

**HANDBOOK OF
ENVIRONMENTAL ENGINEERING**

Volume 2
Solid Waste Processing
and Resource Recovery

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Volume 1: Air and Noise Pollution Control, 1979

Volume 2: Solid Waste Processing and Resource Recovery, 1980

Volume 3: Biological and Natural Control Processes

Volume 4: Solids Separation and Treatment

Volume 5: Physicochemical Technologies for Water and Wastewater
Treatment

HANDBOOK OF ENVIRONMENTAL ENGINEERING

Volume 2

Solid Waste Processing and Resource Recovery

Edited by

Lawrence K. Wang

*Department of Mechanical Engineering
Stevens Institute of Technology
Hoboken, New Jersey*

and

Norman C. Pereira

*Monsanto Company
St. Louis, Missouri*

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Preface

The past few years have seen the emergence of a growing, widespread desire in this country, and indeed everywhere, that positive actions be taken to restore the quality of our environment, and to protect it from the degrading effects of all forms of pollution—air, noise, solid waste, and water. Since pollution is a direct or indirect consequence of waste, if there is no waste, there can be no pollution, and the seemingly idealistic demand for “zero discharge” can be construed as a demand for zero waste. However, as long as there is waste, we can only attempt to abate the consequent pollution by converting it to a less noxious form. In those instances in which a particular type of pollution has been recognized, three major questions usually arise: 1, How serious is the pollution? 2, Is the technology to abate it available? and 3, Do the costs of abatement justify the degree of abatement achieved? The principal intention of this series of books is to help the reader to formulate answers to the last two of the above three questions.

The traditional approach of applying tried-and-true solutions to specific pollution problems has been a major factor contributing to the success of environmental engineering, and in large measure has accounted for the establishing of a “methodology of pollution control.” However, realization of the complexity of current environmental problems, and understanding that, as time goes on, these issues will become even more complex and interrelated, renders it imperative that intelligent planning of pollution abatement systems be undertaken. Prerequisite to such planning is an understanding of the performance, potential, and limitations of the various methods of pollution abatement available for environmental engineering. In this series of books, we will

review at a tutorial level a broad spectrum of engineering systems (processes, operations, and methods) currently being utilized, or of potential utility, for pollution abatement. We believe that the unification to be presented in these books is a logical step in the evolution of environmental engineering.

The treatment of the various engineering systems presented will show how an engineering formulation of the subject flows naturally from the fundamental principles and theory of chemistry, physics, and mathematics. This emphasis on fundamental science is based on the recognition that engineering practice has of necessity in recent years become more firmly based on scientific principles rather than depending so heavily on empirical accumulation of facts, as was earlier the case. It was not intended, though, to neglect empiricism where such data lead quickly to the most economic design; certain engineering systems are not readily amenable to fundamental scientific analysis, and in these instances we have resorted to less science in favor of more art and empiricism.

Since an engineer must understand science within a context of application, we first present the development of the scientific basis of a particular subject, followed by exposition of the pertinent design concepts and operations, and detailed explanations of their applications to environmental quality control or improvement. Throughout, methods of practical design calculation are illustrated by numerical examples. These examples clearly demonstrate how organized, analytical reasoning leads to the most direct and clear solutions. Wherever possible, pertinent cost data have been provided.

Our treatment of pollution-abatement engineering is offered in the belief that the trained engineer should more firmly understand fundamental principles, be more aware of the similarities and/or differences among many of the engineering systems, and exhibit greater flexibility and originality in the definition and innovative solution of environmental pollution problems. In short, the environmental engineer ought by conviction and practice be more readily adaptable to change and progress.

Coverage of the unusually broad field of environmental engineering has demanded an expertise that could only be provided through multiple authorship. Each author (or group of authors) was permitted to employ, within reasonable limits, the customary personal style in organizing and presenting a particular subject area, and consequently it has been difficult to treat all subject material in a homogeneous manner. Moreover, owing to limitations of space, some of the authors' favored topics could not be treated in great detail, and many less important topics

had to be merely mentioned or commented on briefly. In addition, treatment of some well established operations, such as distillation and solvent extraction, has been totally omitted. All of the authors have provided an excellent list of references at the end of each chapter for the benefit of the interested reader. Each of the chapters is meant to be self-contained and consequently some mild repetition among the various texts was unavoidable. In each case, all errors of omission or repetition are the responsibility of the editors and not the individual authors. With the current trend toward metrication, the question of using a consistent system of units has been a problem. Wherever possible the authors have used the British system (fps) along with the metric equivalent (mks, cgs, or SIU) or vice versa. The authors sincerely hope that this inconsistency of units usage does not prove to be disruptive to the reader.

The series has been organized in five volumes:

- I. Air and Noise Pollution Control
- II. Solid Waste Processing and Resource Recovery
- III. Biological and Natural Control Processes
- IV. Solids Separation and Treatment
- V. Physicochemical Technologies for Water and Wastewater Treatment

As can be seen from the above titles, no consideration is given to pollution by type of industry, or to the abatement of specific pollutants. Rather, the above categorization has been based on the three basic forms in which pollutants and waste are manifested: gas, solid, and liquid. In addition, noise pollution control is included in Volume I.

This Engineering Handbook is designed to serve as a basic text as well as a comprehensive reference book. We hope and expect it will prove of equal high value to advanced undergraduate or graduate students, to designers of pollution abatement systems, and to research workers. The editors welcome comments from readers in all these categories. It is our hope that these volumes will not only provide information on the various pollution abatement technologies, but will also serve as a basis for advanced study or specialized investigation of the theory and practice of the individual engineering systems covered.

The editors are pleased to acknowledge the encouragement and support received from their colleagues at the Environmental and Energy Systems Department of Calspan Corporation during the conceptual stages of this endeavor. We wish to thank the contributing authors for their time and effort, and for having borne patiently our numerous

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queries and comments. Finally, we are grateful to our respective families for their patience and understanding during some rather trying times.

LAWRENCE K. WANG
Hoboken, New Jersey
NORMAN C. PEREIRA
Charleston, Tennessee

Contributors

RAUL R. CARDENAS, JR. • *Department of Civil Engineering, Polytechnic Institute of New York, Brooklyn, New York*

JARIR S. DAJANI • *Department of Civil Engineering, Stanford University, Stanford, California*

EUGENE A. GLYSSON • *Department of Civil Engineering, University of Michigan, Ann Arbor, Michigan*

WALTER R. NIESSEN • *Camp Dresser and McKee, Boston, Massachusetts*

NORMAN C. PEREIRA • *Monsanto Company, St. Louis, Missouri*

P. MICHAEL TERLECKY, JR. • *Frontier Technical Associates, Inc., Buffalo, New York*

P. AARNE VESILIND • *Department of Civil Engineering, Duke University, Durham, North Carolina*

LAWRENCE K. WANG • *Department of Mechanical Engineering, Stevens Institute of Technology, Hoboken, New Jersey*

DENNIS WARNER • *Department of Civil Engineering, Duke University, Durham, North Carolina*

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