United States Environmental Protection Agency

Office of Research and Development

EPA/625/N-96/001
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EPA Technology Transfer HIGHLIGHTS

The following technology transfer products were developed by the Center for Environmental Research Information (CERI) over the past year. These products are available and can be obtained from CERI using the form on page 11.

Manuals

Process Design Manual for Land Application of Sewage Sludge and Domestic Septage

(EPA/625/R-95/001)

Almost 33 percent of the 5.4 million dry metric tons of sewage sludge generated annually in the U.S. is land applied. Of the sewage sludge that is land applied, approximately 67 percent is land applied on agricultural lands, 3 percent on forest lands, 9 percent on reclamation sites, 9 percent on public contact sites, and 12 percent is sold or given away. In addition, almost 8.6 billion gallons of domestic septage are generated annually. In 1993, the U.S. Environmental Protection Agency promulgated 40 CFR Part 503 to regulate the use and disposal of sewage sludge. The information in this manual is intended for use by municipal wastewater treatment and sludge management authorities; project planners and designers; regional, state, and local governments concerned with permitting and enforcing federal sludge management regulations; and consultants in relevant disciplines such as engineering, soil science, and agronomy. The manual is intended to provide general guidance and basic information on the planning, design, and operation of sewage sludge land application projects for one or more of the following design practices:

- Agricultural land application (crop production, improvement of pasture and rangeland)
- Forest land application (increased tree growth)
- Land application at reclamation sites (mine spoils, construction sites, gravel pits)
- Land application at public use sites (such as parks, golf courses, lawns, and home gardens).

The manual gives state-of-the art design information for the land application of sewage sludge.

Technical Capsule Reports

Process Capsule Reports For Treatment Of Metal Finishing Industry Wastewaters

Two Process Capsule Reports have been prepared that address evaporation and reverse osmosis. These reports include a process description, applications analysis, O&M considerations and a failure analysis. These failure analyses focus on process failures which result in releases of liquids and vapors to the environment. Such cross-media contamination has received a great deal of attention in the management of control technologies. The process descriptions for each featured technology include their respective principles of operation, specific applications, equipment employed, and a failure analysis categorizing failures with respect to their probability of occurrence (high, moderate, and low) and cause. In addition, each capsule report provides a select reference section for further reading. These reports will enable metal finishing operations to evaluate options for employing physical/chemical separation control technologies in treating process wastewaters.

Evaporation Process Capsule Report (EPA/625/R-96/008)

Evaporation has been an established technology in the metal finishing industry for many years. In this process, wastewaters containing reusable materials, such as copper, nickel, or chromium compounds, are heated, producing a water vapor that is continuously removed and condensed. Failure analysis has shown that to a high degree of probability, seals, valves, and fittings can fail as a result of overheating, mechanical stress, and changes in ambient temperature. Evaporator failure can be caused by foaming and entrainment. When considering a moderate degree of probability of failure, relief valves can fail as a result of overpressure during startups, upsets and shutdowns, as well as, plugging of piping and membrane modules due to solids build-up. Lower probability of failure can be attributed to freezing and miscellaneous mechanical failures.

Reverse Osmosis Process Capsule Report (EPA/625/R-96/009)

Reverse osmosis is a membrane separation process designed to treat wastewater containing a variety of contaminants including organic compounds. Recent advances in the application of this control technology feature higher feed flow velocities, greater toler-

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ance for dissolved solids and turbidity, and higher recovery rates of treated water. Recovered water (permeate) can be recycled or treated downstream depending on plant needs. Failure analysis has shown to a high degree of probability that during startup, shutdown, and upsets, overpressure resulting from plugging can release wastewater as spray or leakage from the process. Plate-and-frame and tubular modules are not as susceptible to plugging as hollow-fiber and spiral-wound modules. To a moderate degree of probability, impairment can result from membrane fouling and scaling. Indication of this type of failure is a reduction in pressure drop across the membrane.

