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Home Page

Home
Table of Contents
Introduction
Contaminants
Treatments/Profiles
References
Appendices
Navigation

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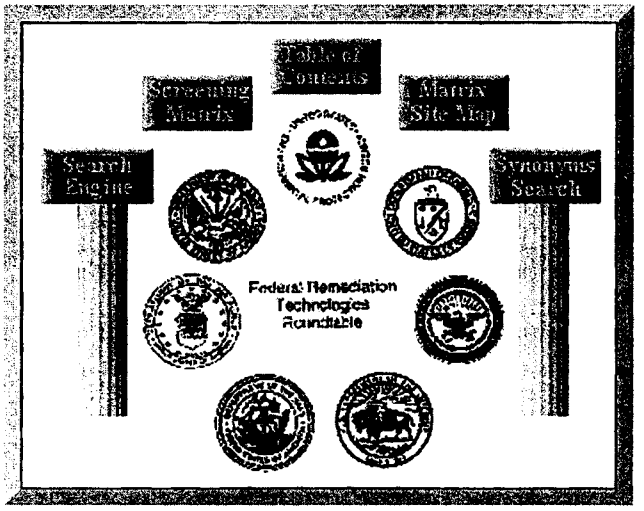

FRTR
Remediation Technologies Screening Matrix and Reference Guide, Version 4.0

REPORT DOCUMENTATION PAGE

Home
Table of Contents
Introduction
Contaminants
Treatment Profiles
References
Appendices
Navigation

REPORT DOCUMENTATION PAGE		Form Approved OMB No. 0704-0188
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13. ABSTRACT

Under contract to the U.S. Army Environmental Center, Platinum International, Inc. has prepared the *Remediation Techn Matrix and Reference Guide*, Fourth Edition. The purpose of this document is to provide enough information to allow the guide, in combination with other references, to efficiently proceed from identifying a contaminated site toward communica recommending suitable site remediation technologies to environmental regulators. The approach used to prepare this do review and compile the unique features of several U.S. Government documents into one compendium document. Inform and presumptive remedies is provided in order to minimize the amount of remediation resources used in obtaining site ch and/or evaluation of every possible remedial alternative. Presumptive remedies are preferred technologies for common c established by the U.S. Environmental Protection Agency (EPA), based on historical patterns of remedy selection and EP engineering evaluation of performance data on technology implementation. Commercially available innovative technologi included.

14. SUBJECT TERMS Remediation, treatment, technology, FRTR, environment, soil, sediment, sludge, ground water, surface water, leachate, volatile organic contaminants, semivolatile organic contaminants, explosives, metals, radionuclides, fuels, screening, alternatives, extraction, destruction, removal, cleanup, containment, and immobilization.		**15. NUMBER OF PAGES** NA - Website **16. PRICE CODE** NA	
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Remediation Technologies Screening Matrix and Reference Guide, Version 4.0

FOREWORD

Home
Table of Contents
Introduction
Contaminants
Treatments/Profiles
References
Appendices
Navigation

The Federal Remediation Technology Roundtable (FRTR) was established in 1991 as an interagency committee to exchange information and to provide a forum for joint action regarding the development and demonstration of innovative technologies for hazardous waste remediation.

One of the distinctive attributes of environmental technology is that the state-of-the-art continually changes. Federal agencies have periodically updated and published information on remediation technologies in an effort to keep pace with these changes. However, government remedial project managers (RPMs) must often sort through large volumes of related and overlapping information to evaluate alternative technologies. Publication of remediation information on the Internet has added a new dimension to the amount of information accessible to the RPM. To assist the RPM in the evaluation process and to enhance technology transfer among Federal agencies, we developed this website to combine the unique features of several agency publications into a single website with extensive links to other remediation technology websites. It allows the RPM to pursue questions based on contamination problems as well as specific technology issues depending on their need.

The selection and use of innovative technologies to clean up hazardous waste sites is increasing rapidly, and new technologies are continuing to emerge. FRTR member agencies plan to frequently update this website to help the RPM keep pace with the ever-changing range of technologies available.

U.S. Army Environmental Center	U.S. Environmental Protection Agency Technology Innovation Office
U.S. Army Corps of Engineers Hazardous Toxic and Radioactive Waste Center of Expertise	U.S. Environmental Protection Agency National Risk Management Research Laboratory
U.S. Air Force Center for Environmental Excellence	U.S. Department of Energy Environmental Management
U.S. Naval Facilities Engineering Service Center	U.S. Geological Survey
Federal Remediation Technologies Roundtable	Interstate Technology Regulatory Cooperation

4.21 Soil Washing

(Ex Situ Soil Remediation Technology)

Previous Section | Top Page | Screen Matrix | Table of Contents | Synonym List | Next Section

Description | Synonyms | Applicability | Limitations
Data Needs | Performance | Cost | References
Site Information | Points of Contact | Vendor Information | Health & Safety

Technology	Description
Soil, Sediment, and Sludge	
3.5 Ex Situ Physical/Chemical Treatment (assuming excavation)	
4.21 Soil Washing	Contaminants sorbed onto fine soil particles are separated from bulk soil in an aqueous-based system on the basis of particle size. The wash water may be augmented with a basic leaching agent, surfactant, pH adjustment, or chelating agent to help remove organics and heavy metals.

