Pilot Project to Optimize Pump and Treat Systems at State-Funded Leaking Underground Storage Tank Sites: Summary Report and Lessons Learned

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NOTICE AND DISCLAIMER

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This report has undergone review by the state site manager and EPA headquarters staff. For more infomation about this project, contact: Joe Vescio (703-603-0003 or vescio.joseph@epa.gov) or Kathy Yager (617-918-8362 or yager.kathleen@epa.gov).

PREFACE

This report was prepared as part of a pilot project conducted by the United States Environmental Protection Agency (U.S. EPA) Office of Underground Storage Tanks (OUST) and the Office of Superfund Remediation and Technology Innovation (OSRTI). The objective of this project is to conduct Remediation System Evaluations (RSEs) of pump and treat systems at State-funded underground storage tank (UST) sites. The following organizations are implementing this project.

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EXECUTIVE SUMMARY

Based on previous success with conducting independent optimization evaluations at Fund-lead pump and treat sites (i.e., those sites with pump and treat systems funded and managed by Superfund and the States), the EPA Office of Superfund Remediation and Technology Innovation (OSRTI) and the Office of Underground Storage Tanks (OUST) commissioned a study to pilot similar evaluations at State-funded leaking underground storage tank (LUST) sites. During 2003 and 2004, independent evaluations were performed at three State-funded UST sites by an independent EPA contractor. The Remediation System Evaluation (RSE) process developed by the U.S. Army Corps of Engineers was used. For each of the three sites, the RSE process included a review of site documents, a site tour to interview State project managers, and preparation of an RSE report. The RSE reports provided site background, summarized the findings from the site visit, and provided recommendations in the following categories:

- recommendations to improve system effectiveness in protecting human health and the environment
- recommendations to reduce life-cycle operation and maintenance (O&M) costs
- recommendations for technical improvement
- recommendations to improve the likelihood of site closure

The three sites that received RSEs were selected by the EPA OSRTI and OUST based on nominations provided by State project managers from the New Jersey Department of Environmental Protection (NJDEP) and the New York State Department of Environmental Conservation (NYSDEC). Both of these State organizations had expressed interest in the optimization process and a willingness to participate in the pilot study. The evaluated sites have a number of similarities, including the following:

- the primary contaminants of concern at all three sites are typical gasoline constituents, such as benzene, toluene, ethylbenzene, and xylene (BTEX)
- all three sites have free product at present
- all three sites address contamination in unconsolidated material

The annual costs for operating the systems ranged from approximately $22,000 per year to $225,000 per year.

The RSE team was able to provide recommendations for each of the three sites. Recommendations for improving effectiveness in protecting human health and the environment and for technical improvement were provided at all three sites. Recommendations for reducing costs and gaining site close out were provided at two of the three sites.

Typical recommendations for improving effectiveness pertained to plume delineation, plume capture, and sampling program effectiveness. Typical recommendations for reducing costs generally included reducing number of sampling locations, replacing a treatment component with a more efficient technology, and reducing granular activated carbon (GAC) change-out. If the cost reduction recommendations are implemented at all the sites, the RSE team estimates that approximately $55,000 per year might be saved. Technical improvement recommendations varied by site, but at two of the sites, the RSE team recommended either instituting or enhancing performance reporting. With respect to gaining site close out, recommendations included developing a site-specific exit strategy and considering alternative remedial approaches.

Based on the results of the RSEs, the RSE process is beneficial at State-funded UST sites. However, it would be helpful to develop a streamlined evaluation process (an "RSE-lite") that could accomplish a beneficial evaluation with a reduced scope of work and reduced cost. In addition, it would be helpful to provide project managers with a tool that could be used to improve reporting of remedial progress.

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1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

During fiscal years 2000, 2001, and 2002, Remediation System Evaluations (RSEs) were conducted at 24 Fund-lead pump and treat (P&T) sites (i.e., those sites with pump and treat systems funded and managed by Superfund and the States). Due to the opportunities for system optimization that arose from those RSEs, the EPA Office of Superfund Remediation and Technology Innovation (OSRTI) and the Office of Underground Storage Tanks (OUST) commissioned a study to pilot RSEs at State-funded leaking underground storage tank (LUST) sites with P&T systems. Starting in June 2003, RSEs at three State-funded LUST sites were conducted to evaluate the effectiveness of the RSE process as an optimization tool for this class of sites. Focus was placed on determining if the RSE process could help States address these environmental liabilities given recent shortages in funding and resources. An independent contractor conducted these evaluations, and representatives from EPA OUST attended the RSEs as observers.

