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Book review

Hazardous Waste Management
Michael D. LaGrega, Phillip L. Buckingham, Jeffrey C. Evans, Environmental Resources Management, McGraw Hill, New York, NY, 2nd Edition, 2001, $108.30 from amazon.com, 1202 pp., ISBN 0-07-039365-6

The first edition of this book was good. This, the second edition, is even better as many of the chapters have been revised as a result of input from the users. Additionally, the increasingly important topic of remediation was expanded, and a regulatory update was (naturally) performed.

Given that broad and important topic of hazardous waste — its generation, handling, disposal and remediation of problems from past inadequate disposal — is a topic of major concern worldwide, it is not surprising this textbook (aimed at senior and graduate students) encompasses more than 1200 pages. It could easily have been double this size. But in the page count allotted, the authors (assisted greatly by members of the consulting firm of Environmental Resource Management) have done very well.

The sequence of topics is one that I find very logical. The four major sections of the book are as follows:

1. Fundamentals
2. Current Management Practices
3. Treatment and Disposal Methods
4. Site Remediation

Under these four broad headings, the authors include 17 chapters (almost evenly divided between the four major sections). Each chapter is followed by an extensive bibliographic list of 'additional reading'. The bibliography was the only area I found lacking, not in extent (as all were very extensive) but in consistency of presentation (author initials varied from one citation to another, publisher, etc.). The authors could have used a 'fussy' technical editor. But the foregoing complaint is a minor one. The book is excellent.

As common with most textbooks, each chapter is followed by a student assignment section entitled 'Discussion Topics and Problems'.

Following the obligatory Introduction (entitled 'Hazardous Waste') and legal framework chapters, the authors delve into basic technical issues. Chapter 3, entitled 'Process Fundamentals', will be very familiar to chemical engineering students, but less so to the civil engineers. It discusses basic chemistry, physical chemical properties, energy and mass

balances, reaction and reactors and geochemical modeling and analysis programs (NETPATH, PHREEQC, TRIPLOT and WATEQ4F).

Continuing on the development of the fundamentals necessary for understanding the topic is Chapter 4, 'Fate and Transport of Contaminants' (when released, inevitably as they are) into the environment. Much to my surprise (and delight) there was even a discussion on air pollution emission modeling including the well-known Gaussian dispersion equation.

Chapter 5, 'Toxicology', begins with the oft-quoted (but oft-forgotten or ignored in public discussion) of Paracelsus who noted "All things are poison and nothing is without poison" (and paraphrasing "it's the dose that matters"). Discussed in the chapter are the important topics of exposure, toxic effects, dose–response relationship, carcinogens and noncarcinogens in ecotoxicology. The author notes that ecotoxicology is a relatively young scientific discipline (called to public attention forcibly by Rachel Carson's text *Silent Spring*). The topic extends the principles of toxicology to natural systems to evaluate the potential (environmental) impact of releases of toxic chemicals on the environment and its inhabitants.

The second major section of the book (Current Management Practices) begins with a chapter on 'Environmental Auditing'. The authors note that auditing has become a standard management practice at large companies and to explore the need they graph the number of pages in the Code of Federal Regulations (Vol. 40) over time. There were fewer than 1000 pages in 1972 but more than 16,000 in 1999. The complex audit, they note, looks at all aspects of environmental activity, not just hazardous waste production and disposal. In this regard, the extent (as they did in air dispersion modeling) of the discussion goes beyond the topic of hazardous waste.

The important (and rapidly developing) field of 'Pollution Prevention' is the topic of Chapter 7. Given the rapid growth of this area, I was surprised to see none of the 58 references was later than 1991.

Chapter 8, 'Facility Development and Options', discusses facilities, facility type and operation and industry closure. What I found interesting in the chapter was a long discussion on Public Participation (including NIMBY). But most surprising was a well-written section on a successful hazardous waste siting project in Alberta, Canada. Included was a detailed description of the siting process and resulting public acceptance of the site.

The third major section (Treatment and Disposal Methods), the one that most directly addresses the disposal of hazardous waste, contains chapters on Physicochemical Processes, Biological Methods, Stabilization and Solidification, Thermal Methods, and Land Disposal.

The fourth and final section of the book (Site Remediation) contains chapters on Quantitative Risk Assessment, Site and Subsurface Characterization, Remedial Technologies, and Evaluation and Selection of Remedial Actions and Corrective Measures.

This book provides a comprehensive introduction to a complex interdisciplinary field. The authors' objective is to provide a sufficient background to students so that they begin to think about how to approach hazardous waste problems rather than provide simple 'cookbook' solutions. That they have done and done well. The book is a welcome addition to the literature; one that, I am sure, will be adopted by many professors.

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