Description:

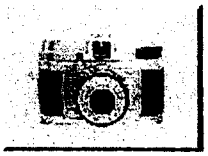

Figure 4-21: Typical Soil Washing Process

Soil washing is a water-based process for scrubbing soils ex situ to remove contaminants. The process removes contaminants from soils in one of two ways:

- By dissolving or suspending them in the wash solution (which can be sustained by chemical manipulation of pH for a period of time).
- By concentrating them into a smaller volume of soil through particle size separation, gravity separation, and attrition scrubbing (similar to those techniques used in sand and gravel operations).

Soil washing systems incorporating most of the removal techniques offer the greatest promise for application to soils contaminated with a wide variety of heavy metal, radionuclides, and organic contaminants. Commercialization of the process, however, is not yet extensive.

The concept of reducing soil contamination through the use of particle size separation is based on the finding that most organic and inorganic contaminants tend to bind, either chemically or physically, to clay, silt, and

organic soil particles. The silt and clay, in turn, are attached to sand and gravel particles by physical processes, primarily compaction and adhesion. Washing processes that separate the fine (small) clay and silt particles from the coarser sand and gravel soil particles effectively separate and concentrate the contaminants into a smaller volume of soil that can be further treated or disposed of. Gravity separation is effective for removing high or low specific gravity particles such as heavy metal-containing compounds (lead, radium oxide, etc.). Attrition scrubbing removes adherent contaminant films from coarser particles. However, attrition washing can increase the fines in soils processed. The clean, larger fraction can be returned to the site for continued use.

Complex mixture of contaminants in the soil (such as a mixture of metals, nonvolatile organics, and SVOCs) and heterogeneous contaminant compositions throughout the soil mixture make it difficult to formulate a single suitable washing solution that will consistently and reliably remove all of the different types of contaminants. for these cases, sequential washing, using different wash formulations and/or different soil to wash fluid ratios, may be required.

Soil washing is generally considered a media transfer technology. The contaminated water generated from soil washing are treated with the technology(s) suitable for the contaminants.

The duration of soil washing is typically short- to medium-term.

Back to Top

Synonyms:

DSERTS Code: N15 (Soil Washing).

Back to Top

Applicability:

The target contaminant groups for soil washing are SVOCs, fuels, and heavy metals. The technology can be used on selected VOCs and pesticides. The technology offers the ability for recovery of metals and can clean a wide range of organic and inorganic contaminants from coarse-grained soils.

Back to Top

Limitations:

Factors that may limit the applicability and effectiveness of the process include:

- Complex waste mixtures (e.g., metals with organics) make formulating washing fluid difficult.
- High humic content in soil may require pretreatment.
- The aqueous stream will require treatment at demobilization.
- Additional treatment steps may be required to address hazardous levels of washing solvent remaining in the treated residuals.
- It may be difficult to remove organics adsorbed onto clay-size particles.

Back to Top

Data Needs:

A detailed discussion of these data elements is provided in Subsection 2.2.1 (Data Requirements for Soil, Sediment, and Sludge). Particle size distribution (0.24 to 2 mm optimum range); soil type, physical form, handling properties, and moisture content; contaminant type and concentration; texture; organic content; cation exchange capacity; pH and buffering capacity. A complete bench scale treatability study should always be completed before applying this technology as a remedial solution.

Back to Top

Performance Data:

At the present time, soil washing is used extensively in Europe but has had limited use in the United States. During 1986-1989, the technology was one of the selected source control remedies at eight Superfund sites.

Soil washing provides a cost effective and environmentally proactive alternative to stabilization and landfilling. Two pilot scale demonstrations were carried out at Fort Polk, Louisiana in 1996. These employed commercially available unit processes - physical separation/acid leaching systems. The system employed acetic acid as the leaching agent, and the other, hydrochloric acid. Input soil had a lead content of approximately 3500 mg/kg. The hydrochloric acid system was most effective. Processed soil had total lead concentration of 200 mg/kg and TCLP levels for lead of approximately 2 mg/L. The through put rate was approximately 6 tons per hour. Choice of acid leaching agent is a function of specific soil chemistry and degree of solubility required.

Back to Top

Cost:

The average cost for use of this technology, including excavation, is approximately $170 per ton, depending on site specific conditions and the target waste quantity and concentration.

Back to Top

References:

Battelle, 1997. ***Physical Separation and Acid Leaching: A Demonstration of Small-Arms Range Remediation at Fort Polk, Louisiana.*** Final report prepared for Naval Facilities Engineering Service Center (NFESC) and U.S. Army Environmental Center under contract with NFESC, Port Hueneme, CA.

Battelle, 1997. ***Physical Separation and Acid Leaching: A Demonstration of Small-Arms Range Remediation at Fort Polk, Louisiana.*** Implementation Guidance Handbook. Prepared for Naval Facilities Engineering Service Center (NFESC) and U.S. Army Environmental Center under contract with NFESC, Port Hueneme, CA.

