ENVIRONMENTAL RESTORATION MANAGEMENT UPDATE

90th Space Wing ■ F.E. Warren AFB, WY 82005 ■ Volume 4, Issue 1 ■ Summer 2002

Removal Action Update

In previous issues of the update, we reported that a removal action was on-going a Landfills (LF) 2a/2b, LF3, and LF5b. The removal action has now been successfully completed and the areas now provide diverse wildlife habitats and a potential recreation area for base residents.

The removal action project included removing all waste from each of the above-mentioned landfill units followed by confirmation sampling, transporting the waste to an area adjacent to LF5a (known as the Waste Co-location Area) an covering the waste with a cap identical to the one previously placed at LF5a. During the project, some areas of waste were found and classified as "hazardous." All of this hazardous waste was disposed off-base at a landfill facility licensed to receive hazardous waste.

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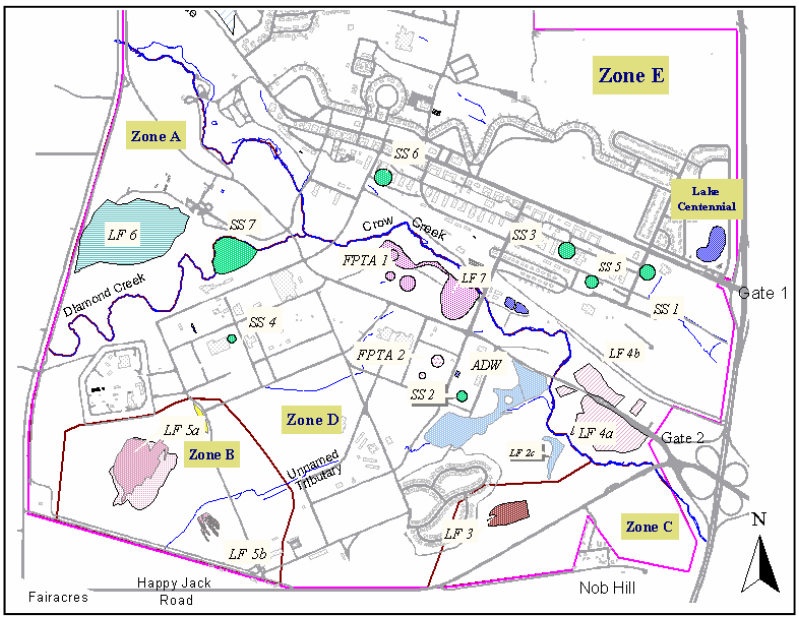

The map above shows the location of the sites where the removal action took place and the location of the Zones where the Remedial Investigations are taking place

Remedial Investigations Underway

The remedial investigation/feasibility study (RI/FS) began for both Zone D and Zone E during the spring and summer of 2001. Groundwater monitoring wells and soil borings were installed, soil and groundwater samples were collected and analyzed, and soil gas surveys were conducted. The RI/FS is the first major step towards reducing the soil and groundwater contamination within Zone D and Zone E. These are the last large investigative efforts to be completed at F.E. Warren.

Zone D contains Spill Sites 2, 4, and 7, LF 2 and 7, and Fire Protection Training Areas (FPTA) 1 and 2. Groundwater contamination within Zone D includes the trichloroethylene (TCE) groundwater plume associated with Spill Site 7, as well as four other TCE plumes with unidentified source areas. The Zone D RI effort also included performing exploratory trenching and characterization sampling in the LF7/FPTA1 area.

Zone E contains Spill Sites 1, 3, 5, and 6, LF4, and the Open Burn/Open Detonation Area. The Zone E RI effort also included

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Remedial Investigations Underway

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performing exploratory trenching and characterization sampling in the LF4 area.

The RI serves as the mechanism for collecting data to:

- Characterize site conditions (the nature and extent of contamination);
- Determine the nature of the waste at the landfills;
- Assess the risk to human health and the environment; and
- Conduct treatability testing to evaluate the potential performance and cost of the treatment technologies that are being considered for the final remedy.

Drilling at the site during the remedial investigation field effort.

The FS is the mechanism for the development, screening, and detailed evaluation of potential methods for cleaning up contaminated sites. The RI and FS are usually conducted concurrently; data collected in the RI influences the development of remedial alternatives in the FS. In turn, this affects the data needs and scope of the treatability studies and additional field investigations. This approach encourages the continual scoping of the site characterization effort, which minimizes the collection of unnecessary data and maximizes data quality.

