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Norm Kulujian (retired), STL for Region 3, wrote and compiled this article from various EPA sources.

RESEARCH AND DEVELOPMENT – OFFICE OF SCIENCE POLICY

FOCUS ON: REGION 3 OPTIMIZATION STUDY OF FUND-LEAD PUMP-AND-TREAT SUPERFUND SITES

A major program initiative to optimize operation and reduce costs associated with remedial sites has identified potential opportunities for substantial long-term savings for the operation and maintenance costs of fund-lead pump-and-treat sites. The optimization studies were conducted in EPA's Region 3 in two phases, involving two Superfund sites in phase one and eight Superfund sites in phase two. The Region 3 review team identified potential annual cost savings of $54,000 per year for each site in the first phase and savings of $130,000 per year for each of the eight sites in the second phase.

As a member of the optimization study team, Norm Kulujian (retired), Superfund and Technology Liaison (STL) in Region 3, was a significant resource in the optimization study, providing direct technical support to 10 fund-lead Superfund sites reviewed in the study. It was Kulujian's comprehensive background in the region's Superfund Program that led to his selection for the study team.

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OSP INTRANET
HTTP://INTRANET.EPA.GOV/OSPINTRA/

OSP INTERNET
HTTP://WWW.EPA.GOV/OSP

BACKGROUND

A nationwide study was conducted by EPA as part of the Office of Solid Waste and Emergency Response's (OSWER) 2001 Superfund Reform Strategy to identify and gather information on the 88 pump-and-treat systems financed by the Superfund Program. Twenty sites in Region 3 were selected for remediation system evaluations (RSE), a review process designed to optimize the remedies in operation at a Superfund site. The process involved a team of engineers and hydrogeologists conducting rigorous, independent evaluations of the sites, including site visits and follow-up discussions with EPA and site contractors. Optimization recommendations usually fall into the following categories: (1) improvement of system effectiveness; (2) reduction of operation and maintenance costs; and (3) identification of technical improvements. Norm Kulujian was asked to participate on a select committee to conduct RSEs of regional pump-and-treat Superfund sites. A team comprised of STL Kulujian, a member of OSWER's Technology Innovation and Field Services staff, a regional senior hydrogeologist, and a contractor planned a detailed RSE for the first two sites: the Greenwood and Havertown Superfund sites. For each site, the team reviewed site documents, conducted a site visit, and prepared several drafts that were discussed with the Remedial Project Manager (RPM), site hydrogeologist, and management prior to writing the final report. The remaining eight fund-lead pump-and-treat sites in Region 3 were evaluated over the next 3 years.

CASE STUDY

One case study is discussed here to provide additional details. The Greenwood Superfund site was one of two sites to have a detailed RSE in 2003.

Greenwood Chemical Superfund Site

The Greenwood Chemical Superfund site is a defunct chemical manufacturing facility in Newtown, Albemarle County, Virginia. The contaminants detected at the site are believed to have originated from numerous poor environmental practices. Liquid waste was discharged through floor drains in the process buildings that drained into unlined pits adjacent to the buildings. Chemical wastes were sent to waste disposal lagoons, and drums with hazardous substances were systematically buried on the plant property.

The evaluation team determined that the most down gradient wells at the site were contaminated, but the extent of contamination down gradient was unknown. The plume needed further delineation, and new monitoring locations were recommended. The monitoring led to the placement of new extraction wells to capture plume contaminants more efficiently. Several existing wells with low extraction rates were eliminated.

FIGURE 1. Greenwood Chemical Superfund site is a defunct chemical manufacturing facility in Newtown, Albemarle County, Virginia.

The treatment plant consists of a 12,600 gallon equalization tank, a mixing and flocculation tank, a plate clarifier and backwash filters, a UV oxidation system with hydrogen peroxide addition, granular activated

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CASE STUDY

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carbon units, and several chemical feed systems. The team suggested several revisions to the treatment plant. It was determined that the metals removal and the UV oxidation system could be removed without comprising remediation goals.

During the site visit, the team learned that a Resource Conservation and Recovery Act (RCRA) cap was planned to reduce exposure to remaining soil contamination and reduce infiltration. The team suggested that the remaining contaminated soil be removed and replaced with clean material. This would prevent direct contact with contaminated soil, and would be as effective as the RCRA cap. The RCRA cap cost was approximately $2 million, and the cost of soil removal and backfill was about $500,000, resulting in a $1.5 million savings.

There were opportunities to reduce onsite operator labor and optimize the groundwater monitoring program. The evaluation team suggested that two full-time operators could be reduced to one full-time operator with occasional help from a part-time technician, reducing costs by approximately $50,000 per year.