Seminar Publications

Managing Environmental Problems at Inactive and Abandoned Metals Mine Sites (EPA/625/R-95/007)

Mining waste generated from active and inactive mining sites and from beneficiation activities is of continuing concern to government officials, private industry, and the general public because of its effect on human health and the environment. The nation's reported volume of mining waste is immense according to a scoping study by the Western Governors' Association Mine Waste Task Force in 1992. Because of over 300,000 acres being affected with over 100,000 sites in nine western states, EPA initiated a series of three seminars in 1994 to present available information concerning control technologies that may be applicable in controlling these potential problems. This seminar series was cosponsored by the Department of Energy (DOE) and held in three western states. This document contains information presented at those seminars.

The seminar presenters, representatives from EPA, their contractors, DOE, their contractors, and several state representatives discussed the state of knowledge at that time. Basic fundamentals of acid mine drainage, known and probable effects on the public health and environment, and control technologies known and under investigation were presented. Some of the techniques included bioremediation, composting, and innovative approaches being investigated by EPA and others.

National Conference on Sanitary Sewer Overflows (EPA/625/R-96/007)

The National Conference on Sanitary Sewer Overflows was held in Washington, DC, on April 24–26, 1995. The conference was a forum for nearly 500 environmental professionals to exchange technical information and experiences relating to the complex issues of sanitary sewer overflows (SSOs).

Thousands of municipalities across the nation are serviced by separate sanitary sewer systems. A chronic problem that faces many of these systems is the occurrence of SSOs. Caused mainly by the infiltration and inflow of wet weather flows and blockages and flow restrictions in the sewer system, these SSOs pose a risk to public health and the quality of our nation's waters. This conference was held to bring together individuals from across the country to discuss the technical and institutional issues related to SSOs. As such, the conference examined a variety of topics relating to the regulation, analysis, evaluation, management and control of SSOs. The presentations at the conference and the selected papers in this document address the following:

- Background and problem definition
- Modeling and assessment
- Institutional issues
- Dealing with private service laterals
- Data collection and analysis
- Case studies
- Storage solutions
- Watershed and regional approaches

This document presents selected, peer-reviewed papers from the conference. The purpose of this document is to share the information presented at the conference with individuals who were unable to attend.

This document will be useful to individuals who are currently facing the complex issues related to the management and control of SSOs. These individuals include environmental regulatory personnel at the federal and state level; decision-makers and technical personnel from regional and municipal wastewater management authorities; private sector personnel, including environmental consultants and equipment manufacturers; university professors, researchers and students; and other interested persons. The goal of sharing this information with a broader audience is to help environmental professionals and others to better understand the complex institutional and technical issues relating to SSOs and to assist environmental decision-makers in making cost-effective decisions.

Handbooks

Management of Water Treatment Plant Residuals (EPA/625/R-95/008)

This handbook is the result of a cooperative effort among the American Society of Civil Engineers, the American Water Works Association, and EPA. It was developed over a four-year period with the assistance of many individuals working in the water supply and residuals management fields. It contains chapters on regulatory issues, characterization, processing, direct discharge to surface waters, discharge to wastewater treatment plants, landfilling, land application, brine waste disposal, radioactive waste disposal, economics, case studies, and waste minimization and reuse.

The handbook provides the consensus opinion/judgment of the cooperating organizations as to what constitutes best practice. It first gives meaningful guidance to federal, state, and local regulatory personnel in reviewing drinking water treatment plant plans for residuals management, and it secondly helps the utility to select an environmentally sound way for managing its residuals. The handbook strives to provide enough information for the user to do a feasibility design of the selected process(es). Design examples, case studies, results of recent research in the field, and pollution prevention methods and technologies are included to the extent that information was available.

Copies of this handbook are available only from either the American Society of Civil Engineers, 345 East 47th Street, New York, NY 10017 (Refer to ASCE Manuals and Reports on Engineering Practice No. 88) or from the American Water Works Association, 6666 W. Quincy Avenue, Denver, CO 80235.