The RI/FS process consists of five phases:

1. Scoping
2. Site Characterization
3. Development and Screening of Alternatives
4. Treatability Investigations
5. Detailed Analysis of Alternatives

The RI/FS work at Zone D has been split into two separate projects: one project is addressing the groundwater within Zone D, while the second project is focusing on investigation and characterization of the sources of the groundwater contamination within Zone D. The RI/FS work was split into the two separate projects due to the large size of Zone D and the complex geology and hydrogeology of the area. Dividing the work will enable the RI/FS work to be completed in a shorter timeframe.

The remedial investigations included performing exploratory trenching and characterization sampling.

The RI reports for both Zone D and Zone E will be completed in the Fall of 2002. The FS reports are expected to be completed in early 2003.

Removal Action Update

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Additionally, a small amount of medical waste was found which was incinerated with other on-base generated medical waste. The total volume of waste removed from all the landfill cells during the project was over 500,000 cubic yards. Confirmation samples show that no residual waste remains.

Upon completion of the waste removal, each site was regarded and seeded. Since the LF2a/2b area lies along the Unnamed Tributary, much attention was given in planting natural vegetation to support the wide variety of wildlife that the area is likely to attract. Ponds were left along the Unnamed Tributary in order to allow for water retention during heavy storm events, which will relieve some downstream flooding of Crow Creek. A footbridge was added over the Unnamed Tributary. The photos included herein show that these efforts have resulted in an aesthetically pleasing, diverse wildlife habitation area.

The aerial photo above, taken after all removal activities were completed at Landfill 3, illustrates the proximity of Landfill 2a/2b and Landfill 3 to one of the on-base housing area

The above photo shows the Landfill 2 area after removal actions were completed. The site is a diverse wildlife habitat area.

Reminder to Residents

This is a reminder to residents of the Nob Hill subdivision that water from private groundwater wells should not be used for drinking. In January 1997, all residents of this area were connected to the City of Cheyenne's water supply system to avoid potential exposure to contaminants in well water. Although concentrations are decreasing, contamination in the groundwater has not yet been reduced to levels that would be considered acceptable for drinking purposes. For this reason, all Nob Hill residents—adults and children—are urged to limit personal consumption of water from private wells. However, groundwater from individual wells is acceptable for other non-drinking uses including watering lawns and animals and washing cars.

Testing Innovative Groundwater Treatment Technologies

F E Warren AFB has awarded a contract to perform four treatability studies on the Zone D groundwater. These studies will determine which technology is best suited for cleanup of the Zone D groundwater. One study will be a biological remediation technology called in-situ Submerged Oxygen Curtain/in-situ Co-Metabolic Oxidation (iSOC/iMOX™), the second study will be of a chemical remediation technology which is potassium permanganate injection. Each of the final two studies are combinations of physical/chemical remediation technologies, one will study an injected iron wall; and the other will be a study of a technology know as the C-Sparger™ system.

The iSOC/iMOX™ system is an innovative bioremediation process, which delivers oxygen and a carbon source, such as propane or methane, to the groundwater. Bioremediation allows natural processes to clean up harmful chemicals in the environment. Microscopic "bugs" or microbes that live in soil and groundwater like to eat certain harmful chemicals. These microbes eat chemicals such as gasoline and oils and use the carbon contained in them as a food source. As the microbes consume the carbon, an enzyme is created and released by the microbes that has been found to breakdown TCE and related contaminants into harmless compounds. The process of the microbes living off of one substance (carbon in the fuels) and releasing an enzyme that will breakdown a different compound (TCE) is known as co-metabolism. The delivery of a supply of oxygen and a carbon source by the iSOC/iMOX™ system will support the microbe population so that high levels of cell growth will be maintained resulting in quicker breakdown of the TCE and related compounds in the groundwater. The innovative design of the iSOC™ uses tiny, porous, hollow fibers contained in a canister that is connected to a source of pure oxygen. It is this design which allows the oxygen to dissolve into the groundwater at very high levels The co-metabolic process will use the iSOC/iMOX™ system to deliver high levels of oxygen and a carbon source such as propane or methane (the food source for the microbes) to the groundwater in order to keep the microbe population high and thriving so they will produce more enzyme to breakdown the TCE and related contaminants. The iSOC/iMOX™ system will be placed in an existing groundwater monitoring well and then the surrounding area will be monitored to determine the effectiveness of the treatment technology.

