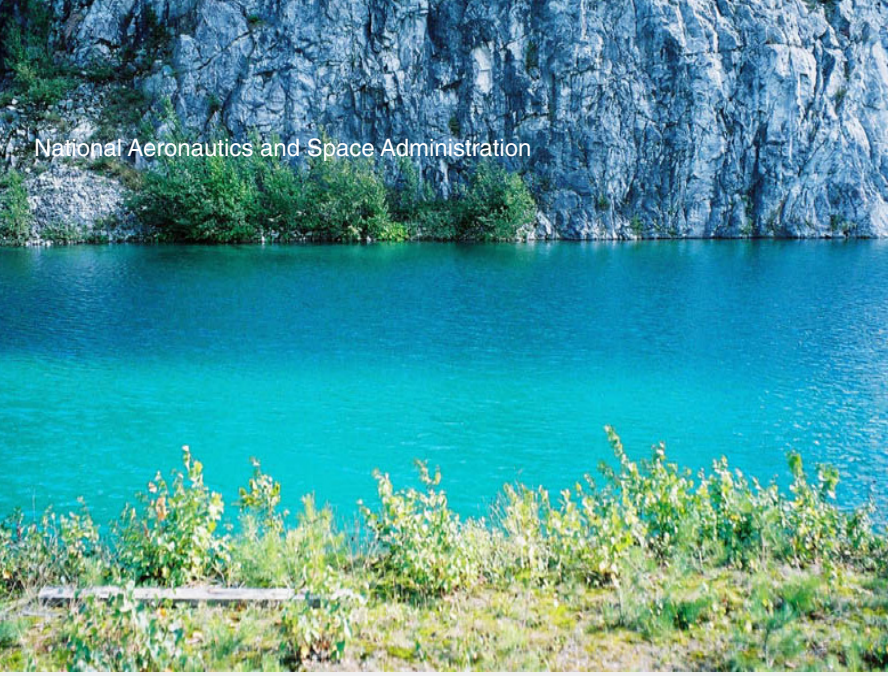


Environment

Emulsified Zero-Valent Iron (EZVI)

In situ treatment of dense nonaqueous phase liquids

NASA seeks to license the NASA-developed technology Emulsified Zero-Valent Iron (EZVI) for use in commercial applications. Developed at the John F. Kennedy Space Center (KSC), this process provides for the in situ treatment of dense nonaqueous phase liquids, or DNAPL's. This technology is one of the few methods available that can treat the DNAPL source. EZVI also overcomes the limitations of current DNAPL treatment technologies by providing a method that is quick, effective, and cost-competitive. EZVI is part of NASA's technology transfer program. This program seeks to promote the commercial use of NASA-developed technologies. KSC has filed a patent application for EZVI. Based on the success of bench-scale testing, the technology was also accepted into the U.S. EPA Superfund Innovative Technology Evaluation (SITE) Program.

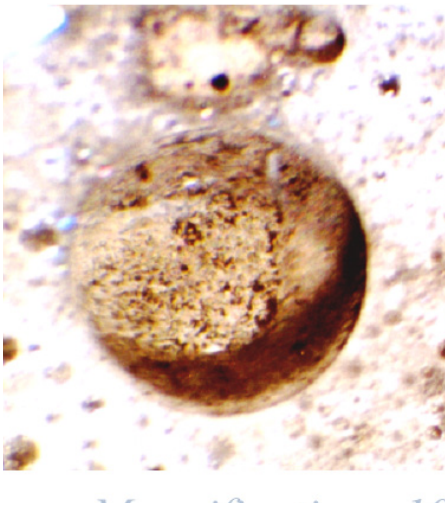
BENEFITS

- Directly treats contaminant source
- Does not mobilize contaminants
- Requires less treatment time
- Reduces treatment costs
- Produces less-toxic and more-easily degradable byproducts
- Is environmentally safe
- Is being evaluated by the U.S. Environmental Protection Agency (EPA)

technology solution

THE TECHNOLOGY

Thousands of DNAPL-contaminated sites have been identified across the United States; however, few technologies exist that can treat DNAPL's in a timely and cost-effective manner. For example, traditional pump-and-treat methods can require decades of treatment time and operational costs. Other methods that treat DNAPL's in place, such as steam injection and radio-frequency-heating, are expensive and can cause contaminant mobilization. NASA's EZVI technology overcomes these limitations by providing a method that is quick, effective, and cost-competitive. EZVI involves placing nanoscale zero-valent iron particles into a surfactant-stabilized, biodegradable oilin- water emulsion. This emulsion is injected into the DNAPLcontaminated zones of the subsurface. The DNAPL is then pulled into the emulsion where the contaminant reacts with the zerovalent iron. Through a process known as reductive dehalogenation, the DNAPL and its daughter products are degraded into ethene and other hydrocarbons. These by-products are finally broken down through biological activities in the subsurface.



EZVI micell showing Zero-Valent Iron particles in a surfactant-stabilized Water-In-Oil emulsion

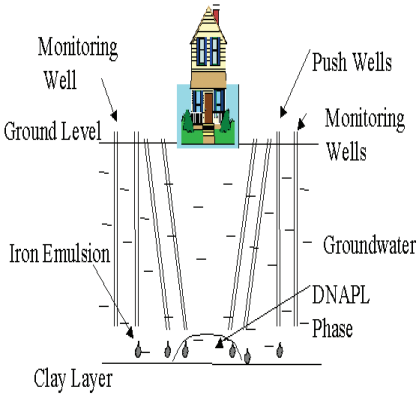


Illustration showing EZVI placed into the DNAPL source zone

APPLICATIONS

The technology has several potential applications:

- Dye and paint manufacturers
- Dry cleaners
- Chemical manufacturers
- Metal cleaning and degreasing facilities
- Leather-tanning facilities
- Pharmaceutical manufacturers
- Adhesive and aerosol manufacturers
- Government facilities

PUBLICATIONS

U.S. Patent 6,664,298

U.S. Patent 7,037,946

More Information

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NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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