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Abstracts of Remediation Case Studies

Volume 4

Federal Remediation Technologies Roundtable
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Prepared by the

Member Agencies of the Federal Remediation Technologies Roundtable

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Environmental Protection Agency
Department of Defense
- U.S. Air Force
- U.S. Army
- U.S. Navy

Department of Energy
Department of Interior
National Aeronautics and Space Administration
Tennessee Valley Authority
Coast Guard

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NOTICE

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FOREWORD

This report is a collection of abstracts summarizing 78 case studies of site remediation applications prepared by federal agencies. The case studies, collected under the auspices of the Federal Remediation Technologies Roundtable, were undertaken to document the results and lessons learned from technology applications. They will help establish benchmark data on cost and performance which should lead to greater confidence in the selection and use of cleanup technologies.

The Roundtable was created to exchange information on site remediation technologies, and to consider cooperative efforts that could lead to a greater application of innovative technologies. Roundtable member agencies, including the U.S. Environmental Protection Agency, U.S. Department of Defense, and U.S. Department of Energy, expect to complete many site remediation projects in the near future. These agencies recognize the importance of documenting the results of these efforts, and the benefits to be realized from greater coordination.

The case study reports and abstracts are organized by technology in a multi-volume set listed below. The 78 new case studies are available on a CD-ROM, and cover a variety of in situ and ex situ technologies. Remediation Case Studies, Volumes 1-13, and Abstracts, Volumes 1-3, were published previously, and contain 140 projects, and are also available on the CD-ROM. Abstracts, Volume 4, covers a wide variety of technologies, including full-scale remediations and large-scale field demonstrations of soil and groundwater treatment technologies. In the future, the set will grow as agencies prepare additional case studies.

2000 Series

Published on CD-ROM, FRTR Cost and Performance Case Studies and Related Information, EPA-542-C-00-001; June 2000

1998 Series

Volume 7: Ex Situ Soil Treatment Technologies (Bioremediation, Solvent Extraction, Thermal Desorption), EPA-542-R-98-011; September 1998

Volume 8: In Situ Soil Treatment Technologies (Soil Vapor Extraction, Thermal Processes), EPA-542-R-98-012; September 1998

Volume 9: Groundwater Pump and Treat (Chlorinated Solvents), EPA-542-R-98-013; September 1998

Volume 10: Groundwater Pump and Treat (Nonchlorinated Contaminants), EPA-542-R-98-014; September 1998

Volume 11: Innovative Groundwater Treatment Technologies, EPA-542-R-98-015; September 1998

Volume 12: On-Site Incineration, EPA-542-R-98-016; September 1998

Volume 13: Debris and Surface Cleaning Technologies, and Other Miscellaneous Technologies, EPA-542-R-98-017; September 1998

1997 Series

Volume 5: Bioremediation and Vitrification, EPA-542-R-97-008; July 1997; PB97-177554

Volume 6: Soil Vapor Extraction and Other In Situ Technologies, EPA-542-R-97-009; July 1997; PB97-177562

1995 Series

Volume 1: Bioremediation, EPA-542-R-95-002; March 1995; PB95-182911

Volume 2: Groundwater Treatment, EPA-542-R-95-003; March 1995; PB95-182929

Volume 3: Soil Vapor Extraction, EPA-542-R-95-004; March 1995; PB95-182937

Volume 4: Thermal Desorption, Soil Washing, and In Situ Vitrification, EPA-542-R-95-005; March 1995; PB95-182945

Abstracts

Volume 1: EPA-542-R-95-001; March 1995; PB95-201711

Volume 2: EPA-542-R-97-010; July 1997; PB97-177570

Volume 3: EPA-542-R-98-010; September 1998

Volume 4: EPA-542-R-00-006; June 2000

Accessing Case Studies

The case studies and case study abstracts also are available on the Internet through the Federal Remediation Technologies Roundtable web site at: http://www.frtr.gov. The Roundtable web site provides links to individual agency web sites, and includes a search function. The search function allows users to complete a key word (pick list) search of all the case studies on the web site, and includes pick lists for media treated, contaminant types, and primary and supplemental technology types. The search function provides users with basic information about the case studies, and allows them to view or download abstracts and case studies that meet their requirements.

Users are encouraged to download abstracts and case studies from the Roundtable web site. Some of the case studies are also available on individual agency web sites, such as for the Department of Energy.

