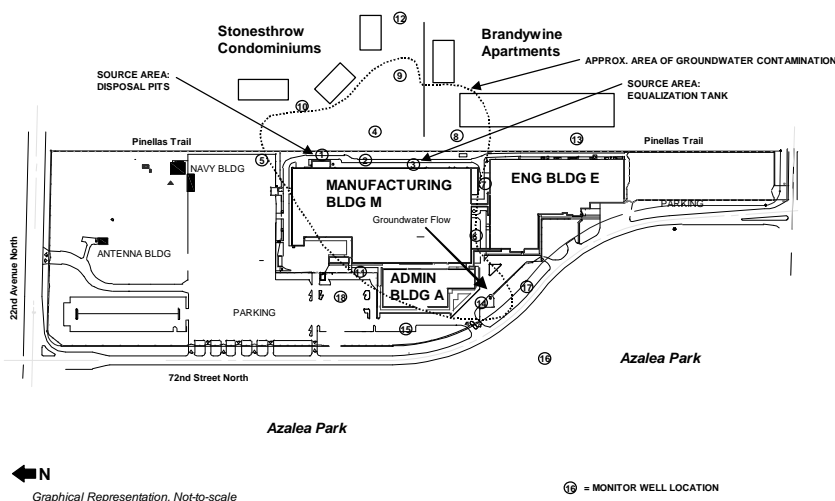




Project History

Raytheon Systems Company (formerly E-Systems) is working with the Florida Department of Environmental Protection (FDEP) under a Consent Order agreement to rehabilitate contaminated groundwater located at its 1501-72nd Street North, St. Petersburg FL facility. The project began in 1991 when an environmental assessment was conducted on a former railbed (currently Pinellas Trail) located along the east side of the electronics manufacturing facility.

During 1992, a preliminary contamination assessment (PCA) was conducted resulting in discovery of an inactive, but contaminated, source area along the east property line associated with disposal practices conducted during pre-mid 1960s. As a result of the PCA, E-Systems conducted a voluntary interim remedial action (IRA) in 1992 to remove the identified contaminated soils prior to Pinellas Trail construction. During August 1992, approximately 85 to 90 cubic yards of contaminated soil was removed for transportation to a permitted offsite disposal facility. The excavated area was backfilled with clean soil. Later, during onsite construction activities in 1994, a wastewater equalization tank was discovered that contained contaminants that resulted in 14 cubic yards of soils being removed for offsite



Raytheon Systems Company (formerly E-Systems) St. Petersburg FL

Focusing on Groundwater

With contaminated soils and the equalization tank removed, the project currently focuses on groundwater restoration. Groundwater is the water located below land surface (subsurface). Local use of groundwater is primarily for irrigation although Florida classifies the groundwater resource in this area as a "potential" drinking water source. No drinking water is obtained from this water source in St. Petersburg. Drinking water is supplied from wells located in Hillsborough and Pasco Counties.



Contaminated Soil Removal, August 1992

Contamination assessment activities at the site involved identifying the extent of groundwater contamination (on-site and off-site), and characterizing the subsurface conditions of the site. A series of direct-push water sampling studies were completed to identify the boundary of the contamination and provide data to locate permanent monitoring wells. Some of the monitoring wells are installed at adjacent condominium and apartment complex properties. These monitoring wells will continue to be used during the project. In May 1998, a Contamination Assessment Report (CAR) was submitted to FDEP. The completion of the CAR, and approval by FDEP in July 1998, allows for the project to progress toward groundwater restoration.

What are the Contaminants? The contaminants are primarily solvents associated with electronics cleaning and painting operations. Trichloroethylene, one of the contaminants identified at the site, was commonly used as a degreasing solvent in the electronics industry. Prior to the 1970's, it was not uncommon for these solvents to be disposed directly into the environment at industrial facilities throughout the U.S. Other contaminants include 1,1,1-trichloroethane, toluene, methyl ethyl ketone, and vinyl chloride. Antimony (a metal) and semivolatile organic compounds (e.g. phenol) are confined to small areas on Raytheon property. Some of these contaminants are common in solvents, paints, and thinners available at any hardware store. These contaminants exceed Florida groundwater guidance concentrations, thus warranting cleanup by Raytheon.



Direct-Push Groundwater Study, May 1995



Monitor Well Installation, February 1996



Completed Monitor Wells, February 1996

Restoring Groundwater – Bioremediation

Raytheon is proposing an innovative technology to address the groundwater contamination at the site. Conditions at the site are amenable to enhancing what is currently occurring naturally in the subsurface at a very slow rate – the slow breakdown of the contaminants by existing microorganisms, or what is referred to as biodegradation.

