichloroethylene can enter the body through inhalation of contaminated air or ingestion of contaminated water. TCE can also enter the body through contact with the skin.

What levels of exposure have resulted in harmful health effects.

Tests using laboratory animals and humans show that short-term and long-term exposures to air containing about 50 parts per million (ppm) or more of trichloroethylene have produced harmful effects. The term "parts per million" is a way of expressing the concentration of a contaminant in a liquid or air. One part per million is equal to one inch in a distance of about sixteen miles (or a penny in ten thousand dollars), a very small amount. Ingestion of TCE for more than two weeks produced harmful effects in the livers of animals. Drinking TCE over longer periods of time caused effects on unborn animals and the kidneys as well as the liver.

Based on animal studies, the Environmental Protection Agency (EPA) has estimated that breathing air containing 1 ppm trichloroethylene every day for 70 years may place as many as 930 persons in a population of 100,000 at risk of developing cancer. EPA has also estimated that drinking water containing 1 ppm TCE every day over a lifetime may place as many as 32 persons in a population of 100,000 at risk of developing cancer.

What recommendations has the federal government made to protect human health?

EPA has established a drinking water standard of 5 parts of trichloroethylene per billion parts of water (ppb). EPA requires industry to report spills of 1,000 pounds or more of trichloroethylene. A reduction of this amount to 100 pounds has been proposed.

What are the methods of treatment and disposal of trichloroethylene?

The recommended method of TCE disposal is incineration following mixing with a combustible fuel. Complete combustion must be achieved to prevent the formation of phosgene, a poisonous gas. An acid scrubber must be used to remove the haloacids produced. There has been an emphasis on recovery and recycling of TCE to reduce emissions into the atmosphere.

Glossary

Background Level: The concentration of any substance which would normally be found in an area. This level is used as a basis of comparison in identifying contamination levels.

Breakdown Products: Most contaminants are combinations of specific substances. Contaminants are degraded, or separated, into these individual substances through chemical or physical means.

Leachate: A contaminated liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides, or fertilizers.

National Priorities List (NPL): EPA's list of uncontrolled or abandoned hazardous waste sites identified for possible long-term clean-up under the Superfund Program.

For more information about Trichloroethylene, please contact EPA at the following address:

U.S.Environmental Protection Agency
ATTN: Superfund Hotline
401 M Street, S.W.
Washington, D.C. 20460
1-800-424-9346 or 1-800-535-0202

The information contained in this fact sheet was compiled from the Toxicological Profile for Trichloroethylene, Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, in collaboration with the U.S. Environmental Protection Agency, October, 1989. *This fact sheet focuses on the impact of hazardous wastes on human health; however, EPA does evaluate these impacts on the environment, including plants and animals.*

EPA Facts About
Groundwater Monitoring

June 1992

What is groundwater monitoring?

Water that has collected naturally and is stored in porous soil and rock under the earth's surface is called groundwater. Nearly half of the population of the United States United States depends on groundwater for their daily water needs, either from private wells or large public water systems.

Everyone wants to be sure that their groundwater supply is safe. To ensure this, samples of water are taken and analyzed for a wide variety of chemicals. It is often necessary to install specially designed wells to obtain the samples. These monitoring wells are installed in and around known or suspected contamination sources such as landfills, waste dumps, and industrial sites. These special monitoring wells are usually laid out in such a way as to intercept any contaminant migration (movement) away from a site. The visible or measurable discharge of a contaminant from it's source is often called a plume, as it is the groundwater equivalent of a smoke cloud coming from a fire. Figure 1 shows a landfill with a plume moving away from it that should be monitored. Figure 2 shows the parts of a typical monitoring well.