The second study will evaluate the effectiveness of the chemical reaction between injected potassium permanganate and TCE and related contaminants to breakdown the contaminants into harmless compounds. This reaction is known as chemical oxidation. Chemical oxidation uses chemicals called oxidants to help change harmful chemicals into harmless ones like water and carbon dioxide. This study will use potassium permanganate which is a strong oxidant that has been used in the treatment of drinking water and wastewater for several decades. The reaction between potassium permanganate and TCE results in the formation of carbon dioxide, manganese dioxide, potassium chloride, and hydrogen chloride, all of which pose no environmental concerns. For this study, potassium permanganate will

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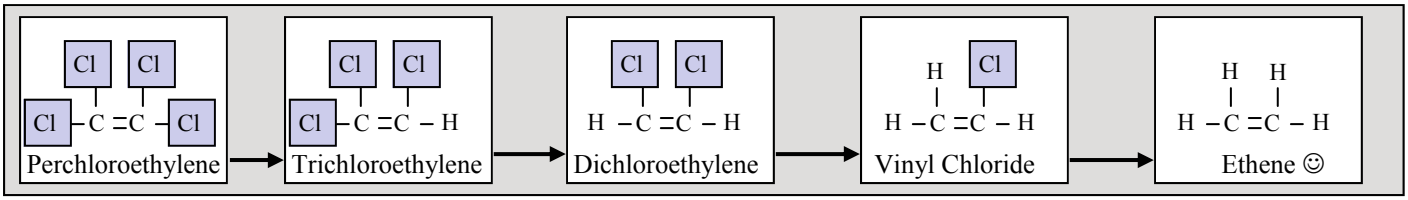

The above diagram shows a step-by-step process of chlorine removal, converting potentially harmful contamination into non-toxic end products.

Testing Innovative Groundwater Treatment Technologies

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be injected under pressure into the groundwater through a series of soil borings over a grid pattern. The groundwater will then be monitored over time to determine if the technology is effectively reducing the levels of contamination in the groundwater.

The third technology to be tested is the C-Sparger™ system. This is another chemical oxidation process but uses ozone as the oxidant rather than potassium permanganate. This system uses a combination of the reaction between the ozone and contaminants and the physical process of injecting air into the groundwater as part of an air sparging system to assist in the breakdown of the contaminants. Air sparging uses air to help remove harmful vapors from polluted soil and groundwater below the water table *(The water table is the level of groundwater below the ground surface)*. By pumping air underground, the chemicals are easier to remove. The advantage of the C-Sparger™ is that very small sparge points are used to produce tiny bubbles that travel through the formation much more efficiently than those produced from conventional sparging units. The smaller bubbles carry the ozone through out the formation to react with and breakdown the contaminants in the groundwater. The C-Sparger™ system first will inject ozone into the groundwater followed by the air bubbles to carry the ozone to the contaminants. The C-Sparger™ system will be placed into three newly installed wells and then surrounding wells will be monitored to determine the effectiveness of the system.

The effectiveness of an iron-filings wall has been successfully demonstrated with the wall that is installed and operating at Spill Site 7. The Spill Site 7 wall was installed by trenching, which restricted the depth the iron could be placed. The iron wall in this study will be injected under pressure into the groundwater formation through soil borings. Injection rather than trenching allows the iron to be installed to greater depths at less expense. As the TCE contaminated groundwater flows through the wall it reacts with the iron and breaks down into harmless compounds. After installation, groundwater will be monitored up gradient and down gradient from the wall to evaluate its effectiveness.

All four systems will be closely monitored during the test period and data will be collected. Experienced professionals will evaluate all data and the technology best suited for groundwater cleanup at FEW will be selected for full implementation. Results of the studies will be presented in future updates.

Access Information on the Internet

Information about cleanup activities at F. E. Warren, as well as other environmental information, is available from many sources on the Internet. Visit these sites to learn about what's going on at F. E. Warren and the community:

U.S. Environmental Protection Agency
http://www.epa.gov

Wyoming Department of Environmental Quality
http://www.deq.state.wy.us

NEW: The F. E. Warren AFB Environmental Restoration Team has a new website. The site provides general background information on the restoration program at the base, a program schedule, information on the team and how to get involved, and information on upcoming meetings. Check it out at:
http://www.warren.af.mil/enviro/few/

For Additional Information...

Information about the F. E. Warren environmental cleanup program is available for review in the Administrative Record File—the official collection of documents, data, reports, and other information that supports EPA's and WDEQ's decisions on cleanup at a site. You may review the Administrative Record File at the following location:

Laramie County Library
2800 Central Avenue
Cheyenne, WY 82001

For additional information about the F. E. Warren environmental restoration management program, please contact one of the following Remedial Project Managers:

RAB Contacts

For information about the Restoration Advisory Board meetings or membership, please contact:

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Inside: Information on F. E. Warren AFB Environmental Restoration

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