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Dedicated to those who support, foster, and promote the development of an environmental ethic in the general population.
Author’s Profile

Kenneth M. Mackenthun, in a 52-year career in water pollution investigations and control, water resources management, hazardous waste management, environmental assessment, and regulation development, has produced over 100 technical publications, including 11 books. He graduated cum laude with a degree in Biology from Emporia (Kansas) College and obtained an M.A. in Zoology from the University of Illinois in 1946.

Mr. Mackenthun worked for the Wisconsin Department of Conservation and Wisconsin State Board of Health for 16 years where he served as Chief Biologist. He served 20 years with the U.S. Environmental Protection Agency (EPA) and its predecessor, the U.S. Public Health Service. He was Director of the Criteria and Standards Division (Water) and Acting Deputy Administrator for Water Planning and Standards where he supervised 220 employees in 4 Divisions. He was responsible for the Clean Water Act Estuarine Report to Congress; In-Place Pollutant Removal; National Water Quality Standards; Water Quality Criteria Development; report on Methods and Procedures to Restore Lakes; Maintaining the Toxic Pollutants List; Hazardous Substances Discharges; Vessel Sewage Discharge Regulations; Aquaculture Program and Regulations; Clean Lakes Restoration Program; and Dredge and Fill Materials Discharge Program.

He served as Adjunct Professor at The American University, Washington, D.C., teaching several courses in the off-campus graduate degree program. He operated his own consulting firm for several years, and served a number of environmental consulting firms, the most recent being ADI Technology Corporation in Crystal City, VA, where he provided environmental consultation to the U.S. Navy’s submarine program. He is a recognized expert in environmental assessments and water regulations.

His experience includes 16 years in state government service, 19 years in federal government service, and 17 years serving various environmental consulting firms.
The contents of this book do not supersede or replace the regulatory requirements of federal, state, or local authorities.
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1 Introduction

Russell Train, first Chairman of the Council on Environmental Quality and second Administrator of the U.S. Environmental Protection Agency (EPA) is quoted as saying, “Whether we like it or not, continued economic and population growth guarantee that environmental issues are going to become more urgent and complex, not less.”

1.1 PURPOSE

This book contains the information you need to know to begin, sustain, and extend a career in environmental and natural resource protection in federal, state, and local governments; industry; and consulting activities. The need to have knowledgeable career people in the environmental field is demonstrated by the heightened public interest in environmental matters, the increasing regulatory compliance requirements, regulatory violations that could and should be eliminated, and the vast number of federal and state environmental regulations promulgated since the EPA was formed in 1970.

The environmental advantage is in maintaining a knowledge of, and being conversant with, environmental regulations and laws, the history of how the laws came into existence, compliance requirements, and the environments to be protected. The personal advantage is considerable and is measurable in career enhancement and personal monetary compensation.

The author's career and interests were first focused on pollution and the water environment in the 1940s and 1950s prior to a general public awareness of the need to control environmental pollution. It extended through the decade of the 1960s (the era of field investigations and demonstrations of the nature and extent of pollution), the decade of the 1970s (the era of federal pollution control laws and regulatory development), and into the 1990s (the era of regulatory refinement and the treatment of non-point source pollution problems previously left unresolved).

1.2 CONTENTS

Let us move ahead to the organization of the text in this book. The next chapter addresses fundamental and environmental concepts that are necessary to an understanding of information related to environmental laws and regulations. Chapter 3 addresses environmental assessment and impacts, National Environmental Policy Act (NEPA) requirements, and the NEPA process, which is essential to sound environmental planning and management.

The next three chapters discuss the air, land, and water resources and introduce the reader to 11 associated federal laws and their respective requirements. There are regulations that are associated with and implement various sections of the laws, and these are not neglected.
Chapters 7 and 8 deal with multimedia toxic and hazardous wastes and laws and regulations that do not fit well with the previous discussions. Chapter 9 discusses the all important matter of environmental compliance. Chapter 10 reminds us that ecosystems will recover when pollution is curtailed. Chapter 11 addresses the current important words, pollution prevention. Chapter 12 provides review questions and answers related to the principal environmental laws and regulations contained in the previous chapters. Chapter 13 discusses safety precautions and features that are necessary when working with toxic and hazardous materials and wastes. Chapter 14 provides a discussion of the vulnerability of the environments most often impacted by pollution occurrences. Chapter 15 records experiences and discussion of experiences associated with a career in government service, industry, and consulting.

1.3 BACKGROUND

Generally, our environment is much cleaner now than it was in the 1950s and 1960s. The decade of the 1960s was the decade that awakened the people of the United States to the fact that air and water pollution must be better controlled. Many lakes, including one of the Great Lakes, were declared “dead” because they were so enriched with nutrients such as nitrogen and phosphorus that massive algal growths developed and later decomposed liberating hydrogen sulfide that permeated the air and blackened white lead paint on shoreside houses that were three or four blocks from the lake. Opened-windowed sleeping was not practical during the summer nights. Sport fishing was no longer an enjoyable sport. At least one river near Chicago contained sufficient floating oil that it burst into flames when a cigarette was tossed into it. Another river in the northeast had floated so many logs from the timber area to a paper mill that its bottom was covered with decomposing wood chips. A chemical, sodium nitrate, was literally shoveled into the river to add dissolved oxygen from the nitrification process. The environment is better now, but there still is pollution and vigilance must still be maintained to ensure that backsliding will not occur and our pollution control efforts continue with the momentum they have achieved.