For more information regarding this project, including the individual RSE reports, please visit

www.cluin.org/optimization

1.2 THE RSE PROCESS

The RSE process was developed by the U.S. Army Corps of Engineers (USACE) and is documented on the following website:

http://www.environmental.usace.army.mil/library/guide/rsechk/rsechk.html

The RSE process is a comprehensive, independent expert evaluation of an operating remediation system. For a P&T system, the RSE team includes one or more senior process engineers and one or more senior hydrogeologists working with the site team (i.e., the site regulator, facility representative, and site contractor). The RSE team evaluates the following items:

- system goals
- site conceptual model
- extraction well network
- above-ground treatment system
- ground water and treatment process monitoring
- system effectiveness with respect to protection of human health and the environment
- data management
- costs

The RSE process includes scheduling a site visit, reviewing site data, visiting the site for one to two days, submitting a draft report for review by the site managers, and finalizing that report considering the comments from the review. The RSE site visit generally needs to be scheduled a month in advance to allow for transfer of key site documents to the RSE team for their review prior to the site visit. Once the site visit is conducted, the draft RSE report is generally submitted in approximately 45 days. The time

frame for finalizing the RSE report depends heavily on the time taken for the site managers to review the draft report and send comments to the RSE team. The typical cost for an RSE is about $25,000.

During the site visit the RSE team tours the facility and surrounding area and interviews the site team. The RSE report documents the findings and presents recommendations to improve the remedy. The recommendations typically fall into the following categories:

- recommendations to improve system effectiveness in protecting human health and the environment
- recommendations to reduce life-cycle operation and maintenance (O&M) costs
- recommendations for technical improvement
- recommendations to improve the likelihood of site closure

The recommendations obviously have the benefit of the operational data unavailable to the original designers; therefore, an RSE is viewed as a team effort between the site managers and the RSE team rather than a site audit.

1.3 THE RSE REPORT

The detailed RSE report for each site contains the following sections:

- an introduction that details the purpose of the visit, the RSE team, the documents reviewed, persons contacted, site location, history, hydrogeology, etc.

- a description of the remediation system including the extraction and treatment systems

- system objectives, plus performance and closure criteria

- findings and observations from the RSE site visit including system and component performance, recurring problems, capture zone evaluation, and contaminant delineation

- evaluation of the system effectiveness with respect to protection of human health and the environment for ground water, surface water, air, and soils

- recommendations intended to

    - enhance remedy effectiveness with respect to preventing plume migration and monitoring other exposure pathways
    - reduce life-cycle O&M costs
    - improve technical operations
    - gain site closeout

- a table summarizing the recommendations, including estimated capital costs and estimated annual cost increases or decreases associated with each recommendation

The cost estimates provided in the RSE reports have levels of certainty comparable to those done for CERCLA Feasibility Studies (-30/+50%). The observations and recommendations presented in the RSE reports are not intended to imply a deficiency in the work of either the designers, operators, or site managers. They are offered as constructive suggestions that have the benefit of an independent review of operational data that was unavailable to the original designers. In general, system improvements are

merited because site conditions and/or available technologies have changed since design and installation of the P&T systems.

1.4 SITE SELECTION PROCESS

EPA OUST and OSRTI selected the three sites to receive RSEs by soliciting nominations from the New Jersey Department of Environmental Protection (NJDEP) and the New York State Department of Environmental Conservation (NYSDEC). Both of these State organizations had expressed interest in the optimization process and a willingness to participate in the pilot study. Both State agencies selected sites that had relatively high remediation costs compared to their other State-funded sites.

1.5 EVALUATED SITES AND SCHEDULE

The three UST sites that were evaluated are listed in the following table along with the dates of various milestones in the RSE process.

Site Name and Location	Date of RSE Site Visit	Date Draft RSE Report was Submitted	Date Final RSE Report was Submitted
Morgan Terminal Brooklyn, New York	6/4/2003	7/18/2003	6/11/2004
Shorco South Mahwah, New Jersey	7/29/2003	7/7/2004	9/30/2004
A-Z Automotive West Milford, New Jersey	7/30/2003	7/27/2004	9/30/2004

Note: Contracting difficulties that were beyond the control of EPA, the States, and the contractor resulted in a stoppage of work from August 2003 through May 2004.