In addition, a limited number of hard copies are available free of charge by mail from NSCEP (allow 4-6 weeks for delivery), at the following address:

U.S. EPA/National Service Center for Environmental Publications (NSCEP)
P.O. Box 42419
Cincinnati, OH 45242
Phone: (513) 489-8190 or
(800) 490-9198
Fax: (513) 489-8695

INTRODUCTION

Increasing the cost effectiveness of site remediation is a national priority. The selection and use of more cost-effective remedies requires better access to data on the performance and cost of technologies used in the field. To make data more widely available, member agencies of the Federal Remediation Technologies Roundtable (Roundtable) are working jointly to publish case studies of full-scale remediation and demonstration projects. Previously, the Roundtable published 13 volumes of case study reports. At this time, the Roundtable is publishing a CD-ROM containing 78 new case study reports, primarily focused on soil and groundwater cleanup.

The case studies were developed by the U.S. Environmental Protection Agency (EPA), the U.S. Department of Defense (DoD), and the U.S. Department of Energy (DOE). They were prepared based on recommended terminology and procedures agreed to by the agencies. These procedures are summarized in the Guide to Documenting and Managing Cost and Performance Information for Remediation Projects (EPA 542-B-98-007; October 1998).

The case studies and abstracts present available cost and performance information for full-scale remediation efforts and several large-scale demonstration projects. They are meant to serve as primary reference sources, and contain information on site background and setting, contaminants and media treated, technology, cost and performance, and points of contact for the technology application. The studies contain varying levels of detail, reflecting the differences in the availability of data and information. Because full-scale cleanup efforts are not conducted primarily for the purpose of technology evaluation, data on technology cost and performance may be limited.

The case study abstracts in this volume describe a wide variety of ex situ and in situ soil treatment technologies for both soil and groundwater. Contaminants treated included chlorinated solvents; petroleum hydrocarbons and benzene, toluene, ethylbenzene, and xylenes; polycyclic aromatic hydrocarbons; pesticides and herbicides; explosives/propellants; metals; and radioactivity. Many of the applications described in the case study reports are ongoing and interim reports are provided documenting their current status.

Table 1 provides summary information about the technology used, contaminants and media treated, and project duration for the 78 technology applications in this volume. This table also provides highlights about each application. Table 2 summarizes cost data, including information on quantity of media treated and quantity of contaminant removed. In addition, Table 2 shows a calculated unit cost for some projects, and identifies key factors potentially affecting technology cost. (The column showing the calculated unit costs for treatment provides a dollar value per quantity of media treated and contaminant removed, as appropriate.) Cost data are shown as reported in the case studies and have not been adjusted for inflation to a common year basis. The costs should be assumed to be dollars for the time period that the project was in progress (shown on Table 1 as project duration).

While a summary of project costs is useful, it may be difficult to compare costs for different projects because of unique site-specific factors. However, by including a recommended reporting format, the Roundtable is working to standardize the reporting of costs to make data comparable across projects. In addition, the Roundtable is working to capture information in case study reports that identify and describe the primary factors that affect cost and performance of a given technology. Factors that may affect project costs include economies of scale, concentration levels in contaminated media, required cleanup levels, completion schedules, and matrix characteristics and operating conditions for the technology.

Table 1. Summary of Remediation Case Studies (continued)

Site Name, State (Technology)	Principal Contaminants*: Chlorinated Solvents	BTEX and/or TPH	Pesticides/Herbicides	Explosives/Propellants	Metals	Radionuclides	Media (Quantity Treated**)	Project Duration	Highlights
Keesler Air Force Base Service Station, AOC-A (ST-06), Mississippi (Monitored Natural Attenuation)		●			●		Soil, groundwater, and soil gas	September 1997 to April 1999	Monitored natural attenuation for a gasoline contaminated site
Kelly Air Force Base, Former Building 2093 Gas Station, Texas (Monitored Natural Attenuation)		●					Soil, groundwater, and soil gas	July 1997 to July 1998	Monitored natural attenuation for a gasoline-contaminated site
Fry Canyon, Utah (Permeable Reactive Barrier)					●	●	Groundwater (33,000 ft^3 or 200,000 gallons)	Ongoing, data from September 1997 to September 1998	Demonstration of three types of PRBs to treat uranium-contaminated groundwater
Moffett Field Superfund Site, California (Permeable Reactive Barrier)	●						Groundwater	April 1996 to December 1997	Demonstration of PRB to remediate groundwater contaminated with chlorinated solvents
Tacony Warehouse, Pennsylvania (Permeable Reactive Barrier; Pump and Treat)	●						Groundwater (393,165 gallons during the first year)	May 1998 through 2001 (projected)	Use of an extraction well surrounded by permeable reactive media at site contaminated with chlorinated solvents.
Debris/Solid Media Treatment									
Lawrence Livermore National Laboratory, California (Chemical Reduction/Oxidation; Direct Chemical Oxidation)	●			●			Waste streams from LLNL operations	Not identified	Pilot-scale demonstration of the DCO process to treat a variety of organic aqueous waste streams
Savannah River Site, South Carolina (Chemical Reduction/Oxidation)						●	Organic wastes	1996 to 1997	Demonstrate acid digestion of organic wastes as an alternative to incineration
Argonne National Laboratory - East, Illinois (Physical Separation)						●	Debris (concrete)	August 1997 to September, 1997	Demonstration of a remotely-controlled concrete demolition system to remove radioactively contaminated concrete
Argonne National Laboratory - East, Illinois (Physical Separation)						●	Debris (concrete floor)	Not identified	Demonstration of a remotely-operated scabbler to decontaminate radioactive concrete flooring
Fernald Site, Ohio (Physical Separation)						●	Debris	August 1996 to September 1996	Demonstration of soft blast media to clean surfaces contaminated with uranium

