United States
Environmental Protection
Agency

Office of Solid Waste and
Emergency Response
Washington DC 20460

July 1992
EPA/542/B-92/004

Technology Innovation Office

EPA

Literature Survey of Innovative Technologies for Hazardous Waste Site Remediation

1987-1991

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For sale by the U.S. Government Printing Office
Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328
ISBN 0-16-036253-9

ACKNOWLEDGEMENTS

This document was prepared under the direction of John Kingscott, work assignment manager for the U.S. Environmental Protection Agency's Technology Innovation Office. Special acknowledgement goes to the EPA Headquarters Library for their expert advice and assistance.

FOREWORD

A major impediment to the broader use of innovative treatment technologies for hazardous waste site remediation is the absence of cost and performance data. Analysts who are considering the potential use of these new technologies find it challenging to remain aware of the most recent technical developments. This project was conceived as an effort to improve awareness of technical literature and increase the efficiency of the evaluation process for innovative technologies.

The project represents a unique attempt to draw from extensive bibliographic resources available through commercial databases. A keyword search strategy was developed to screen references and the abstracts were subsequently reviewed for relevancy. An emphasis was placed on engineering applications as opposed to pure research. The resulting bibliography represents a survey which can be easily updated over time. The references for each technology are certainly not comprehensive, however, they should be representative and useful to those who must remain aware of current developments.

Walter W. Kovalick, Jr.

Walter W. Kovalick, Jr., Ph.D
Director, Technology Innovation Office

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Introduction

Background

EPA's Office of Solid Waste and Emergency Response is seeking to further the use of innovative hazardous waste treatment technologies in its programs. In order to achieve more permanent remedies, the Agency is encouraging the use of new or innovative technologies that are capable of treating contaminated soils/sludges and ground water more effectively, less expensively, and in a manner more acceptable to the public than existing conventional methods.

As a result of the immense size of our future hazardous waste remediation effort, there is a great deal of public and private interest in new technology development. Along with this interest has come a corresponding large increase in the technical literature. For the analyst who is considering new technologies as potential remedies, access to this literature is critical. Innovative technologies can be defined as those that lack sufficient performance and cost data to allow routine use for site remediation. This absence of information constitutes a principal impediment to their consideration and eventual use. Therefore, the technical analyst is faced with a major challenge of remaining aware of current developments in this rapidly evolving field.

This bibliography results from an effort to improve awareness of the technical literature concerning innovative technologies. For the purpose of this effort, these technologies are defined as alternatives to the conventional remedies of incineration and solidification/ stabilization for soils and pump and treat for ground water. This definition is based on the assumption that adequate cost and performance data are available to select these conventional remedies. This definition is not meant to imply that no new and important developments are taking place for these conventional technologies.

The bibliography was developed using the extensive resources of available commercial databases and software. The commercial databases are continually updated with references from a broad array of scientific and engineering disciplines. Potentially relevant information can be readily identified through keyword searches. This project entailed the development of a keyword search strategy which attempts to identify the maximum number of relevant citations while minimizing extraneous references.

The Technology Innovation Office conducted this project in conjunction with the EPA Headquarters Library Hazardous Waste Collection Staff who helped develop the search strategy. The information in this survey has been distributed on diskettes to the EPA Headquarters and Regional libraries and they may be able to help you with computerized searches.

Purpose

The bibliography is intended to increase the efficiency of the technology evaluation process. The document is not meant to be comprehensive in scope nor is it meant to convey an endorsement of the citations. It is meant to provide a survey of publications which could be useful when innovative technologies are investigated. As a research aid, the bibliography can help provide insights into current developments and provide references which may serve as a basis for further investigations.

An advantage of the procedure used to develop this document is that it allows for easy updating. If this document is well received, annual updates will be compiled for successive five year periods. The information can be downloaded and used with available software in a keyword search format. The search strategy is currently being improved and will be available in the future for those who want to create their own reference file for keyword searches.

Methodology

The bibliography was compiled using databases available on the DIALOG information system. Specifically, CA Search (from the American Chemical Society), Compendex Plus, NTIS, Energy Science and Technology Database, Chemical Engineering and Biotechnology Abstracts, and Pollution Abstracts were used. The search was limited to the years 1987-1991 in order to focus on the most current literature. The targeted treatment technologies included solvent extraction, chemical dechlorination, soil washing, vacuum extraction, soil flushing, thermal desorption, in situ vitrification, and biological technologies for soils and any in situ processes for ground water. The search strategy was developed by observing keywords associated with references that were deemed to be of interest, identifying terminology for describing the technologies, and identifying additional keywords necessary to eliminate irrelevant references. For example, queries with keywords such as soil washing, soil venting, and bioremediation resulted in a large percentage of relevant citations. However, technology descriptions such as solvent extraction, dechlorination, thermal desorption, and biodegradation are used in fields outside of hazardous waste site remediation and required additional limiting keywords to narrow the scope of the search.

Although the search was primarily focused on remediation of sites with contamination from hazardous waste, references for petroleum contaminated sites were also retained. However, a search strategy specifically directed to this problem area would expand the number of citations.