Guides to Pollution Prevention

Pollution Prevention in the Paints and Coatings Industry (EPA/625/R-96/003)

The paints and coatings industry represents a significant source of multimedia pollution through the use of solvent-based process materials and the extensive amounts of wastewater generated by the operations. This manual presents practices for minimizing the generation of pollution in this industry.

Regulations at the federal, state, and local level emphasizing source reduction of pollutants are driving facility operators to investigate the use of alternative cleaning formulations and paint systems. Aqueous degreasers and powder coatings are examples of efforts to

reduce air emissions and control costs associated with the treatment of contaminated wastewater.

Many small and mid-sized facilities cannot take full advantage of technology transfer within the industry. The information in this manual can help operators assess operations and processes for pollution prevention options in using cleaner technologies and more efficient management practices. The technical information contained in this manual can guide improvements in quality and efficiency, influencing prevention by reducing wastes.

The manual has three general sections:

- An overview of the industry and an introduction to pollution prevention for paint and coating operations;
- Pollution prevention considerations; and
- Case studies of approaches for reducing process waste.

Appendices provide a list of suppliers of aqueous and semi-aqueous degreasers and process equipment, methodology for specified dilution ratio calculations, and a spreadsheet for factoring transfer efficiency considerations into application processes.

The audiences for this document are facility operators and managers, manufacturing process managers, painters, and environmental engineers.

Best Management Practices for Pollution Prevention in the Slabstock and Molded Flexible Polyurethane Foam Industry (EPA/625/R-96/005)

The 1990 Clean Air Act Amendments require EPA to develop standards for major emission sources of 189 hazardous air pollutants (HAPs). EPA has identified the flexible polyurethane foam industry as a significant emitter of HAPs and has slated the industry for regulation under Title III of the Act, with standards scheduled to be promulgated no later than November 15, 1997.

This manual presents pollution prevention options for the two major sectors of the flexible polyurethane foam industry: slabstock and molded foam production. Designed for use by both polyurethane foam manufacturers and regulatory personnel, it achieves the following:

- Provides an overview of the flexible foam industry and chemistry of foam production, common to both slabstock and molded industry segments;
- Details manufacturing processes and potential pollution prevention measures for slabstock and molded foam production;
- Details pollution prevention opportunities for operations that are common to both;
- Provides worksheets for pollution prevention measures and emission and cost calculations; and
- Lists additional resources.

This manual will be useful for those interested or involved in the industry including facility managers, regulators and environmental managers and engineers.

Best Management Practices for the Textiles Industry (EPA/625/R-96/004)

The textiles industry is one the nation's oldest, dating to the beginning of the American industrial revolution in the 1790s. Despite perceptions of the decline of U.S. textile manufacturing in the face of international competition, the industry remains one of the largest, most diverse, and dynamic segments of the U.S. manufacturing sector.

This guide represents a comprehensive history of the U.S. textiles industry, describes wastestreams from diverse industrial processes and products, and provides reliable pollution prevention options for this industry. The audience for this manual can range from small and medium-sized companies in textile-related manufacturing to those involved in regulation, permitting, and assisting in environmental management and pollution prevention planning.

This document is divided into eight sections, briefly described below. It has a comprehensive index to assist in selected topic searching.

- An overview of the textiles industry in the U.S. describes production processes and the technological base of the industry, with discussion of the major waste and pollution issues that exist.
- Wastes generated in the textiles industry are catagorized.
- General pollution prevention approaches are described that are applicable throughout the textiles industry.
- Pollution prevention opportunities are identified for specific textile processes or operations, covering raw material handling and usage, yarn formation, slashing and sizing, fabric formation, textile preparation, dyeing, printing, finishing, and cutting and sewing operations.
- A composite list of the key pollution prevention features offer a comprehensive and effective plan for development and implementation of a successful program.
- Business considerations of pollution prevention are discussed including incentives and barriers to implementation of pollution prevention measures.
- A selection of case studies display successful implementation of pollution prevention in textile processing.
- A comprehensive listing of references is furnished.

