



# Environmental Remedy Optimization

Program Manager: 402-697-2566

## U.S. ARMY CORPS OF ENGINEERS

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Optimization can improve the outcomes of environmental remediation and can be performed at many stages of the remediation process. The U.S. Army Corps of Engineers (USACE) Environmental and Munitions Center of Expertise (EM CX) developed the Remediation System Evaluation (RSE) process in the late 1990s as a way of assessing and optimizing operating remediation systems. Over time, additional optimization activities including Tiger Team Reviews and Alternatives Panels have been developed to provide other methods for remedy optimization.

A key element of all remedy optimization activities conducted by the EM CX is the independent technical evaluation completed by experienced subject matter experts.



At this Army site, a Remediation System Evaluation (RSE) conducted by the Environmental & Munitions Center of Expertise identified opportunities to improve performance and reduce life-cycle costs by over \$1,300,000.

### Benefits

The RSE process is routinely applied at Formerly Used Defense Sites and select Army installations and has been successfully used on behalf of several federal agencies at many sites across the country. The Environmental Protection Agency (EPA) has integrated the RSE process into its optimization initiative for improving the cost-effectiveness of remedies at fund-financed sites and has applied, with assistance of USACE staff and contractors, the RSE process at dozens of Superfund sites.

Periodic optimization of the systems can improve their effectiveness in protecting human health and the environment, speed cleanup and substantially reduce costs for operation, maintenance and monitoring. Optimization efforts conducted to date at federal sites suggest that annual operations and maintenance (O&M) costs may be reduced by 20 to 30 percent (or more) using the RSE process. RSEs conducted by USACE have identified potential cost savings of \$35,000 to more than \$500,000 per year in O&M at each site. A less intensive (desktop) optimization, termed a Tiger Team study, does not include a site visit and results in a memo of only findings and recommendations.

The EM CX can also provide optimization suggestions at the Feasibility Study stage for a project through a half-day briefing and discussion, called an "Alternatives Panel," involving the district project team and a multi-disciplinary panel of experts from the EM CX to identify the best technologies and alternative strategy to consider for the site.

### Costs

An RSE typically costs less than \$35,000 for single site and can be completed in several months. This includes senior staff labor and travel. Tiger Team evaluations and Alternatives Panels cost approximately \$10,000 and can be completed in less than two months.

**U.S. Army Corps of Engineers – Engineering and Support Center, Huntsville**  
P.O. Box 1600, Huntsville, AL 35807 Public Affairs Office 256-895-1694  
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## Case Study 1

A facility-wide RSE was performed at a 5,000-acre Air Force base in the central United States. The RSE addressed contamination in 12 operable units (OUs). The RSE evaluated multiple groundwater extraction, soil vapor extraction, multiphase extraction systems and associated treatment facilities. Groundwater treatment facility flow rates ranged from 15 to 100 gpm. Primary water treatment processes consisted of air stripping and granular carbon adsorption. Contaminants included petroleum hydrocarbons, chlorinated solvents and selenium.

**Findings:** The existing operations staff was continuously evaluating methods of optimizing operations. The RSE evaluators made the following recommendations:

- Perform additional capture zone analyses at three OUs
- Modify pumping rates at two OUs
- Reduce groundwater monitoring frequency at numerous OUs
- Consider converting one soil vapor extraction system to bioventing
- Convert four extraction systems to monitored natural attenuation
- Use an alternative discharge point from the primary treatment facility
- Modify the existing well maintenance program
- Develop a closure strategy plan

**Costs:** Annual O&M costs were \$1.4 million, and the RSE cost was \$35,000. The projected annual savings was \$350,000 or 25 percent of the O&M costs.

## Case Study 2

An Alternatives Panel was performed for a FUDS project in the midwestern U.S. The project involves cleanup of a former intercontinental ballistic missile base where solvents have contaminated a groundwater plume that extends multiple miles from the site. Participants included the USACE district and contractor executing the project as well as EM CX subject matter experts in various fields including legal, remediation engineering, geology, risk assessment and vapor intrusion.

The Alternatives Panel discussed the site history, conceptual site model, potential remedial action objectives and remedial alternatives that could be evaluated in the upcoming Feasibility Study. A creative brainstorming session was performed to generate recommendations and ideas for the project delivery team to consider.

Results were:

- Four ideas for site characterization to identify data gaps and evaluate how and when to address the data gaps.
- Seven ideas for defining potential remedial action objectives and identifying applicable, relevant, and appropriate requirements.
- 12 ideas for remedial alternatives including considering the appropriateness of alternatives being considered already as well as possible new alternatives
- 12 ideas for how proposed remedial technologies could be best presented in the Feasibility Study and executed in the field.

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