States are required by Section 305 (b) of the Clean Water Act to submit a biennial report to the EPA that describes the water quality of the state. EPA, in turn, prepares a National Water Quality Inventory, which is submitted to the Congress biennially. The latest EPA report (EPA, 1995) states that the United States has 3.5 million miles of rivers, and streams; 40.8 million acres of lakes, ponds, and reservoirs; 34,388 square miles of estuaries; 58,000 miles of ocean shoreline, 5,559 miles of Great Lakes shoreline, and 277 million acres of wetlands such as marshes, swamps, bogs, and fens. Alaska boasts 170 million acres of this wetland total.

According to the EPA report, rivers are polluted by bacteria, siltation, nutrients, oxygen-depleting substances, metals, habitat alterations, and suspended solids. The leading source of pollution is from agriculture with municipal point sources being second. Lakes are polluted by nutrients, siltation, oxygen-depleting substances, metals, suspended solids, pesticides, and priority organic toxic pollutants. Agriculture, again, was the leading source of pollution with municipal point sources in second place.
The leading pollutant for the Great Lakes is toxic organic chemicals, primarily polychlorinated biphenyls (PCBs), followed in much smaller measure by pesticides and non-priority organic chemicals. The principal leading sources of pollution are air pollution, discontinued discharges, and contaminated sediments.

Estuaries are polluted principally by nutrients, bacteria, and oxygen-depleting substances, which are provided by urban runoff and storm sewers, municipal point sources, agriculture and industrial point sources, in that order. Wetlands integrity is affected by sediments, flow alterations, habitat alterations, and filling and draining. Agriculture, urban runoff, and hydrologic modification are the principal sources. Ground water is affected by leaking underground storage tanks (an estimated 139,000 tanks have leaked), agricultural activities (where 1.1 billion lb of pesticides are applied to agricultural lands annually), superfund sites, and septic tanks. The most common ground water contaminants are petroleum compounds, nitrates, metals, volatile organic compounds, and pesticides.

Pursuant to Section 201 of the National Environmental Policy Act, the President shall transmit to the Congress an Environmental Quality Report. The current report for 1994 and 1995 is the 25th Anniversary Report by the Council on Environmental Quality. This report indicates that carbon monoxide emissions from 1970 to 1994 declined from 128 to 98 million tons per year or 23 percent. Lead emissions are down 98 percent over the 1970 to 1994 period and 75 percent over the 1985 to 1994 period. Nitrogen oxide emissions are up 14 percent from 10.6 to 23.6 million tons per year during the 1970 to 1994 period. High levels of ozone persist in many heavily populated areas, including much of the Northeast, the Texas Gulf Coast, and Los Angeles. It is estimated that about 50 million people lived in counties with ozone levels above the national standard in 1994. Over the 1970 to 1994 period, emissions of sulfur dioxide were down 32 percent.

The conversion of wetlands to other uses has slowed over the past several decades, dropping from an average of 690,000 acres per year in the 1954 to 1974 period to about 423,000 acres annually in the 1974 to 1983 period. The total wetland acreage in the United States in the mid-1980s was about 103.24 million acres. This is considerably less than the EPA report discussed earlier.

Municipal solid waste generation has grown steadily and is expected to grow even more. From 1960 to 1994, waste generation increased from 88 million tons to 209 million tons per year. Per capita generation rose from 2.7 lb/d in 1960 to 4.4 lb/d in 1994. It is projected to hold steady at 4.4 lb per capita per day through the year 2000, but increase to 4.7 lb per capita per day by the year 2010.

The 25th Anniversary Report states that the number of lakes, rivers, and other U.S. waterways where consumers have been advised to avoid or limit consumption of trout, salmon, or other fish species because of chemical contamination rose from 1,278 in 1993 to 1,740 in 1995. The contaminated fish advisories were issued for fish flesh concentrations of mercury, PCBs, chlordane, dioxins, and DDT. The increased number of contaminated fish advisories was owing to mercury and PCB concentrations in fish flesh. The fish advisories, issued for more than 1,700 water bodies, represent a 14 percent increase over the previous year.
1.4 ENVIRONMENTAL ETHIC

There is evidence that an environmental ethic is gaining ground among the general population. People are feeling better about their environment. Leopold (1949) attempted to establish an ecological conscience among his contemporaries. Leopold's message has persisted. That message is needed more today than ever before to counteract any effort at backsliding. Hopefully, a couple of decades from now, the environmental ethic will be even stronger among the general population. The human population will be more at peace with the requirements of its environment. The environmental ethic will dominate that relationship.

Regulations are required to keep societal goals focused on future attainment. In 1992, Mackenthun and Bregman published certain principles related to environmental regulations. It is worthwhile to repeat them here:

• The purpose of an environmental regulation is to adequately protect, in a broad sense, the environment for man.
• Because of the infinite variation in biological and chemical reactions to environmental change and perturbations, regulations must allow flexibility for adjustment to a particular circumstance. The burden of proof for a more restrictive regulation logically rests with government; the burden of proof for justifying regulatory relaxation, where the need is demonstrated through investigation and assessment, rests with the discharger.
• Political and legislative deadlines often have fostered benign cynicism because of their unrealistic nature in a regulatory world of abundant checks and balances.
• Determining the current state-of-the-art knowledge related to a particular subject is a time-consuming endeavor. The search for an answer in the realm of the unknown is research operating though undeterminable time.
References Cited
and Selected Reading

Seventh annual report on carcinogens, National Institute of Environmental Health Sciences, Research Triangle Park, NC, 1994.