The following are brief descriptions of each of the evaluated sites. RSE findings and recommendations are discussed in the Section 2.0 of this report.

Morgan Terminal - Brooklyn, New York

The Morgan Terminal site is an abandoned oil terminal located at 200 Morgan Avenue in Brooklyn, New York. The site consists of a two story terminal operations building and maintenance building, seven bulk fuel oil storage tanks, and several underground storage tanks. The site has historically been impacted by diesel fuel and No. 6 fuel oil and dissolved hydrocarbons. Current contamination largely consists of No. 6 fuel oil. The surrounding area is comprised of industrial facilities and warehouses. Morgan Avenue borders the site to the west, and the English Kills borders the site to the north and east.

Site-related contamination was first reported in 1992 by the Coast Guard when oil was found seeping into the English Kills. Between December 1992 and January 1993 a remedial investigation (RI) was conducted including the installation of 20 ground water monitoring wells and tank testing. Primary recommendations included additional subsurface investigation, removal of floating product from monitoring wells, emptying and cleaning of tanks, and design of a remediation system. Additional investigations have occurred and the site now has over 40 monitoring wells. The tanks were cleaned in 1994, and a remediation system became operational in June 1995.

The State does not own the property. The current owner reportedly lives in Florida and, at the time of the interim consent order in 1994, over $800,000 in back taxes were owed. The State has a lien on the property to recover costs if the property is ever sold.

Shorco South - Mahwah, New Jersey

The Shorco South site is located on the southbound side of Route 17 in the Township of Mahwah, New Jersey. The Shorco South site is downgradient of the Shorco North site, which also has ground water impacted with petroleum constituents. The Shorco South site remediation is currently being run by NJDEP under the publicly funded cleanup program, while the Shorco North remediation is still being operated by the responsible party. Ground water flows in a south to southwest direction across the Shorco South site, towards the Ramapo River.

Dissolved benzene, methyl tertiary-butyl ether (MTBE), and tertiary-butyl alcohol (TBA) levels are present in many wells above ground water criteria and are good "indicator parameters" for continuing impacts at the site. Toluene, ethylbenzene, xylene, and lead only sporadically exceed the criteria, and occur at wells within the plumes associated with the three indicator parameters (benzene, MTBE, and TBA). On-site wells located upgradient of on-site sources ("upgradient" wells) are impacted, but at lower concentrations than the "mid-plume" wells. Impacts at these "upgradient wells" are most likely due to Shorco North, and concentrations at these wells are decreasing over time. At the "mid-plume" wells (impacted primarily by sources at Shorco South) the concentrations also appear to be decreasing over time, though in some cases concentrations still remain several orders of magnitude above cleanup criteria.

A ground water pump and treat system was completed during 1991 which included 6 recovery wells. Nine well points were added to the system in 1996 to improve containment at the downgradient south corner of the site. The well points were not effective due to fouling problems. The current pump and treat system consists of an approximately 200 foot long trench 14 to 16 feet deep that was installed in late 2001, but has not operated except for testing.

A-Z Automotive - West Milford, New Jersey

The A-Z Automotive site is a former gasoline retail outlet and automobile service station located on Union Valley Road between St. George Street and LouAnn Boulevard in West Milford, Passaic County, New Jersey. Approximately 25 residences are located on St. George Street and LouAnn Boulevard to the east of the A-Z site. Belcher Creek is about 1,000 feet further to the east of the subdivision. Petroleum impacts were discovered at the site in 1989 initially due to a diesel spill that occurred during the filling of a UST. Subsequent investigations found UST leaks, basement vapor issues, and potable well impacts. Shallow ground water occurs in a glacial deposit overburden that is reported to be about 80 feet bgs. The potable wells in the area are completed in the underlying bedrock (potable wells are reported to average about 150 feet bgs). Between 1989 and 1992, potable well sampling indicated exceedances of New Jersey Department of Environmental Protection (NJDEP) ground water standards at nine potable wells, and detectable contaminant concentrations in twelve additional wells. Gasoline odors were noted at that time in the basements of several residences. Approximately 19 point of entry treatment (POET) systems with GAC treatment were in place as of May 1995 and most of these are still in place. Contaminants of concern include typical gasoline constituents such as benzene, toluene, ethylbenzene, xylenes (BTEX), MTBE, TBA. Benzene is present above NJDEP standards in the most widespread area. Analytical results for ground water samples taken in July 2003 show a marked decrease in the extent and magnitude of dissolved concentration from earlier results. Free product has been observed at the site, reaching as far as

300 feet east of the abandoned gas station where up to three feet of product has been observed during pumping conditions. There is concern that a large volume of product is trapped below the water table.