Summary Reports

Pump and Treat Ground-Water Remediation: A Guide for Decision Makers and Practitioners (EPA/625/R-95/005)

Pump and treat is one of the most widely used ground-water remediation technologies. The pump and treat remediation approach is used at about three-quarters of the Superfund sites where ground water is contaminated and at most sites where cleanup is required by the Resource Conservation and Recovery Act and state laws. Although the effectiveness of pump and treat systems has been called into question after two decades of use, this approach remains a necessary component of most ground-water remediation efforts and is appropriate for both restoration and plume containment.

This guide presents the basic concepts of pump and treat technology and provides decision makers with a foundation for evaluating the appropriateness of conventional or innovative approaches. Conventional pump and treat methods involve pumping contaminated water to the surface for treatment. However, the term pump and treat is used here in a broad sense to include any system where ground-water withdrawal from or injection into ground water is part of a remediation strategy. Variations and enhancements of conventional pump and treat include several physical, chemical, and biological enhancements.

This guide provides an introduction to pump and treat groundwater remediation by addressing the following questions:

- When is pump and treat an appropriate remediation approach?
- What is involved in "smart" application of the pump and treat approach?
- What are tailing and rebound and how can they be anticipated?
- What are the recommended methods for meeting the challenges of effective hydraulic containment?
- How can the design and operation of a pump and treat system be optimized and its performance measured?
- When should variations and alternatives to conventional pump and treat methods be used?

An in-depth understanding of hydrogeology and ground-water engineering is required to design and operate a pump and treat system. Readers seeking more information on specific topics covered in this document should refer to the U.S. Environmental Protection Agency documents listed at the end of this guide.

Control of NO_x Emissions by Reburning (EPA/625/R-96-001)

Nitrogen oxide (NO_x) emission control technologies that are capable of achieving NO_x emission reductions from a coal-fired boiler can be classified as either combustion modifications or post-combustion flue gas treatment. Combustion modification techniques prevent the formation of NO_x during combustion or destroy the NO_x formed during primary combustion. These techniques include the use of low-NO_x burners, overfire air, and boiler combustion optimization. Post-combustion flue gas treatment reduces the NO_x content of the flue gas through techniques such as selective catalytic reduction and selective non-catalytic reduction.

Reburning, as described in this report, is a combustion modification since the formation of NO_x is minimized in one portion of the boiler and a portion of the NO_x that does form is destroyed in another.

Unlike some other NO_x control approaches, reburning technology is applicable to a wide variety of the boilers and, in many cases, can be implemented within a relatively short period of time. Reburning is ideal for wet-bottom (i.e., slagging) boilers. The only other commercially available NO_x control alternative for this type of boiler is flue gas treatment, which is more costly per ton of NO_x reduction achieved. Because of reburning's applicability to a wide variety of coal-fired combustion sources, several demonstration projects have been undertaken to gather data on reburning. As a result of such projects, reburning technology is now offered commercially by several firms.

Reburning reduces NO_x emissions by completing combustion in three stages. In the first stage, NO_x formation due to interactions between the fuel and combustion air at high temperatures is controlled by reducing the burner heat release rate and the amount of oxygen present. In the second stage, additional fuel is added under reducing (oxygen-deficient) conditions to produce hydrocarbon radicals that react with the NO_x formed in the first stage to produce nitrogen gas. Additional combustion air is added in the lower-temperature third stage and combustion is completed. In retrofit applications such as discussed in Section 3, reburning has achieved up to 60% reduction from baseline NO_x emissions.

Software

Drinking Water Treatment Plant Advisor (EPA/625/R-96/002)

The Drinking Water Treatment Plant (DWTP) Advisor and User Documentation are designed to assist personnel who are responsible for improving the performance of existing water treatment plants in order to achieve compliance with the Surface Water Treatment Rule. The 'expert' information contained in the program's knowledge base was obtained from knowledge engineering sessions with domain experts and from *Interim Handbook: Optimizing Water Treatment Plant Performance Using the Composite Correction Program Approach,* EPA/625/6-91/027. The handbook described methods to evaluate an existing facility's potential to achieve required performance, and a process for systematically improving performance.

