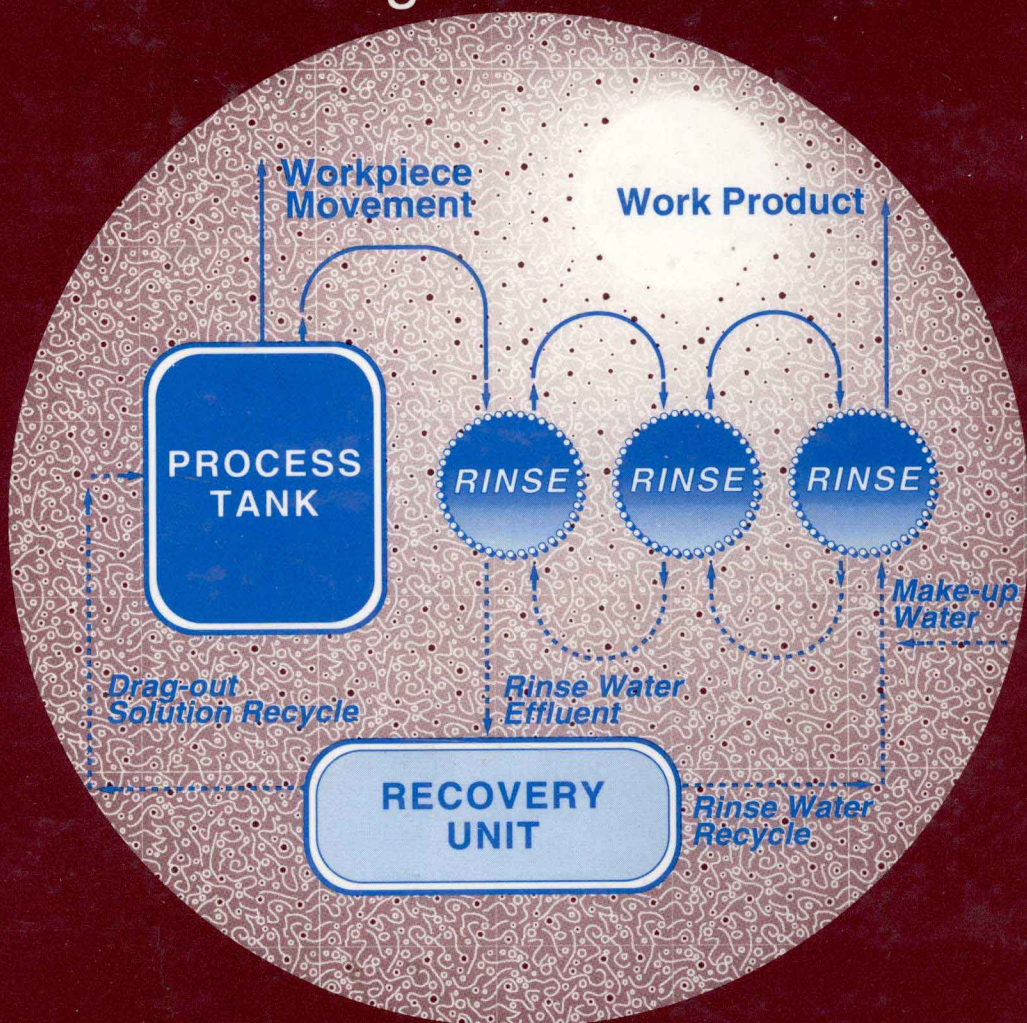


POLLUTION PREVENTION

Louis Theodore
Young C. McGuinn



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To

Joe Reynolds

There are some individuals who assist us, teach us, pray for us, encourage us and help make life worth living. Funny, we never seem to have enough time to let them know how much we appreciate them. Thanks.

Louis Theodore

AND

To My Parents

Young McGuinn

Preface

Beginning is the most important part of the work.

Plato (427-327 B.C.)
The Republic, Book I

The engineering profession has recently expanded its responsibilities to society to include the management of wastes, with particular emphasis on control by pollution prevention. The term pollution prevention, in this text, is defined as that process or operation that attempts to reduce or eliminate the generation of wastes and/or pollutants that are emitted into the environment. Unfortunately, the term pollution prevention has come to mean different things to different people. Other terms—including waste minimization (a term that the EPA has discouraged the use of because it focuses on hazardous wastes only), waste reduction, source reduction, and pollution minimization (a common term in industry)—have come, in a very general sense, to be used interchangeably with pollution prevention. However, irrespective of the term employed, the main focus of environmental control today and in the future will be to reduce or eliminate any waste pollutant streams from entering the environment.

