Fuel Hydrocarbon Remediation

Cleanup
CU-20

LEAD AGENCY: U.S. Navy

LAB: Naval Facilities Engineering Service Center (NFESC)

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PROBLEM STATEMENT: Fuel-contaminated water and soil remediation technologies evaluation is one of several thrusts managed under the umbrella of the National DoD Environmental Technology Demonstration Program initiative started in FY93. This demonstration program supports SERDP program efforts to meet DoD environmental obligations, and reduce the future life-cycle costs associated with cleanup and compliance with environmental regulations. Success will be measured by the ability to meet cleanup levels, acceptance by regulators, and by transferring technologies with performance data and design guides to industry.

The goal is to achieve regulatory and institutional acceptance of, and transfer to industry, innovative remediation technologies for fuel contaminated water and soils. The most common fuel contaminated sites within DoD are those with jet fuels (JP-5), marine diesel, gasoline and bunker fuel. These sites are located near underground storage tanks (UST), fuel farms and other locations where spills have occurred, resulting in extensive fresh and brackish surface and groundwater contamination, and soil contamination.

Remedial action at these sites are often complicated. This is due to numerous UST excavation sites being in areas of shallow water tables overlying brackish water, and others with fresh water containing high dissolved solids. Some of these sites are located in extreme geologic and climatic conditions. This effort applies to the DoD Cleanup Pillar, Requirement Thrusts 1.N: Treatment of Fuels in Soil and 1.J: Treatment of Fuels in Groundwater, as identified in the Tri-Service Environmental R&D Strategic Plan.

PROJECT DESCRIPTION: The objective of the National DoD Environmental Technology Demonstration Program for fuel contaminated water and soil is to conduct side-by-side field demonstrations comparing advanced technologies under similar conditions. The DoD requirements being addressed are (1.I.1.e) Process to Remediate Groundwater Contaminated with Hydrocarbon Fuels and (1.I.4.m) Process to Remediate Soils Contaminated with Hydrocarbon Fuels.

Demonstration projects will test innovative remediation treatment train technologies at ex-situ soil treatment site(s), ex-situ surface and groundwater treatment facilities, and in-situ soil and groundwater treatment site(s) in a wide range of climatic conditions. Candidate technologies selected within specific treatment method areas will be technologies emerging from DoD laboratories as identified in the Tri-Service Environmental Quality Research and Development Strategic Plan, and Broad Agency Announcement (BAA) solicitations. Projects from the EPA SITE Technology and Demonstration program may also be candidates for demonstration. Emerging technologies such as the following proposed projects will be demonstrated:

Bioremediation technology (Phase I) will be demonstrated using soil contaminated with different types of fuel. This will include gasoline, diesel, JP-5 and possible combinations of these hydrocarbons. The technical objective is to determine biocell and nutrient feed design parameters. In this innovative biocell demonstration, highly mobile nutrient mixtures will be evaluated with respect to optimizing native soil hydrocarbon degrading microorganisms to quicken the pace of cleanup. Because of uncertainties with

regard to dynamic living organisms, and environmental factors which influence these systems, low-to-moderate risk is associated with the bioremediation effort.

Bioremediation has been field studied for a number of years. Biological treatment processes investigated have used indigenous or selectively cultured bacteria and/or fungi. Some biological processes studied used existing soil conditions while other studies, including this effort, altered/enhanced environmental factors influencing microorganism transformation of hazardous waste with changes in pH, temperature, oxygen concentration, and availability of essential nutrients.

The enhanced bioremediation project demonstration for ex-situ treatment of fuel-contaminated soil is being conducted at the Naval Construction Battalion Center (NCBC), Port Hueneme, California. This site is one of the National DoD Environmental Technology Demonstration Program fuel and solvent remediation demonstration sites.

In Phase II and onward, other technologies, or treatment trains, will be evaluated at fuel and solvent remediation demonstration sites including in-situ decontamination treatment of soil and groundwater with brackish and high dissolved solids content. Demonstrations will be prioritized and scheduled in five phases. Each demonstration project will last approximately two years. These technologies will be identified and selected by a multi-disciplinary peer review panel. Candidate projects may come from emerging modifications to treatment trains such as the following areas: (1) thermal or chemical enhanced soil vapor extraction, (2) soil flushing and washing amendments, (3) chemical catalytic reduction/oxidation mixed product recovery, (4) emission controls for low temperature thermal desorption, and (5) free product recovery.

Because of uncertainties with regard to potential responding organizations and companies, low-to-moderate risk is associated with these remediation projects.

EXPECTED PAYOFF: Field and laboratory data collected will be incorporated into a Tri-Service Data Package to develop life-cycle cost information and design engineering guidelines. Those technologies transferred would reduce remediation costs, accelerate the pace of cleanup, and facilitate compliance with various Federal and State regulations in order to protect human health and the environment. The transfer of critical technologies into full scale implementation is an integral and strategic part of the DoD environmental objective.

The data presented in technology transfer media will be comparable with data from other DoD, EPA and DoE SERDP projects. Technology transfer involves dissemination of information within the DoD engineering and environmental organizations which are making remedial action decisions and external transfers to industry and other Federal, State and Municipal organizations evaluating those decisions or implementing the technologies. Major benefits resulting from these technology demonstration projects are applicable and transferable to a large number of DoD sites reducing the cost associated with site demonstrations and the time needed to remediate sites.

TRANSITION PLAN: At the completion of each field demonstration, a technology transfer package which includes an Implementation Guidance Document will be prepared and disseminated with organizations (DoD, EPA, DOE) which are making remedial action decisions. These technologies will be transferred to industry and other Federal, State and Municipal organizations for implementation at multiple DoD sites national and world-wide. The National DoD Environmental Technology Demonstration Program Test Organization is responsible for a multi-media technology transfer package that will include: (1) technical short courses/seminars, (2) on-site visitor's workshops, (3) field assistance, (4) conference exhibits, and (5) demonstration videotapes and brochures. The principal investigator/project officer will develop professional journal articles.