Although the DWTP Advisor is capable of producing assessments based on the Comprehensive Performance Evaluation methodology, the most effective results will always be produced by experienced users who are knowledgeable in the techniques and philosophy behind the methodology.

The DWTP Advisor is a software application which has been designed to provide assistance in the evaluation of drinking water treatment plants. Specifically, this program, which is based on the Comprehensive Correction Program (CCP) Approach, involves the following activities: evaluation of major unit processes, assessment of plant performance, identification and prioritization of performance limiting factors, assessment of applicability of follow-up CCP, and reporting of results.

The DWTP Advisor requires an IBM AT or compatible computer with the following components: a hard disk with at least 5.0 megabytes of free space; at least 550 kilobytes of available conventional memory; a 3.5 inch high density floppy disk drive (1.4 MB); DOS version 3.0 or higher; and a printer.

Middle Eastern and North African Small Community Wastewater Project

Ensuring an effective peace in the Middle East includes cooperative efforts between countries to preserve and enhance the water resources and the environment of the region. While water scarcity is particularly acute in the Middle East and North Africa, many other countries across the globe are also facing the dilemma of how to maximize available water resources.

The amount of water available is finite, yet the number of people in need of using the resource continues to grow. The pressures of modern agriculture, industry, and urban lifestyles—multiplied by growing populations (populations in the region alone are doubling every two or three decades) and rising standards of living—are causing water tables and river levels to fall and contamination to spread. In many cases, water supplies are becoming unusable.

During 1992 discussions of the Multilateral Middle East Peace Process, Environmental and Water Resources Working Groups identified the lack of small community sanitation and reuse as a major common problem throughout the region. To that end, a workshop was arranged in the U.S. during the summer of 1993 by the Department of State (DOS), the U.S. Agency for International Development (USAID) and the U.S. Environmental Protection Agency (EPA). The attendees were provided information and software to assist their planning for future wastewater systems in the numerous small communities under their jurisdiction.

Subsequently, the U.S. sponsored a meeting in Cairo, on June 12–15, 1994, to explore the next steps in providing technical assistance for small community wastewater facilities planning in the Middle East. This meeting was sponsored jointly by the Multilateral Working Groups on Environment and Water Resources. The meeting brought together thirty-five participants including Egyptian, Israeli, Jordanian, Moroccan, Omani, Palestinian, and Tunisian wastewater experts as well as participants representing the U.S., Russia (as cosponsor of the Peace Process), the United Nations Development Program (UNDP), and the World Bank.

The June 1994 meeting in Cairo was organized to encourage regional participants to initiate a planning phase for wastewater projects for small communities that they were to identify. By moving forward in this way, it is envisioned that demonstration projects will be built and that regional parties will begin exchanging information on performance with these systems in the region.

In parallel with the Peace Process efforts, a project was proposed and funded under the international program of the President's Environmental Technology Initiative to support the same issues, i.e., low-cost small community technologies for wastewater collection, treatment and reuse in North Africa and the Middle East. This project consists of a two-pronged approach to convincing the government decision makers and technical experts of these regions that low-cost, low-maintenance technologies are available which are appropriate for application to solve their problems. The primary effort was devoted to organizing and implementing, by EPA and the U.S. Department of Agriculture (USDA), a seminar and exhibition of equipment in Tunisia. The best U.S. professionals in these fields were employed in concert with U.S. manufacturer-exhibits to present the strongest possible evidence of the desirability of these appropriate technologies for solving small community problems. The second effort involved the identification of projects in the region where these technologies were already being investigated at full-scale. Agreements were negotiated with regional scientists and engineers to evaluate those technologies and to deliver their assessments of them to regional forums, thus verifying the original presentation by U.S. experts. Three such evaluations were funded in Morocco, Egypt, and Israel, evaluating slow sand filtration and constructed wetlands, small-diameter gravity sewers, and lagoon-reservoir-reuse systems, respectively. These projects are nearing the completion of evaluation, and each will be presented at regional meetings beginning in November 1996. The Peace Process project involved the first regional team of experts traveling to potential sites in several countries, and resulted in choosing the Village of Taffough in the Hebron district of the West Bank for construction. The village site is amenable to wastewater collection by small-diameter gravity sewers, intermittent sand filter treatment and reuse on locally grown crops without any mechanical/electrical equipment requirement. The donor organizations (World Bank, USAID, UNDP, etc.) which operate in the area are observing the progress of the project since its apparent features so well fit the needs of the small settlements in the area. A preliminary plan has been created, and detailed design is scheduled for this winter. Construction funding is nearly secured from Saudi Arabian sources for initiation in 1997.