Soft Media Blasting at the Fernald Site, Fernald, Ohio

Site Name: Fernald Site	Location: Fernald, OH
Period of Operation: August 19 - September 5, 1996	**Cleanup Authority:** Not identified
Purpose/Significance of Application: Demonstration of soft blast media to clean surfaces contaminated with uranium	**Cleanup Type:** Field demonstration
Contaminants: Radionuclides • Enriched uranium (1.34 wt-% U-235) • Contaminant levels of 18,000 dpm/100 cm^2 measured prior to demonstration	**Waste Source:** Residue from enriched uranium processing operations

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Technology:
Soft Media Blasting
- Compressed air is used to propel soft blast media through a hose onto the contaminated surface; soft media traps and absorbs contaminants on impact
- Air compressor - minimum requirements (250 ft^3/min of air; 120 psi line pressure at the feed unit); for demonstration- 375 ft^3/min, 150 psi
- Feed unit - contains media mixture; connected to a hose (1 1/4-in. diameter; 25-ft long) fitted with a venturi-style tungsten carbide blast nozzle (3/8 in and 1/2 in nozzles tested during demonstration)
- Blast pressure - 45 psi; media flow - 20-25 lbs
- Six grades of media available (color-coded by grade); two grades of media were tested - green media containing no abrasive; brown media containing Starblast® abrasive
- Demonstration involved cleaning a settling tank contaminated with enriched uranium process residue

Type/Quantity of Media Treated:
Debris (concrete)

Regulatory Requirements/Cleanup Goals:
- Performance objectives included cleaning effectiveness (based on amount of residual radioactivity) and production rate
- Evaluate the technology for use in cleaning radioactive-contaminated surfaces

Results:
- Radiation levels were below the minimum detectable count rate (MDCR) following the demonstration
- Production rate was 92 ft^2/hr; rate was slower than expected - worker time was limited to 1 hr/day because of the noise generated by the system (106 to 113 dB)
- Brown media was effective on thick dirt; brown media generated more dust than the green media

Costs:
- Demonstration cost for soft media blasting - $\$4.60/ft^2$
- Projected full-scale costs are comparable to baseline technology (high-pressure water washing) for an area of 900ft^2 or larger

Soft Media Blasting at the Fernald Site, Fernald, Ohio

Description:
A field demonstration of Soft Media Blasting Technology (SMBT) was performed at the Fernald Site to evaluate the capability of the technology for cleaning radioactively-contaminated surfaces. SMBT uses compressed air to propel soft blast media onto the contaminated surface, with the soft media trapping and absorbing contaminants on impact. Six grades of media are available for the SMBT, manufactured by AEA Technologies, Inc. For the demonstration, two grades were tested - one containing no abrasive and one containing the Starblast® abrasive. A settling tank contaminated with enriched uranium process residue was used for the demonstration.

The results of the demonstration showed that the SMBT reduced radiation levels from 18,000 dpm/100 cm^2 to MDCR. The production rate of 92 ft^2/hr was slower than the baseline technology of high-pressure washing. Because the system was noisy, the time an individual could work was limited. The demonstration cost for soft media blasting was \$4.60/ft^2, more expensive than the baseline technology. However, the projected full-scale costs for SMBT are comparable to the baseline technology for an area of 900ft^2 or larger. Issues associated with full-scale implementation include the noise level produced by the system and improving the ergonomic design of the nozzle/hose assembly to make it less awkward to use. While the media was not recycled during the demonstration, a unit (Classifier Unit) can be added to the system for this purpose. The decision to not recycle the media during the demonstration was based on a concern that the feed and classifier units would not be successfully decontaminated following repeated recycling of the contaminated media.