The resulting strategy was used to produce a list of references and abstracts that were manually reviewed. References addressing the following subjects were eliminated:

- Waste streams or BDAT
- Fate and transport unless explicitly related to treatment
- Oil spill cleanup (however, treatment of UST sites was included)
- General survey reports unless they are focused on remediation
- Above-ground water treatment

Database Sources

The searches were conducted on the DIALOG Information Retrieval Service, provided by Dialog Information Services, Inc. DIALOG contains over 380 databases covering a broad scope of disciplines. The databases on the DIALOG system contain in excess of 260 million records. Records, or units of information, can range from a directory-type listing of companies, associations, or famous people; to an in-depth financial statement for a particular company; to a citation with bibliographic information and an abstract referencing a journal, patent, conference paper, or other original source; to the complete text of a journal article. The databases used in the search are described below:

CA Search

The CA SEARCH database includes citations to the literature of chemistry and its applications. CA SEARCH contains the basic bibliographic information appearing in the printed version of *Chemical Abstracts*. CA Search records contain CA General Subject headings from a controlled vocabulary and CAS Registry Numbers (unique numbers assigned to each specific chemical compound).

Chemical Engineering and Biotechnology Abstracts

Chemical Engineering and Biotechnology Abstracts provides information on industrial practice and theoretical chemical engineering. The abstracts in the database cover the processing of chemicals including chemical reactions, mixing or separation, heating or cooling, and transport. The database is produced by the Royal Society of Chemistry in the United Kingdom.

Compendex Plus

The COMPENDEX PLUS database is the online version of the *Engineering Index*, which supplies abstracted information from the world's significant literature of engineering and technology. The COMPENDEX PLUS database provides world-wide coverage of approximately 4,500 journals and selected government reports and books. Subjects covered include: civil, energy, environmental, geological, and biological engineering; electrical, electronics, and control engineering; and computers, robotics, and industrial robots.

Energy Science and Technology Database

The Energy Science and Technology Database (formerly DOE Energy) is one of the world's largest sources of literature references on all aspects of energy and related topics. Energy topics covered include nuclear, wind, fossil, geothermal, tidal, and solar energy. Related topics such as environment, energy policy, and conservation are also included. The database is produced by the Department of Energy.

NTIS

The NTIS Database consists of abstracts of government-sponsored research, development, and engineering, plus analyses prepared by federal agencies, their contractors, or grantees. It is the means through which unclassified, publicly available, unlimited distribution reports are made available for sale from agencies such as EPA, NASA, DDC, DOE, HUD, DOT, Department of Commerce, and some 240 other agencies. In addition, some state and local government agencies now contribute their reports to the database. NTIS covers a wide spectrum of subjects, including administration and management, agriculture and food, behavior and society, building, business and economics, chemistry, civil engineering, energy, health planning, library and information sciences, materials science, medicine and biology, military science, and transportation.

Pollution Abstracts

POLLUTION ABSTRACTS is a leading resource for references to environment-related literature on pollution, its sources, and its control. Among those subjects covered by POLLUTION ABSTRACTS database are: air pollution, environmental quality, noise pollution, pesticides, radiation, solid wastes, water pollution, and more.

Citation Format

The citations in this bibliography generally contain the following information:

Title
Author
Source (journal or conference where paper was presented)
Date
Database from which the citation came
Notes about the document
Accession/ordering numbers

Although this document does not contain abstracts of the cited documents, abstracts for many of the documents do exist. The EPA Headquarters and Regional Libraries may be able to help you locate abstracts or full text of the documents listed. Many company, university, and public libraries also have access to Dialog as well as other information services that can provide an abstract and can also be used to further enhance a search for information about innovative technologies.

Ordering Information

The documents in this survey should be readily available through interlibrary loan or

through commercial document delivery services. Many company, university, government, and public libraries will borrow items from other libraries through interlibrary loan for a user. If the item is a journal article, the lending library will supply a copy of the article; for other documents, the item will be borrowed for a limited time.

There are also commercial document delivery services from whom one can purchase copies of documents or, in some cases, originals. These services will normally take orders by telephone if one supplies a credit card number. To locate such a document delivery service, look under "Information Bureau" or "Information Broker" in the yellow pages of your local telephone directory. There is also a directory entitled, *Burwell Directory of Information Brokers* that contains a section on document delivery services. Local libraries may have a copy of the directory or may otherwise be able to help locate a document supplier.

Many of the documents in this bibliography can also be ordered from the producer of the individual database. Documents from NTIS, CA Search (from the American Chemical Society), and Compendex Plus (from Engineering Information, Inc.) can be ordered through DIALOG's Dialorder service. When using Dialorder, a DIALOG account holder can order documents using the DIALOG record accession number—the first number on the last line of the bibliography citation (or the only number on the last line of citations from CA Search). In addition, NTIS and Compendex Plus/Engineering Information have their own ordering accession number—the second number on the last line of the bibliography citation (usually beginning with PB for NTIS and EI or EIN for Compendex Plus).

For more information about ordering from the database producers, contact:

NTIS (703-487-4650)
Engineering Information, Inc. (212-705-7301)
American Chemical Society (800-848-6538 x 2956)

Surveys

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ISBN 0-16-036253-9