BDM, 1997. ***Demonstration of Physical Separation/Leaching Methods for the Remediation of Heavy Metals-Contaminated Soils at Small-Arms Range Final Report.*** Prepared for U.S. Army Environmental Center (USAEC) and Naval Facilities Engineering Service Center under contract with USAEC, Aberdeen Proving Ground, MD.

BDM, 1997. ***Demonstration of Physical Separation/Leaching Methods for the Remediation of Heavy Metals-Contaminated Soils at Small-Arms Range Worldwide Search Report.*** Prepared for U.S. Army Environmental Center (USAEC) and Naval Facilities Engineering Service Center under contract with USAEC, Aberdeen Proving Ground, MD.

California Base Closure Environmental Committee (CBCEC), 1994. ***Treatment Technologies Applications Matrix for Base Closure Activities, Revision 1***, Technology Matching Process Action Team, November, 1994.

EPA, 1989. ***Innovative Technology: Soil Washing***, OSWER Directive 9200.5-250FS.

EPA, 1989. ***Soils Washing Technologies for: Comprehensive Environmental Response, Compensation, and Liability Act, Resource Conservation and Recovery Act, Leaking Underground Storage Tanks, Site Remediation***.

EPA, 1990. ***Soil Washing Treatment***, Engineering Bulletin, EPA, OERR, Washington, DC, EPA/540/2-90/017. Available from NTIS, Springfield, VA., Order No. PB91-228056.

EPA, 1991. ***Biotrol Soil Washing System***, EPA RREL, series includes Technology Evaluation Vol. I, EPA/540/5-91/003a, PB92-115310; Technology Evaluation Vol. II, Part A, EPA/540/5-91/003b, PB92-115328; Technology Evaluation Vol. II, Part B, EPA/540/5-91/003c, PB92-115336; Applications Analysis, EPA/540/A5-91/003; Technology Demonstration Summary, EPA/540/S5-91/003; and Demonstration Bulletin, EPA/540/M5-91/003.

EPA, 1992. ***A Citizen's Guide to Soil Washing***, EPA, OSWER, Washington, DC, EPA/542/F-92/003.

EPA, 1992. ***Bergmann USA Soil/Sediment Washing System***, EPA RREL, Demonstration Bulletin, EPA/540/MR-92/075.

EPA, 1993. ***Bescorp Soil Washing System Battery Enterprises Site Brice Environmental Services, Inc.***, EPA RREL, Demonstration Bulletin, EPA/540/MR-93/503.

EPA, 1993. ***Biogenesis Soil Washing Technology***, EPA RREL, series includes Demonstration Bulletin, EPA/540/MR-93/510; Innovative Technology Evaluation Report, EPA/540/R-93/510; and Site Technology Capsule, EPA/540/SR-93/510.

EPA, 1997. ***Best Management Practices (BMPs) for Soil Treatment Technologies: Suggested Operational Guidelines to Prevent Cross-media Transfer of Contaminants During Clean-UP Activities***, EPA OSWER, EPA/530/R-97/007.

Federal Remediation Technologies Roundtable, 1995. ***Remediation Case Studies: Thermal Desorption, Soil Washing, and In Situ Vitrification***, EPA/542/R-95/005.

- Soil Washing at the King of Prussia Technical Corporation Superfund Site, Winslow Township, New Jersey

Raghavan, R., D.H. Dietz, and E. Coles, 1988. ***Cleaning Excavated Soil Using Extraction Agents: A State-of-the-Art Review***, EPA Report EPA 600/2-89/034.

Back to Top

Site Information:

- Ft. Polk, LA
- Twin Cities AAP, New Brighton, MN
- **EPA Demo**: Santa Maria, CA
- Army Saginaw Bay Confined Disposal Facility, MI
- **DOE Demo**: Clemson Technical Center, SC
- **EPA & DOE Demo:** Montclair, West Orange & Glen Ridge Sites, NJ
- **EPA Demo**: Toronto Port Industrial District, Canada
- **Army Demo**: Sacramento Army Depot, CA
- **DOE Demo**: Fernald Site, OH
- **EPA Demo**: Alaska Battery Enterprises Superfund Site, AK
- **EPA Demo**: MacGillis & Gibbs Superfund Site, MN
- **EPA Demo**: Pensacola, FL
- Toronto Port Industrial Dist., Ontario, Canada
- Escambia Wood Treating Company Superfund Site, Pensacola, FL
- NEL Demo: NAS North Island Installation Restoration (IR) Site 4
- King of Prussia Technical Corporation Superfund Site, Winslow Township, NJ
- Additional site information on the FRTR web site

Back to Top

Points of Contact:

General FRTR Agency Contacts

Technology Specific Web Sites:

Government Web Sites

Non-Government Web Sites

Back to Top

Vendor Information:

A list of vendors offering Ex Situ Physical/Chemical Soil Treatment is available from the Vendor Information System for Innovative Treatment Technologies (VISITT) developed by U.S. Environmental Protection Agency (EPA).

Back to Top

Health and Safety:

Back to Top

Previous Section | Top Page | Screen Matrix | Table of Contents | Synonym List | Next Section