The technical leadership for these projects has been provided since 1993 by the staff of the Center for Environmental Research Information (CERI) at the request of the EPA Office of Water. USDA is EPA's partner in all of these efforts, providing supplemental technical expertise and managing the administrative aspects of these projects. The work has drawn directly on the small-community technologies efforts of CERI over the past two decades and has provided an excellent verification forum for those efforts which were originally conceived to provide low-cost, appropriate technologies to solve rural problems in the U.S.

For additional information on the technologies employed, the following publications may be ordered from CERI with the form on page 11:

EPA/625/1-91/024 - *Alternative Wastewater Collection Systems Manual*
EPA/625/R-92/004 - *Guidelines for Water Reuse*
EPA/625/R-92/005 - *Wastewater Treatment/Disposal for Small Communities*

Any questions on the North African and Middle Eastern projects described above should be directed to Mr. James Kreissl of CERI at (513)569-7611 or via e-mail at kreissl.james@epamail.epa.gov.

The Annual Meeting of the Air and Waste Management Association

In June 1996 the Air and Waste Management Association held its annual technical meeting and exhibition in Nashville, TN. EPA participated by exhibiting literature and graphics on new technologies available for use to comply with its regulations; electronic bulletin boards containing data bases from which to obtain the most recent data and recently proposed and promulgated regulations; examples of application of commercial technologies under differing conditions and situations; general information on how to access EPA information; and publications on technology and regulations. EPA is planning its involvement at the next annual meeting and exhibition in Toronto, Ontario, Canada in 1997. Hope to see you there!

Conference on Contaminated Sediments

The area of contaminated sediments is one of growing environmental concern. Many areas of the U.S. have contaminated sediments that require treatment and management including rivers, harbors, Superfund sites and the Great Lakes. In addition, sediments removed from dredging operations from navigable waterways, under the direction of the Army Corps of Engineers, must be evaluated for environmental impacts.

EPA has authority under a number of statutes to manage contaminated sediments and has a number of programs to address these problems. For example, the 1987 amendments to the Clean Water Act authorized the Assessment and Remediation of Contaminated Sediments Program to develop guidance on techniques for the identification of sediment problems, assessment of their impact, and the selection and implementation of remedial options. EPA's Contaminated Sediment Management Strategy, published in 1994, describes actions that the Agency will take to accomplish strategic goals for contaminated sediments. EPA's Office of Research and Development (ORD) has completed several research projects at some of its laboratories under the contaminated sediments strategy involving assessment or remediation.

EPA will sponsor a conference on contaminated sediments in Cincinnati, Ohio (target date is early 1997) to disseminate information on assessment methods and remediation technologies. For more information about the conference contact Susan Brager, Eastern Research Group at (617) 674-7200.

Pollution Prevention Workshops in Peru

The proliferation of firms that handle hazardous substances or generate toxic wastes, especially in many areas of the developing world like South and Central America, is a problem requiring increased attention. To assist developing countries in initiating programs for hazardous waste management, CERI cooperated with the Pan American Health Organization's Center for Sanitary Engineering and Environmental Sciences (CEPIS) in Lima to assemble industry-specific pollution reduction and control materials and present workshops. Workshop locations, dates, and industrial areas covered are shown in the table below.

