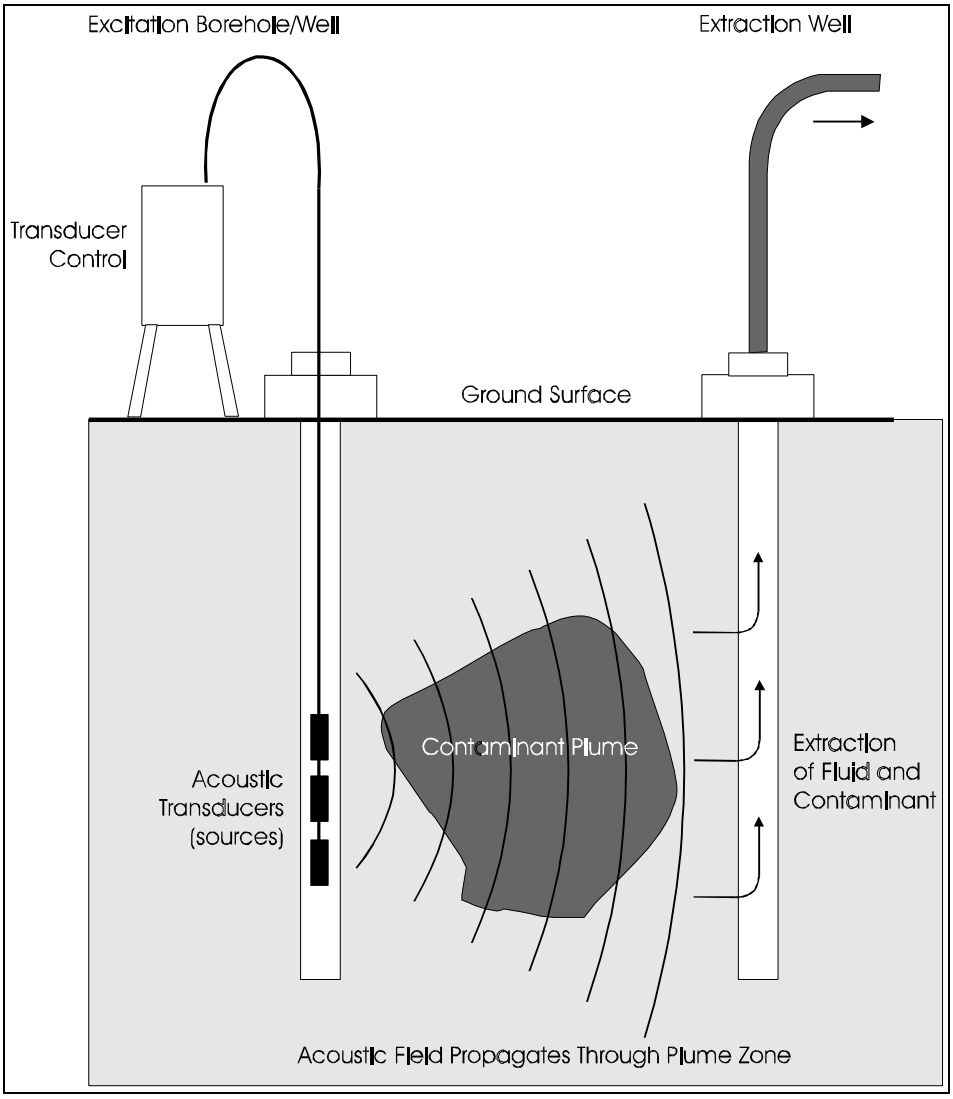
Acoustically Enhanced Remediation of Contaminated Soil and Groundwater

Developer: Weiss Associates
Contract Number: DE-AR21-94MC30360
Crosscutting Area: N/A

Subsurface Contaminants FOCUS AREA

Problem:

Existing remediation technologies are inadequate for meeting the nation's cleanup goals in a reasonable period of time and at a reasonable cost. This is especially true in the case of fine-grained soils due to their low permeability and generally high absorptive capacity. More efficient technologies are needed that will significantly reduce the time and cost required to remediate soils contaminated with petroleum hydrocarbons, chlorinated solvents, radionuclides and metals.



Solution:

This project will investigate the use of acoustic excitation fields (AEFs) to enhance the rates of fluid and contaminant extraction from a wide variety of soil types. Successful completion of this program will result in commercially-viable, advanced in situ remediation technology that will significantly reduce cleanup times and costs.

The figure shows one concept of how this technology could be implemented in the field. In this example, a borehole/well with downhole acoustic sources is used to generate and propagate the AEF. An extraction well recovers the pore fluid with contaminant, and the fluid is pumped to the surface for treatment and/or disposal.

Benefits:

- In situ remediation of hydrocarbons, chlorinated solvents, radionuclides, and metals in soils and bedrock
- Enhanced in situ remediation of free-phase, dissolved, and sorbed contaminants

- Augments existing remediation technologies such as ground water pump-and-treat, and soil vapor extraction

- Augments advanced remediation technologies such as soil heating and steam flooding

- Potentially significant reductions in cleanup times and costs

Technology:

Numerous studies suggest the potential for acoustically enhanced remediation of contaminated soils and ground water. Many of these studies were performed in the former Soviet Union and were directed toward enhanced oil recovery. The results from field studies are particularly intriguing. They suggest that weak elastic waves from regional earthquakes or Vibroseis™-type sources can increase oil production from reservoirs as deep as 4,000 feet (1,200 meters).

A key question to be answered by laboratory experiments is whether there are beneficial effects of AEFs at low power densities and strain levels, as suggested by field studies or if high power densities are required to drive the soil at high strains where its mechanical response is non-linear.

If there are beneficial effects at low power densities, the eventual field design can probably be comparatively simple (and less expensive). If high power levels are needed, they can be generated in the field using advanced acoustical sources and control techniques.

Project Conclusion:

This project was completed in December 1996 at the end of the Phase II Technology Scaling Investigation. At completion, it was determined that the laboratory results did not meet predetermined success criteria, and, although more a reflection of laboratory testing than of the technology itself, technical basis for proceeding to Phase III Field Testing was not provided by the Phase II effort as planned. The contractor is continuing the development of this technology and has developed a detailed business plan for commercialization as part of participation in the DOE Dawnbreaker Forum during September 1997.

Contacts:

Weiss Associates is an environmental services company founded in 1980. Their staff of geologists and engineers are highly skilled and experienced in regulatory compliance and permitting, air quality, site characterization, modeling, risk assessment, and soil and ground water remediation. They also develop and apply state-of-the-art technologies for waste site characterization, monitoring, and remediation. For information on this project, the contractor contact is:

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DOE's Federal Energy Technology Center supports the Environmental Management - Office of Science and Technology by contracting the research and development of new technologies for waste site characterization and cleanup. For information regarding this project, the DOE contact is:

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