Present in almost all natural environments, including saturated soils within the groundwater table, naturally occurring microorganisms use available carbon sources that exist in their environment for energy. During biodegradation, microorganisms transform nutrients into forms useful for energy and cell reproduction by facilitating the transfer of electrons. This results in oxidation of the electron donors and reduction of the electron acceptors. Electron donors usually consist of natural organic material, but anthropogenic carbon, such as molasses and corn syrup, can also be utilized as electron donors. Similar to the way humans breakdown oxygen (an electron acceptor) in the process of digesting food, microorganisms can use contaminants in the process of breaking down a food source in the subsurface environment. Contaminates such as chlorinated organic compounds (e.g. trichloroethylene), serving as electron accep-

tors, are broken down in this process, which is technically described as reductive dechlorination. Since a food source is normally minimal in the subsurface, the addition of a nutrient such as a diluted molasses, enhances this process. The elegance of this approach is that it allows an already occurring natural system to take care of a problem much more efficiently and effectively than traditional engineered technologies.

Enhanced bioremediation is a relatively new restoration technology when compared to traditional technologies such as pump & treat. Pump & treat involves the pumping of contaminated groundwater to an above-ground treatment system. Disadvantages of pump & treat include air emissions, waste and water disposal issues, energy and capital costs, high operation and maintenance costs, and long cleanup time-frame (in some cases 20+ years). It still has applications in small cleanup sites or sites where migration (spreading) is an issue. Other newer restoration technologies such as air sparging and reactive walls also have significant inherent disadvantages that make them inappropriate for the Raytheon site.



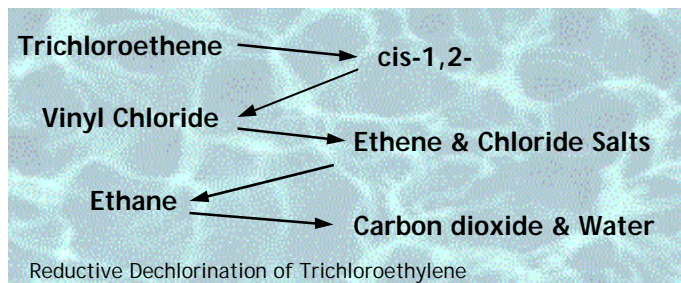
Bioremediation Nutrient Injection System, Houston TX



Injection Point at a Houston Shopping Center

The bioremediation approach requires that a pilot study be performed on Raytheon property for up to six-months. This study will provide data essential for design of a full-scale treatment system. The system involves installing a series of wells called injection points. A dilute solution of food-grade molasses is introduced into each injection point based on a schedule determined by the engineering firm. In addition, periodic sampling is conducted at monitor wells to track subsurface conditions and the breakdown of the contaminants. If all goes well in the process, significant reduction of contaminant concentrations and possibly cleanup could occur in 3-5 years (a pump & treat system for this site would take longer than 20 years). Studies conducted at other sites show significant decreases of contaminant concentrations within the first year of injections.

Although this technology may significantly reduce the contaminants in the groundwater to very low concentrations, it may not reduce all contaminants to concentrations below the State standards. In this case, the State may approve a process called natural attenuation. During natural attenuation, the contaminants will tend to go away over time due to processes such as biodegradation, dispersion, dilution, sorption, and volatilization. Engineering models are utilized and a monitoring program is established to ensure that contaminant concentrations do not rise as time progresses and that the attenuation process is actually occurring.



Definitions Associated With This Project

Anthropogenic –resulting from the influence of humans on nature (e.g. corn syrup derived from human processing of corn)

Bioremediation –A process of cleaning up a contaminated site utilizing naturally-occurring biological processes.

Contaminant –an undesired substance introduced into the environment.

Reductive dechlorination – The breakdown of chlorinated organic compounds by a reduction process where the contaminant acts as an electron acceptor.

Timeline and Schedule

Preliminary Contamination Assessment – Completed 1992

Interim remedial action (soil removal) - Completed 1992

Consent Order executed – March 1995

Contamination Assessment – Completed May 1998

Feasibility Study – Submitted February 1999

Pilot Study – Plan 1999

Remedial Action Plan and Remediation – Plan Start Year 2000

Current Status

A Feasibility Study (FS) was submitted to FDEP on February 25, 1999. The FS proposes a pilot study for innovated bioremediation system described in this document. The 6-month pilot study is recommended to allow engineers to design a full-scale bioremediation system. All work is subject to approval by FDEP.



Raytheon Systems Company (formerly E-Systems), Area Photo

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