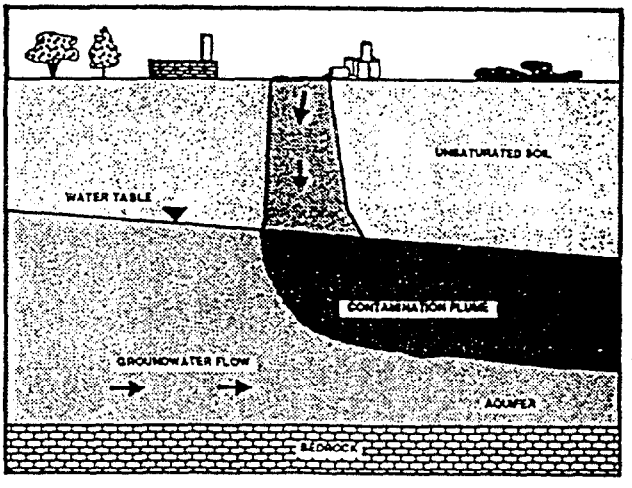

Figure 1: Spill Site Showing Contaminant Plume

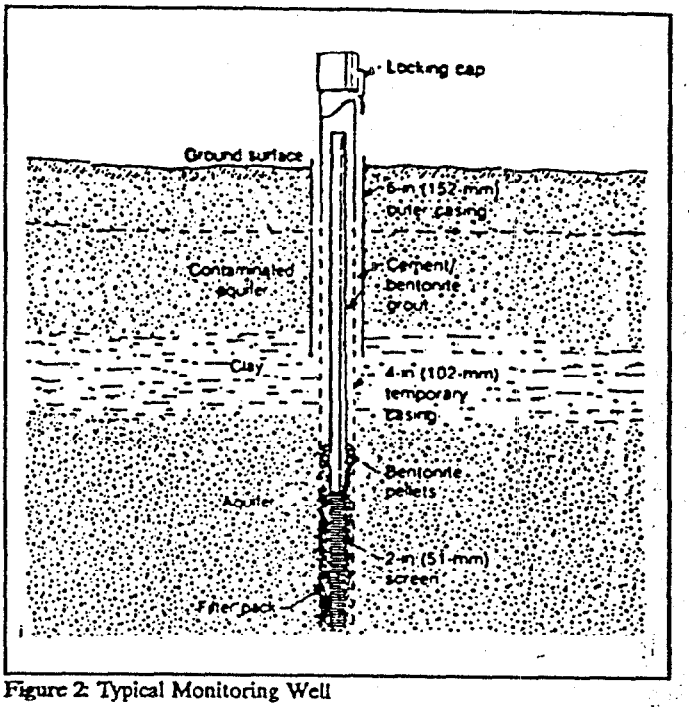

Figure 2: Typical Monitoring Well

What does monitoring tell us ?

The monitoring wells in and around a site are sampled periodically, typically several times each year. The wells are locked between sampling to prevent tampering which could affect sample results. The samples are taken by specially trained people using sterilzed equipment to be sure that the sample truly represents what is in the ground. The water samples are analyzed by a certified laboratory for a large number of chemicals. The results are usually expressed in parts per million or parts per billion. These numbers represent the relative concentration of the chemical in the groundwater, and are the ratio of units of chemical per million or billion units of groundwater. This information is compiled using computer programs which keep track of the results and compare them to established standards. These programs are designed to look for changes over time, and to make predictions of how the plume of contamination may migrate through the ground in the future. Using this information, scientists and regulators can decide on the best method of controlling, containing and remediating (cleaning up) the contamination. Monitoring is also essential in determinig if a remedy is working. This information is vital if they are to properly protect human health and the environment.

How is monitoring well sampling performed?

The sampling of monitoring wells is usually done by trained field personnel from the testing laboratory or by groundwater consultants. In general, a sample is taken only after the pH, electrical conductivity, and temperature of the water being pumped from the well have stabilized. (pH is a numerical measure of the relative acidity of the water; zero to seven indicate decreasing acidity, seven to fourteen indicate increasing alkalinity, while seven is considered neutral.)

How is contaminant movement predicted?

In many instances of groundwater contamination, the ability to predict how the contaminant plume will behave in the future can only be based on the results of expensive drilling and sampling programs. Many scientists interested in the movements of contaminants in groundwater believe that it will soon be possible to use mathematical modeling techniques to estimate the spread of a particular contaminant and its concentration at any point in the plume.

How are the locations of monitoring wells determined?

Once the general limits of the plume have been identified, several monitoring wells are installed in or near the plume. The purpose of these monitoring wells is to:

- Determine the properties of the rock formation in which the contamination is found and the surrounding aquifers.
- Determine the level of groundwater of all aquifers in the area.
- Provide samples of groundwater for the detection of contaminants.
- Monitor the movement of the contaminant plume.

Usually one monitoring well is located near the center of the plume in the path of the groundwater as it moves away from the site. Another is installed farther away, but in the path of the plume. Background conditions are recorded from a third monitoring well that is located in an uncontaminated area (see Figure 3).