Lima	*August 14-16, 1996*	*Metal Mining, Tanneries, Textiles, Electroplating, Foundries, and Seafood Processing*
Chimbote	*August 19-20, 1996*	*Foundries, Electroplating, and Seafood Processing*
Trujillo	*August 20-21, 1996*	*Tanneries and Foundries*
Piura	*August 22-23, 1996*	*Electroplating and Seafood Processing*
Arequipa	*August 26-28, 1996*	*Tanneries, Foundries, Electroplating, and Textiles*

The goal of these workshops was to provide technical assistance to firms engaged in potentially polluting manufacturing activities and improve process efficiencies, thus reducing costs and enhancing the environment. The target audience was industrial personnel from small- and medium-sized industries. Issues covered during the workshops included the following:

- Environmental degradation from industrial waste
- The significance of small- and medium-sized industries in pollution prevention efforts
- The principles of pollution prevention and resulting cost savings
- The application of these principles to specific industries
- Centralized waste treatment
- Case studies

The workshops encouraged participation. The first day of each workshop they presented information on environmental legislation, the environment in Peru, technical and financial resources, human and occupational safety and health, and centralized waste treatment. The remainder of the workshops consisted of day-long parallel technical sessions for each industrial area. These sessions focused on the technical options for preventing, minimizing, and treating the resulting wastes generated and included case study exercises to apply the principles of pollution prevention to the industries.

About 700 individuals, mainly from industry, attended the workshops. Information developed for the workshops is being prepared for publication in English and Spanish by CERI and CEPIS.

For any questions on the Pollution Prevention Workshops, call Jim Smith at 569-7355; send him e-mail at smith@cincy.cin.epa.gov.

TECHNOLOGY TRANSFER PRODUCTS

MANUALS

Land Treatment of Municipal Wastewater (Oct. 1981) 625/1-81/013
Supplement for Land Treatment of Municipal Wastewater (Oct. 1984) 625/1-81/013a
Dewatering Municipal Wastewater Sludges (Sept. 1987) 625/1-87/014
Municipal Wastewater Disinfection (Oct. 1986) 625/1-86/021
Fine Pore Aeration Systems (Oct. 1989) 625/1-89/023
Alternative Collection Systems for Small Communities (Oct. 1991) 625/1-91/024
Guidelines for Water Reuse (Sept. 1992) 625/R-92/004
Wastewater Treatment/Disposal for Small Communities (Sept. 1992) 625/R-92/005
Control of CSO Discharges (Sept. 1993) 625/R-93/007
Nitrogen Control (Sept. 1993) 625/R-93/010
Alternative Methods for Delivery and Recover (Oct. 1994) 625/R-94/003
Recycling and Reuse of Materials Found on Superfund Sites (Oct. 1994) 625/R-94/004
Ground Water and Leachate Treatment Systems (Jan. 1995) 625/R-94/005
◆ Process Design Manual for Land Application of Sewage Sludge and Domestic Septage 625/R-95/001
Process Design Manual: Surface Disposal of Sewage Sludge and Domestic Septage 625/R-95/002

TECHNICAL CAPSULE REPORTS

Radon-Resistant Construction Techniques for New Residential Construction: Technical Guidance 625/2-91/032
◆ Treatment Of Metal Finishing Industry Wastewaters: Evaporation Process Capsule Report 625/R-96/008
◆ Treatment Of Metal Finishing Industry Wastewaters: Reverse Osmosis Process Capsule Report 625/R-96/009

