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Process Design Manual

Land Treatment of Municipal Wastewater Effluents

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Land Treatment of Municipal Wastewater Effluents

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Notice

This document has been reviewed in accordance with U.S. Environmental Protection Agency policy and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Foreword

The U.S. Environmental Protection Agency (EPA) is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory (NRMRL) is the Agency's center for investigation of technological and management approaches for preventing and reducing risks from pollution that threaten human health and the environment. The focus of the Laboratory's research program is on methods and their cost-effectiveness for prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites, sediments and ground water; prevention and control of indoor air pollution; and restoration of ecosystems. NRMRL collaborates with both public and private sector partners to foster technologies that reduce the cost of compliance and to anticipate emerging problems. NRMRL's research provides solutions to environmental problems by: developing and promoting technologies that protect and improve the environment; advancing scientific and engineering information to support regulatory and policy decisions; and providing the technical support and information transfer to ensure implementation of environmental regulations and strategies at the national, state, and community levels.

This publication has been produced as part of the Laboratory's strategic long-term research plan. It is published and made available by EPA's Office of Research and Development to assist the user community and to link researchers with their clients.

Sally Gutierrez, Director
National Risk Management Research Laboratory

Abstract

The U.S. Environmental Protection Agency guidance on land treatment of municipal and industrial wastewater was updated for the first time since 1984. Significant new technological changes include phytoremediation, vadose zone monitoring, new design approaches to surface irrigation, center-pivot irrigation, drip and micro-sprinkler irrigation, and capital and operating costs. Also included in the new manual are new performance data on soil-aquifer treatment, a rational model for balancing oxygen uptake with BOD loadings, and industrial wastewater land application guidance, emphasizing treatment of food processing wastewater. Costs and energy use of land treatment technologies are updated.

Slow-rate land treatment remains the most popular type of land treatment system. Many slow-rate systems are now designed as water reuse systems. Trends in distribution have been toward sprinkler and drip irrigation systems.

A CD which accompanies the document contains copies of earlier editions of the land treatment manual and the latest manual for water reuse.

KEYWORDS: land treatment, soil aquifer treatment, spray irrigation, groundwater monitoring, vadose zone sampling, costs

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The authors wish to dedicate this manual to the memory of Sherwood C. “Woody” Reed whose advocacy of the use of natural systems for wastewater treatment, including land treatment, ponds, and constructed wetlands generated much of the scientific data that went into the development of the 1977 and 1981 editions of this manual. He conducted or managed numerous field investigations and developed guidance materials, project case studies, cost curves, and other materials that have been used extensively in EPA, Water Environment Federation, and Corps of Engineers publications. He has also written numerous journal articles, conference papers, and textbooks and taught courses on natural systems and wastewater treatment throughout the U.S. and around the world.