The most difficult decision is usually not where to place the monitoring well, but at what depth the samples should be taken. Selection of the most appropriate depths depend on the characteristics of both the contaminant and the aquifer or soil surrounding the site. The design of the well and sampling plan are extremely important if meaningful and accurate information concerning the extent of contamination is to be obtained. Proper placement of the monitoring wells is also important and must be based on accurate information concerning the pattern of groundwater flow and the type of contamination.

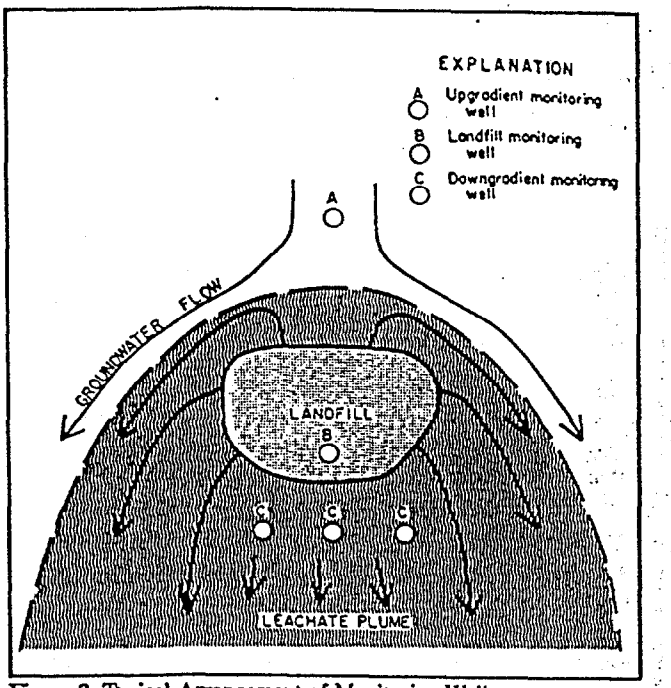

Figure 3: Typical Arrangement of Monitoring Wells

For more information about Groundwater Monitoring, please contact EPA at the following address:

U.S. Environmental Protection Agency
ATTN: Superfund Hotline
401 M Street, S.W.
Washington, D.C. 20460
1-800-424-9346 or 1-800-535-0202

The information contained in this fact sheet was compiled from Superfund Innovative Technology Evaluation (SITE), a publication of the U.S. environmental Protection Agency, November 1991.

EPA Facts About *Pump-and-Treat*

June 1992

What is the pump-and-treat method?

The pump-and-treat method is the most common remedial (cleanup) technology used in purifying contaminated *aquifers*. These aquifers are natural, underground rock formations that are capable of storing large amounts of water. The pump-and-treat process usually includes three steps. First, the contaminated groundwater is recovered from the aquifer through recovery wells. Second, the recovered water is treated. Finally, the treated water is discharged and the contaminants are disposed of.

Groundwater collection systems are designed to capture contaminated groundwater by removing it from the aquifer. These collection systems are also used to prevent the spread of contamination. As the contaminated groundwater is recovered from the aquifer, the contamination is prevented from moving deeper into the aquifer or spreading into surrounding clean aquifers.

Why not simply treat water at the well?

Another form of the pump-and-treat process, called well-head treatment, is sometimes used when drinking water wells are contaminated. In some cases, it has been found to be cost-effective to continue to recover contaminated groundwater, but to remove the contaminants before delivering it to users.

There are several variations of this approach. At some sites, the source of the contamination is known and an auxiliary recovery system has been installed. This auxiliary system is intended to cleanup the contaminated aquifer or may operate simply to prevent further spread of contamination. The contaminated water is drawn away from the drinking water well and redirected. In other cases, the source of contamination is not known and the well-head treatment system may be the only practical alternative.

The system may use a variety of tools to move and redirect groundwater, including *extraction wells*, *injection wells*, *drain intercepts*, and *barrier walls*. Extraction wells are designed to pump groundwater out of the aquifer and to redirect the remaining water. Injection wells use the opposite method; pumping water into an aquifer to change its flow patterns. Drain intercepts are surface features that are designed to capture and redirect the groundwater flow. Barrier walls may be installed in the cleanup area to create physical barriers to groundwater flow.

Why do we want to pump groundwater?

The treatment of a contaminated aquifer, or "aquifer restoration", is not the only goal of groundwater extraction systems. Another goal is the control of contaminant migration (movement). Groundwater pumping techniques involve the active management of groundwater to contain or remove contaminants. These techniques can also be used to adjust the groundwater level so that no migration will occur.

