LAND TREATMENT OF HAZARDOUS WASTES

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Edited by

JAMES F. PARR
PAUL B. MARSH
JOANNE M. KLA

Agricultural Environmental Quality Institute
Agricultural Research Service
U.S. Department of Agriculture
Beltsville, Maryland

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Foreword

Every segment of our society has benefited from the products of modern industrial chemistry. But production of a useful chemical usually creates a residue or by-product that must be disposed of. Often such disposal has been done on land by way of chemical dumps and landfills. In recent years, chemical dumpsites have become the subject of increased public concern, and in some instances, they have caused apprehension with respect to possible related health risks. Though few of these risks have been scientifically validated with indisputable evidence, the allegations of unacceptable risk have nevertheless remained. Although toxicological and epidemiological evidence is often inadequate in such situations, the public has called for remedial action and, consequently, the gathering of scientific evidence to assess the risks.

Better ways must be found to dispose of and detoxify industrial wastes in an environmentally safe and acceptable manner. One possibility currently under consideration is to detoxify these wastes by land treatment/landfarming, wherein the toxic constituents are subjected to inactivation, adsorption, and chemical or biological degradation. Such methods are already being practiced to some degree for petroleum and food processing wastes, and for municipal sewage sludge.

The authors examine the possibilities for improving the efficacy of land treatment and for its extension to other industrial chemical disposal situations. In the utilization of land as a treatment system for industrial wastes, the primary objective is to use the chemical and microbiological properties of a soil to enhance the detoxification, degradation, and inactivation of waste constituents, while preventing or minimizing the contamination of surface water, groundwater and the food-chain with these chemicals.

This book presents a critical review and assessment of current knowledge and management practices for ultimate disposal of a number of hazardous waste

chemicals. It provides useful information and strategies for the design, development, and effective management of land treatment systems for hazardous wastes, and identifies areas of research that are needed to maximize the potential value of land treatment systems and to minimize associated risks.

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A draft of this text has been reviewed by the U.S. Environmental Protection Agency and the U.S. Department of Agriculture, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of these agencies. Mention of trade names or commercial products is made only for clearer communication, and does not constitute endorsement or recommendation for use over equivalent products.

Contributors*

W.D. Burge	Microbiologist, Biological Waste Management and Organic Resources Laboratory, Agricultural Environmental Quality Institute
R.L. Chaney	Research Agronomist, Biological Waste Management and Organic Resources Laboratory, Agricultural Environmental Quality Institute
R.H. Fisher	Microbiologist, Biological Waste Management and Organic Resources Laboratory, Agricultural Environmental Quality Institute
S.B. Hornick	Soil Scientist, Biological Waste Management and Organic Resources Laboratory, Agricultural Environmental Quality Institute
D.D. Kaufman	Research Soil Microbiologist, Pesticide Degradation Laboratory, Agricultural Environmental Quality Institute
J.M. Kla	Technical Information Specialist, Maryland Environmental Service, Biological Waste Management and Organic Resources Laboratory, Agricultural Environmental Quality Institute
P.B. Marsh	Microbiologist, Biological Waste Management and Organic Resources Laboratory, Agricultural Environmental Quality Institute
P.A. Paolini	Soil Scientist, Biological Waste Management and Organic Resources Laboratory, Agricultural Environmental Quality Institute

J.F. Parr	Chief, Biological Waste Management and Organic Resources Laboratory, Agricultural Environmental Quality Institute
L.J. Sikora	Microbiologist, Biological Waste Management and Organic Resources Laboratory, Agricultural Environmental Quality Institute
J.M. Taylor	Plant Physiologist, Biological Waste Management and Organic Resources Laboratory, Agricultural Environmental Quality Institute
G.B. Willson	Agricultural Engineer, Biological Waste Management and Organic Resources Laboratory, Agricultural Environmental Quality Institute

*Contributors are all located at the U.S. Department of Agriculture, Agricultural Research Center, Beltsville, Maryland.

Contents

Introduction

Present-day Americans enjoy many comforts and conveniences unknown a century ago. Our homes are more uniformly heated in winter and cooled in summer; our foods are available in greater variety in the supermarket; our accessibility to national and international news is broader and more prompt; our medical care is vastly improved, and our life expectancy has increased. Much of this progress has come, either directly or indirectly, from basic advances in science and from the genius of American industry in implementing these advances for improving the lot of mankind.

Many industries have been involved in this progress, but none more significantly than the chemical industry. Intertwined as it is with all other phases of U. S. industry, the chemical industry exerts a profound and pervasive influence on all of American life. The basic chemical-industrial goal of "a better life through chemistry" is backed by a long list of validated accomplishments.

But time and progress itself have brought with them new challenges. We have become increasingly aware, especially in the past two decades, of potential environmental hazards and health risks from undue exposure to certain chemicals. Much recent information suggests that cancer may be largely of environmental origin. Animal data which indicate that some chemicals may cause birth defects are readily available. Not surprisingly, then, the public has an increased sense of apprehension about chemicals.

In part, environmental pollution with chemicals is a direct result of progress in the sense that a large and ever growing list of new industrial chemicals is produced each year and with it the possibility of new byproducts and chemical wastes. But

even more relevant is the fact that our concept of what constitutes a hazardous pollutant has undergone considerable change during the past two decades. Chemicals once thought to be relatively innocuous must now be regarded as potentially hazardous and toxic, and as possible causes of cancer, birth defects, and/or other health problems. Clearly, better methods are needed for the ultimate disposal of these wastes than have traditionally been used.

Two methods that appear to control the risk from disposal of hazardous wastes are 1) disposal in well designed hazardous waste landfills, and 2) high-temperature incineration. Though these methods can protect the environment, disposal of many wastes in this fashion is very expensive. Less expensive methods for disposing of these wastes and at the same time protecting the environment are badly needed.

Land treatment is a less expensive alternative method for ultimate disposal of many industrial wastes. In land treatment, soil is used to hold toxic chemicals while microbes degrade the compounds. For bulk organic sludges with high water content, land treatment may be the disposal method of choice; whereas for small volumes of still-bottoms containing very high concentrations of toxic organic chemicals, another method may be best.

The present book is a critical review and evaluation of available information relevant to land treatment of hazardous wastes. This information comes from basic research on organic and inorganic chemicals in the environment, from research and the practice of land application of sewage sludge, crop residues, food processing wastes, etc., and from the limited research conducted on hazardous wastes. The authors note processes by which land treatment degrades wastes, and by which environmental impacts could result from land treatment. Ways for using this information in designing and managing a land treatment site are also presented.

An important goal in writing of this book was to identify research needs for land treatment of hazardous wastes. The authors feel that if the suggested research is conducted, many industries and local, state, and federal agencies will have a better scientific basis on which to design and permit land treatment systems.

PART I

PROCESSES THAT INFLUENCE THE FATE AND EFFECTS OF WASTE