The current P&T system consists of one main recovery well for hydraulic control (RW-13). Other wells are periodically pumped to lower the water table for SVE application. The recent (May to July 2003) system flow rate has been about 20 gpm. The current SVE system consists of several wells that can recover vapors to prevent contaminant migration to residences, and to remove mass. The vapors are extracted at a rate of approximately 70 to 100 cfm, and are currently treated by a catalytic oxidizer.

2.0 SUMMARY OF RSE FINDINGS AND RECOMMENDATIONS

2.1 COMPARISON OF SITE/SYSTEM CHARACTERISTICS

The five evaluated systems had the following similarities:

- the primary contaminants of concern at all three sites were hydrocarbons, such as BTEX compounds
- all three sites either have or had non-aqueous phase liquid (NAPL) present
- all three sites addressed contamination in unconsolidated material
- two of the three facilities (A-Z Automotive and Morgan Terminal) were no longer active
- annual O&M costs for the systems in increasing order were
  - $21,600 per year (Morgan Terminal)
  - $103,000 per year (Shorco South)
  - $225,400 per year (A-Z Automotive)
- all three of the sites had potential ecological receptors; only one of the sites (A-Z Automotive) had potential human receptors

More information about each site can be found in the individual RSE reports.

2.2 COMMON THEMES REGARDING RECOMMENDATIONS FOR IMPROVING EFFECTIVENESS

Each of the three evaluated sites had recommendations for improving effectiveness. Those recommendations generally pertained to plume delineation, plume capture (i.e., containing the contaminant plume and preventing further plume migration), and effectiveness of the sampling program.

- Installation of additional monitoring wells for further delineation of ground water impact was recommended at A-Z Automotive. At a minimum, installation of a well pair was recommended by the RSE team to serve as a sentinel well for plume migration.
- With regard to plume capture, evaluation of capture was recommended at two of the three sites. At A-Z Automotive, the RSE team believed capture was likely insufficient, allowing contaminants to migrate from the site. The RSE team provided recommendations to improve evaluation of capture. At Shorco South, the RSE team recommended additional data or further analysis to confirm capture.
- Formalizing/modifying the sampling program was recommended at all three of the sites. The RSE team recommended starting an annual ground water monitoring program at A-Z Automotive, including indoor air sampling at nearby residences. At Morgan Terminal, the RSE team recommended including sampling and analysis of chlorinated solvents because there was

evidence this class of contaminants were present at the site. At Shorco South, the RSE team recommended indoor air sampling in an on-site building.

Other recommendations in this category included obtaining a discharge permit/agreement and conducting effluent sampling at Morgan Terminal. At the time of the RSE, the site did not have a documented discharge permit or agreement and the discharge was not being sampled. Morgan Terminal could also benefit from demolition of site structures and excavation of underlying contaminated soil. At the time of the RSE, the site was a safety hazard and an attraction for vagrants and vandals.

2.3 COMMON THEMES REGARDING RECOMMENDATIONS FOR COST REDUCTION

Recommendations to reduce cost were provided at two of the three sites (A-Z Automotive and Shorco South). Those recommendations generally included modifying the sampling program, replacing a treatment component with a more efficient technology, and reducing GAC change-out frequency.

At A-Z Automotive, the recommended modifications included the following:

- The contractor scope should be clarified to assist the project manager with tracking activities and costs.

- Vapor phase GAC units can be used to replace the catalytic oxidizer to lower electricity usage, and the change-out frequency for the liquid phase GAC could be reduced from 12 per year to four per year.

At Shorco South, the RSE team suggested the following modifications:

- The site team should reduce the number of wells for quarterly sampling.

- The site team should attempt to avoid TBA treatment by negotiating with the publicly-owned treatment works (POTW) because it would be readily treated through the biological treatment process at the POTW but would be expensive to treat on site.

