

- maintenance
- pre-startup review
- management of changes
- safety audits (Chapter 6)
- accident investigation (Chapter 7) Each of these topics is covered well in the book. Other chapters discussed [chapter number shown in ()]:
- Establishing an Emergency Response Plan (8)
- Handling Registration Procedures (9) [of the plan which must be supplied to the EPA]
- Totaling the Costs (10)
- Avoiding Penalties (11)
- Coordinating with OSHA's Process Safety Management Standard (12)
- Determining Program Levels of RMP (13)
- Choosing Analytical Methods (14)
- Selecting Inherently Safer Approaches (15)

I was particularly interested in the modeling (Chapter 15) in which the author discusses the many approaches that can be used to determine downwind concentrations of released chemicals. The simplest (but least accurate) method is to use USEPA-supplied tables—but the approach will “likely (to) produce worst-case concentrations that exceed any reasonable, likely concentration to be produced by an accidental release.” A more sophisticated approach is to use a (computer) model such as: T/Screen, Cameo/Aloha, Degadis, Slab, Screen 3 and ISCT3.

The author's writing ends at p. 120 to be followed by extensive appendices including:

- EPCRA 302: List of Extremely Hazardous Substances
- EPA's Title III: List of Lists (Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112 (r) of the Clean Air Act as Amended April 7, 1997)
- 40 CFR Part 68: Chemical Accident Prevention Provisions
- NASA's Lewis Safety Management and the Safety Permit System
- Risk Management Plan Data Elements
- Sample RMP for Propane Industry

Ordinarily, I chafe at extensive appendices, but in this case, (including the inclusion of 60 + pages from the Federal Register) they are warranted. I especially appreciate the inclusion of two example RMP plans (or elements thereof) as the last two appendices.

My only negative comment is that the book provides few references to the literature; conversely, it does cite government sources (CFR, EPA, etc.) well.

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Practical Environmental Bioremediation: The Field Guide, R. Barry King, Gilbert M. Long and John K. Sheldon, Lewis Publishers, Boca Raton, FL, 2nd edn., 1997, US\$79.95, 184 pp., ISBN: 1-56670-208-9

Given the immense cost of cleaning up chemically-contaminated sites, remediation engineers have searched for and found a less expensive and often faster cleanup technique than pump-and-treat or dig up and rebury. That technique is bioremediation.

The bioremediation approach (and its advantages) is described by the authors as follows:

“Bioremediation can often be significantly less expensive (1/3 to 1/2 the cost) when compared to other alternatives. In the case of surface treatment of soils, it will usually take more time to complete when compared to excavation and landfill disposal. However, when applied in situ for groundwater treatment, it can reduce the time severalfold compared to conventional pump-and-treat technologies, which can take 15 to 30 years without completing the job. Although bioremediation of metals is just an emerging technology at the present time, there is a chance it can restore certain environments.”

“Bioremediation is the application of the normal metabolic processes of microorganisms to alter the chemical structure of organic materials in solid, liquid, or vapor states in order to render the compounds less toxic to humans and the surrounding environment. It is also the use of microbial metabolic processes to change the valence state (or redox potential) of metals for detoxification, or to render them less soluble, and therefore unavailable for transport through the environment. This is accomplished by manipulating the environment of the site in ways that encourage multiplication and fast metabolism of the microorganisms which can degrade or detoxify the unwanted contaminants.”

This book is a very readable (although at times the prose is more colloquial than formal) practical treatise on bioremediation which the authors define as:

“A treatability technology that uses biological activity to reduce the concentration or toxicity of a pollutant. It commonly uses processes by which microorganisms transform or degrade chemicals in the environment.”

The three modes of biotreatment they discuss are:

- biostimulation
- bioaugmentation
- intrinsic treatment

The last mode of treatment (intrinsic) is a natural process which I define as ‘let nature do its thing’. But if nature will not (or cannot) remove the contamination, then man’s intervention is needed. The chapters following the introduction describe: (1) microbial nutrition and environmental requirements (Chapter 2) and (2) microbial destruction of environmental pollutants (Chapter 3). These chapters define microbial processes and the microbial pathways of biodegradation. But how to optimize these processes in nature is the challenge. That is the role of the bioremediation laboratory (Chapter 4). As a part of the discussion of laboratory choice/study, the authors give the cost thereof. Practical suggestions on choosing a laboratory also are given.

The background having been discussed, the authors move to the main topic at hand: cleanup methods. Chapter 5 is an overview of bioremediation. Details are found in subsequent chapters:

- Anaerobic Biodegradation: Sans Oxygen (Chapter 6)
- Surface Bioremediation of Soils and Sludges: Land Treatment (Chapter 7)
- Bioreactors: The Technology of Total Control (Chapter 8)

- In Situ Aquifer Bioremediation (Chapter 9)
- Lagoon Bioremediation (Chapter 10)
- Vadose Zone Bioremediation (Chapter 11)

Although the book claimed case histories are included, few are found. The two I did find, one on the cost of conceptual design of a soil, land treatment system and the other on good bioremediation were excellent. I just wish there had been more such examples.

The book is well-referenced (with references especially up-to-date) except that many of the references would be difficult, if not impossible, to obtain being conferences and newsletters (many of which were published by a now defunct organization). For a detailed look at the bioremediation literature, the reader should turn to a companion book, *Remediation of Petroleum Contaminated Soils: Biological, Physical and Chemical Processes*, also published by Lewis.

A short (9-page) glossary ends the book. Given the topic and the unusual words used, it is appropriate.

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Bioremediation: Principles and Practice, Vol. 1: Fundamentals and Application, \$149.95, 788 pp., *Vol. 2: Biodegradation Technology Developments*, \$149.95, 741 pp., *Vol. 3: Bioremediation Technologies*, \$149.95, 698 pp., Subhas K. Sikdar and Robert L. Irvine (Eds.), Technomic Publishing Co., Inc., Lancaster, PA, 1997–1998, ISBN: Vol. 1: 1-56676-308-8, Vol. 2: 1-56676-530-7, Vol. 3: 1-56676-561-7

This three-volume set represents a major contribution to the biodegradation literature [the authors use the word bioremediation broadly to cover biological processes whereas I usually restrict that term to cleanup of contaminated sites; but I defer to their definition for purposes of this review].

The authors state in three separate paragraphs, and I fully agree:

“This three-volume series, *Bioremediation: Principles and Practice*, will provide a state-of-the art description of advances in pollution treatment and reduction using biological means; identify and address, at a fundamental level, broad scientific and technological areas that are unique to the subject or theme and that must be understood if advances are to be made; and provide a comprehensive overview of new developments at the regulatory, desk-top, bench-scale, pilot-scale, and full-scale levels.”

“Glancing through the tables of contents, you will see that our objective for this series was to provide the theoretician and practitioner with an overview of bioremediation that will allow new research programs to be formulated and bioremediation technologies to be improved.”

“Developing this series has been a lengthy process because of the size of the project and because of the standard of excellence that has been set.”

As an editor, I truly appreciate the daunting task that Sikdar and Irvine faced in soliciting, getting written and submitted, having reviewed (as all papers were) and