Increasing numbers of engineers, technicians, and maintenance personnel are being confronted with problems in this most important area. Since the problem of waste control is a relatively new concern, the environmental engineer of today and tomorrow must develop a proficiency and an improved understanding of not only pollution prevention but also waste management in order to cope with these challenges. Although this is not the first professional book to treat this particular subject, it is the only book dealing with the technical and engineering aspects of pollution prevention that may be used as a text.

This text-reference book is intended primarily for regulatory personnel, practicing engineers and engineering/science students and contains engineering methods for source reduction and the technical aspects of pollu-

tion prevention in general. It is assumed that the reader has already taken basic courses in physics and chemistry, and has a minimum background in mathematics through calculus. The authors' aim is to offer the reader the fundamentals of this subject with appropriate practical applications to pollution prevention and the general subject of waste management, and to provide an introduction to the specialized literature in this and related areas. The readers are encouraged, through the references, to continue their own development beyond the scope of this book.

As is usually the case in preparing a book, the problem of what to include and what to omit has been particularly difficult. However, every attempt has been made to offer engineering course material to individuals with a technical background at a level that should enable them to better cope with some of the complex problems encountered in pollution prevention today.

The book is divided into four parts: Process and Plant Fundamentals, Pollution Prevention Options, Pollution Prevention Applications, and Case Studies. The general subject of process and plant fundamentals, equipment and calculations is examined in Part 1. A separate chapter is devoted to process diagrams. Economic considerations are also reviewed. Part 2 covers the broad subject of pollution prevention options. This section of the book includes chapters on source reduction, recycling, treatment methods (including incineration details), and ultimate disposal. A separate section on multi-media approaches and energy conservation is also contained in Part 2. Part 3 is highlighted by individual chapters devoted to specific industrial applications involving pollution prevention. The book concludes with case studies, which are presented in Part 4.

The authors cannot claim sole authorship to all the material in this text. The present book has evolved from a host of sources, including: notes, homework problems and lecture handouts prepared by L. Theodore for a one semester, three credit Pollution Prevention graduate course at Manhattan College; USEPA APTI Manual *Principles of Accident and Emergency Management*; L. Theodore, J. Reynolds, and F. Taylor's Wiley-Interscience text, *Accident and Emergency Management*; USEPA APTI Problem Workbook *Hazardous Waste Incineration*, L. Theodore; USEPA APTI Problem Workbook SI:412D *Control of Gaseous and Particulate Emissions*, L. Theodore and Y.C. McGuinn; and USEPA/625/7-88/003 *Waste Minimization Opportunity Assessment Manual*. Although the bulk of the material is original and/or taken from sources that the authors have been directly involved with, every effort has been made to acknowledge material drawn from other sources. The authors trust that their apology will be accepted for any error(s) or omission(s), and changes will be included in a later printing.

For some, particularly for novices, the book may serve as a starting point that will allow them to become acquainted with the pollution prevention field. For others, who would classify themselves as experts, the book could serve as a reference text. It may also be useful as a tool for training in industry, in government, or in academia. The book should be valuable to engineers in regulatory agencies and industry, to technicians, and to maintenance personnel. It may also be of value to individuals involved with air quality and environmental management. The aim of the authors is to provide, in a thorough and clear manner, a book covering both the fundamentals of pollution prevention and their application to real-world problems. It is hoped that it will serve both industry and government in attempting to reduce and/or eliminate waste problems that can result in the loss of human and animal life, materials, vegetation, and property.

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Louis Theodore
Young McGuinn

Riverdale, New York

Introductory Comments Regarding Pollution Prevention

Applying pollution prevention strategies will not eliminate all wastes from all production processes. Rather, it offers a more cost-effective means of minimizing the generation of waste. Source reduction is the first step in a hierarchy of options for reducing the pollution risks to human health and the environment. The next step in such a hierarchy is the responsible recycling of any wastes that cannot be reduced at the source. When recycling is conducted in an environmentally sound manner, it shares many of the same advantages as source reduction, such as conserving energy and other resources, reducing reliance on raw materials, and the need for end-of-pipe treatment or containment of wastes. Wastes that cannot be “feasibly” recycled should be treated in accordance with environmental standards that are designed to reduce both the hazard and volume of waste streams. Finally, any residues remaining from the treatment of waste should be disposed of safely in order to minimize their potential for release into the environment. This hierarchy establishes a set of presumptions, rather than an ironclad rule since other practices, such as treatment and proper disposal, can also be protective of the environment. Industries can be expected to balance costs and benefits when evaluating pollution prevention opportunities, considering such factors as savings in raw material and operating expenditures, avoided pollution control costs, reduced liability, and improved relations with local communities.

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