The RSE team estimates that implementing these recommendations at the two sites could save approximately $55,000 per year.

2.4 COMMON THEMES REGARDING RECOMMENDATIONS FOR TECHNICAL IMPROVEMENT

The recommendations for technical improvement were provided at all three sites. The recommendations varied by site and included, removing a GAC effluent tank, repairing insulation or relocating treatment component indoors, and improving housekeeping. Technical improvement recommendations at two of the sites pertained to reporting. At A-Z Automotive, the RSE team recommended instituting a quarterly system performance report and an annual ground water report. At Morgan Terminal, the RSE team recommended improving the content of semi-annual reports and reducing errors.

2.5 COMMON THEMES REGARDING RECOMMENDATIONS FOR SITE CLOSURE

The RSE team provided recommendations in this category at all three sites, as summarized below:

- At A-Z Automotive, the RSE team recommended considering an exit strategy that could serve as a plan for the duration of the remedy. An evaluation should be made as to whether aquifer restoration is achievable with the current system. A time frame for shutting down the system should be estimated, and a specific monitoring program to indicate when the system can be shut off should be determined.

- At two of the sites, the RSE team suggested alternative or additional remedial approaches. At Morgan Terminal, several alternative remedial approaches were recommended to replace current remediation system because it does not appear to be effective. At the Shorco South, vacuum enhanced short-term extraction at hot-spot wells was suggested to accelerate site cleanup. An air sparging or biosparging system could also be considered instead of ground water extraction once the hydraulic containment is no longer necessary.

3.0 FEEDBACK ON THE RSE PROCESS FROM SITE STAKEHOLDERS

3.1 LESSONS LEARNED

The primary lessons learned are as follows:

- Although the LUST sites evaluated in this project are generally not as complex as the Superfund sites or RCRA sites evaluated in other RSE pilot projects, they are sufficiently complex to merit long-term remedial actions and can benefit from RSEs or other forms of independent optimization evaluations.

- The RSEs yielded potential opportunities to improve remedy effectiveness. The RSE team generally found it important to improve the evaluation of plume capture at these sites, to better refine remedial objectives, to conduct adequate sampling, and to address source areas.

- The RSEs generally identified potential opportunities for cost reduction. However, because the remedies evaluated during this pilot had relatively low costs compared to previously reviewed Superfund and RCRA remedies, the potential for cost reduction was not as substantial. The RSE process would be more cost effective if the process could be streamlined and conducted for a reduced cost.

- Reporting at the UST sites is generally not as comprehensive as the reporting at the more complicated sites. More effective reporting, particularly at A-Z Automotive and Morgan Terminal, would likely facilitate site management. In general, more comprehensive reporting would facilitate the implementation of a streamlined RSE process.

- Conducting RSEs at UST sites that are not State funded could also be beneficial to State UST programs. State programs might also benefit by conducting RSEs at responsible party sites that demand substantial personnel resources or that are part of a reimbursement program. However, conducting RSEs at these sites would be a different dynamic than conducting RSEs at State-funded sites because a responsible party would be involved, and an evaluation would not be considered independent if it were used for enforcement purposes.

3.2 RECOMMENDATIONS

Based on the above lessons learned, the following items are recommended:

- The development of a template progress report with template tables and example figures specifically aimed at UST sites would likely facilitate future reporting efforts at UST sites. The resulting improvements in reporting would likely improve site management and facilitate the implementation of streamlined optimization evaluations.

- A streamlined optimization evaluation (e.g., an “RSE-lite”) specifically developed for UST sites would make optimization more cost-effective at UST sites and would enable many more sites to benefit from optimization. The RSE-lite would not likely include a site visit. Rather, it would primarily rely on document review, conference calls, and email exchanges. By eliminating the

site visit and streamlining the actual RSE report, it is hoped that the cost for an RSE-lite at UST sites might be as low as $5,000.

- The above-mentioned template and RSE-lite process should be piloted at UST sites. Once again, emphasis could be placed on State-funded UST sites; however, if the States find it beneficial to include responsible party sites, such sites could also be included. If this is the case, the States would need to identify responsible party sites that were willing to participate in the pilot. The States and the responsible party would need to understand that the RSE process is intended as an independent evaluation and should not be used as a tool for enforcement.