SEMINAR PUBLICATIONS

Permitting Hazardous Waste Incinerators 625/4-87/017
Meeting Hazardous Waste Requirements for Metal Finishers 625/4-87/018
Transport and Fate of Contaminants in the Subsurface 625/4-89/019
Corrective Actions - Technologies and Applications 625/4-89/020
Solvent Waste Reduction Alternatives 625/4-89/021
Requirements for Hazardous Waste Landfill Design, Construction and Closure 625/4-89/022
Technologies for Upgrading Existing or Designing New Drinking Water Treatment Facilities 625/4-89/023
Risk Assessment, Management and Communication of Drinking Water Contamination 625/4-89/024
Design and Construction of RCRA/CERCLA Final Covers 625/4-91/025
Site Characterization for Subsurface Remediation 625/4-91/026
Nonpoint Source Watershed Workshop 625/4-91/027
Medical and Institutional Waste Incineration: Regulations, Management, Technology, Emissions, and Operation ... 625/4-91/030
Control of Biofilm Growth in Drinking Water Distribution Systems 625/R-92/001
Organic Air Emissions from Waste Management Facilities 625/R-92/003
The National Rural Clean Water Program Symposium 625/R-92/006
RCRA Corrective Action Stabilization Technologies 625/R-92/014
Control of Lead and Copper in Drinking Water 625/R-93/001
Wellhead Protection: A Guide for Small Communities 625/R-93/002
Operational Parameters for Hazardous Waste Combustion Devices 625/R-93/008
Design, Operation, and Closure of Municipal Solid Waste Landfills 625/R-94/008
National Conference on Urban Runoff Management 625/R-95/003
National Conference on Environmental Problem Solving with Geographic Information Systems 625/R-95/004
◆ Managing Environmental Problems at Inactive and Abandoned Metals Mine Sites 625/R-95/007
◆ National Conference on Sanitary Sewer Overflows 625/R-96/007

◆ Listed for first time.

TECHNOLOGY TRANSFER PRODUCTS (continued)

BROCHURES

Environmental Pollution Control Alternatives: Drinking Water Treatment for Small Communities 625/5-90/025
Regional Environmental Monitoring and Assessment Program (R-EMAP) 625/R-93/012

HANDBOOKS

Control Technologies for Hazardous Air Pollutants (July 1991) 625/6-91/014
Retrofitting POTWs for Phosphorus Removal in the Chesapeake Bay Drainage Area (Sept. 1987) 625/6-87/017
Guide to Technical Resources for the Design of Land Disposal Facilities (Dec. 1988) 625/6-88/018
Guidance on Setting Permit Conditions and Reporting Trial Burn Results (Jan. 1989) 625/6-89/019
Retrofitting POTWs (July 1989) 625/6-89/020
Hazardous Waste Incineration Measurement Guidance (June 1989) 625/6-89/021
Stabilization/Solidification of CERCLA and RCRA Wastes (July 1989) 625/6-89/022
Quality Assurance/Quality Control (QA/QC) Procedures for Hazardous Waste Incineration (Jan. 1990) 625/6-89/023
Operation and Maintenance of Hospital Waste Incinerators (Jan. 1990) 625/6-89/024
Assessing the Geochemical Fate of Deep-Well Injected Hazardous Waste (June 1990)
  Reference Guide 625/6-89/025a
  Summaries of Recent Research 625/6-89/025b
Stabilization Technologies for RCRA Corrective Actions (Aug. 1991) 625/6-91/026
Optimizing Water Treatment Plant Performance Using the Composite Correction Program Approach (Feb. 1991) .. 625/6-91/027
Remediation of Contaminated Sediments (Apr. 1991) 625/6-91/028
Sub-Slab Depressurization for Low-Permeability Fill Material 625/6-91/029
Sewer System Infrastructure Analysis and Rehabilitation (Oct. 1991) 625/6-91/030
Materials Recovery Facilities for Municipal Solid Waste (Sept. 1991) 625/6-91/031
Vitrification Technologies for Treatment of Hazardous and Radioactive Waste (May 1992) 625/R-92/002
Control of Air Emissions from Superfund Sites 625/R-92/012
Subsurface Field Screening, Characterization and Monitoring Techniques: A Desk Reference Guide (Sept. 1993)
  Volume I: Solids and Ground Water - Appendices A and B 625/R-93/003a
  Volume II: The Vadose Zone, Field Screening and Analytical Methods - Appendices C and D 625/R-93/003b
Urban Runoff Pollution Prevention and Control Planning (Sept. 1993) 625/R-93/004
Use of Airborne, Surface and Borehole Geophysical Techniques at Contaminated Sites:
  A Reference Guide (Sept. 1993) 625/R-92/007
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