All of the evaluation team's recommendations were accepted and are planned for implementation. ■

CONCLUSIONS

The optimization project accrued benefits beyond the long-term savings of operations and maintenance costs. Additional value was derived from review of the hydrogeology and sampling of each site, whereby changes in site conditions and more recent advancements in groundwater plume delineation methods could be factored into the optimization scenarios.

The review team also provided a third-party evaluation of site conditions and effectiveness of the pump-and-treat remedy. The high degree of interaction and shared knowledge among the participants improved the overall understanding of the study sites and provided a consistent review across multiple sites in Region 3.

There were specific technical recommendations to reduce costs at each site. These included treatment system changes such as streamlining the UV oxidation system and the volatile organic compound removal and/or air stripping process. Cost considerations also included reducing process and groundwater sampling frequency, reducing laboratory analysis of certain parameters, reducing operator labor, and eliminating unnecessary data validation.

With respect to system effectiveness improvements, the RSE team identified several sites that had no formal capture zone analysis. It was unknown whether the extraction system provided the intended containment.

There were instances of insufficient information for groundwater flow analysis to compare the amount of water flowing through the site to the amount of water extracted for treatment. The study team suggested using a conceptual model to establish a target capture zone and determine whether further site characterization was necessary. The team suggested that the potential for vapor intrusion should be evaluated at several sites.

The Region 3 Optimization Studies are being reviewed for applicability in other regions with the hope that the knowledge gained from the Region 3 experience can be transferred to other regions to provide long-term savings for the Superfund Program. An RSE of two fund-lead pump-and-treat Superfund sites conducted in Region 10 in 2002 is under consideration for expansion to more Superfund sites in the region. ■

IN THE LABORATORY

Over the years, ORD laboratories have conducted extensive research on monitoring performance, and evaluation and remediation of pump-and-treat remediation systems, particularly systems dealing with dense non-aqueous phase liquids (DNAPLs). This research has been converted to technical support to RPMs for determining and evaluating remedies for Superfund site remediation.

The Ground Water Technical Support Center (GWTSC) of the Ground Water and Ecosystems Restoration Division in ORD's National Risk Management Research Laboratory in Ada, Oklahoma, is developing a guidance document tentatively entitled "A Systematic Approach for Evaluation of Capture Zone at Pump and Treat Systems." Additionally, the GWTSC has been conducting training courses for regional staff on how to apply the information provided in the guidance document.

The new guidance document updates the 2002 guidance document also developed at the GWTSC entitled "Elements for Effective Management of Operating Pump and Treat Systems." ORD's seminal contribution to optimization began with Methods for Monitoring Pump-and-Treat Performance in 1994.

AVAILABLE RESOURCES

"Action Plan for Ground Water Remedy Optimization," memorandum from Michael B. Cook to Superfund National Policy Managers, Regions 1-10 and OSWER Office Directors, August 25, 2004 (http://www.clu-in.org/download/remed/hyopt/guidance/general_guidance/final_action_plan.pdf)

Publications

Improving Nationwide Effectiveness of Pump-and-Treat Remedies Requires Sustained and Focused Action to Realize Benefits, Office of Inspector General Memorandum Report (Report No. 2003-P-000006, March 27, 2003) (http://www.epa.gov/superfund/action/postconstruction/oigptreport.pdf)

Pilot Project to Optimize Superfund-Financed Pump and Treat Systems: Summary Report and Lessons Learned (EPA 542-R-02-008a, November, 2002) (http://www.epa.gov/swertio1/download/remed/rse/phase_ii_report.pdf)

Final Report of the Remediation System Evaluation: Boomsnub/AIRCO Superfund Site, Hazel Dell, Washington, February 26-27, 2002 (http://www.epa.gov/tio/download/remed/rse/final_boomsnub_rse_091702.pdf)

Groundwater Pump and Treat Systems: Summary of Selected Cost and Performance Information at Superfund- financed Sites (EPA 542-R-01-021a, December 2001) (http://www.epa.gov/superfund/action/postconstruction/p1report.pdf)

Methods for Monitoring Pump-and-Treat Performance (EPA/600/R-94/123, June 1994) (http://www.epa.gov/Region10/offices/oea/gwf/issue20.pdf)

Conferences

Remediation of Chlorinated and Recalcitrant Compounds, Long Term Monitoring Strategies and Remedial Action Optimization, Battelle Conference, May 22-25, 2006, Monterey, California (Reference www.battelle.org/chlorcon)

Association of State and Territorial Solid Waste Management Officials 2006 Symposium, Optimization of Fund-Lead Pump-and-Treat Sites in Region 3, August 14-16, 2006, Scottsdale, Arizona (http://www.astswmo.org)

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