The area of contaminated groundwater associated with a site is called a plume, and is the groundwater equivalent of smoke from a fire. A water barrier may be constructed by causing the water in an aquifer to move in such a way as to prevent the plume from moving toward a drinking well. Pump-and-treat technology is used to construct these water barriers to prevent off-site migration of contaminants. In most aquifer restoration systems, plume containment is listed as secondary goal. It is usually necessary to establish control of contaminant migration if the aquifer is to be cleaned up. Exceptions to this general rule are sites where the aquifer can restore itself naturally by discharging to surface water bodies or through chemical or biological degradation (breaking down) of the groundwater contaminants to render them harmless to human health and the environment.

Control of groundwater contamination involves one or more of four options: (1) containment of a plume; (2) removal of a plume after the source of contamination has been removed; (3) reduction of groundwater flow to prevent clean groundwater from flowing through a source of contamination, or to prevent contaminated groundwater from moving toward a drinking well; and (4) prevention of a plume by lowering the water table beneath a source of contamination.

Why do we use pump-and-treat?

Groundwater collection and treatment has proven effective over a wide range of site conditions and contaminants. Well collection systems can remove groundwater from the great depths. In addition, the costs associated with this technology are generally moderate.

What pumping systems are used?

Almost all remediation of groundwater at contaminated sites is based on groundwater extraction by wells or drains. This process is usually accompanied by treatment of the extracted water prior to disposal.

Well collection systems consist of a line or circle of wells placed around the contaminated area or in the path of the contaminated groundwater flow. This type of well system limits movement of the plume and collects groundwater by pumping it from the ground faster than it can be replaced from nearby areas. This ensures that the flow of groundwater is toward the well area and not away. The groundwater is pumped to the surface where it is treated to remove the contaminants.

Drain collection systems consist of horizontal pipes with holes along the length that are placed in the ground below the groundwater level. These drains are placed around the contaminated area or in the path of the contamination plume. This system uses gravity flow to collect groundwater, or can be pumped to accelerate the flow.

What methods are used to clean up groundwater?

Once the contaminated water is collected, it can be treated by using one or a combination of the following proven methods:

Biological Treatment - This treatment is similar to that used in normal sewage treatment plants using beneficial *microorganisms* such as bacteria and protozoa to break down contaminants into non-hazardous substances.

Carbon Adsorption - This treatment involves passing the contaminated water through carbon filters. Contaminants are adsorbed (cling to the surface) of the carbon particles and are removed from the water. This is the same water treatment used by most household aquariums.

Air Stripping - This treatment uses an air stream that moves across the surface of the water to capture and remove VOCs from the water.

Ultraviolet/Oxidation - This treatment uses high intensity light and chemicals (ozone and peroxide) to destroy contaminants.

What site conditions hamper pump-and-treat technology?

Several physical features of a hazardous waste site have been identified that can interfere with the cleanup process of pump-and-treat sites. One is that the contaminants tend to adhere (stick to) the surface of the materials that make up the aquifer. If this adsorption is neglected in the planning stages, the effectiveness of the pump-and-treat method will be over-estimated. Second, variations in the size and pore space of the aquifer can also reduce the effectiveness of this technology by making it difficult to control the flow of groundwater. Third, if the contaminant is still present, it can continue to spread hazardous waste into the aquifer, perhaps faster than the pump-and-treat method can remove it. Finally, if the contaminant is a petroleum based product, it will not dissolve in the water and will not be removed from the aquifer when the water is pumped out.

GLOSSARY

Aquifer: An underground geological (rock) formation that can store and transmit large amounts of water.

Barrier Walls: Walls installed in the cleanup area to create physical barriers for groundwater flow, causing redirection of the flow.

Drain Intercepts: Surface channels of trenches installed at the ground surface of the cleanup area designed to capture and redirect groundwater flow.

Extraction Well: A well where water is pumped out of the well in order to redirect groundwater movement (by changing the hydraulic gradient).

Injection Well: A well where water is pumped into the aquifer in order to redirect groundwater movement.

Microorganisms: Microscopic animal or plant life; particularly any of the bacteria, protozoa, viruses, etc.

For more information about Pump-and-Treat, you may contact EPA at the following address:

U.S. Environmental Protection Agency
ATTN: Superfund Hotline
401 M Street, S.W.
Washington, D.C. 20460
1-800-424-9346 or 1-800-535-0202

The information contained in this fact sheet was compiled from Basis of Pump and Treatment: Groundwater Remediation Technology, a publication of the U.S. Environmental Protection Agency, 1990.