of safety analysis "by presenting a framework for quick management when planning, executing and documenting safety analysis using a checklist method (given in the Appendix)."

All chapters in the book (see below) expand on the ideas and questions on which the checklist is based. They evaluate the most important hazards, identification and modeling methods, and describe the factors to be considered in their use. The application and result of consequence modeling and estimates are described in a similar manner. The book also gives guidance for determining the study objectives, defining the study boundaries, estimating the need for resources, selecting the hazard identified in modeling methods, selecting reliability data, planning consequence estimations, and, finally, evaluating and documenting the results of a safety analysis.

The book has the following 15 chapters:

1. Introduction
2. Safety Analysis, Risk Analysis, Risk Management
3. Quality of Safety Analysis
4. Advantage and Limitation of Safety Analysis
5. Definition of Goals and Planning of Resources
6. Identification of Hazards
7. Identification of Human and Organizational Factors
8. Modeling of Accident Sequence
9. Determination of Accident Frequencies
10. Modeling of Accident Consequences
11. Determination of Accident Consequences
12. Performance of the Analysis
13. Documentation of Safety Analysis
14. Evaluation of the Results
15. Measurements Necessary After the Analysis

GARY F. BENNETT

Hazardous Waste Site Soil Remediation: Theory and Application of Innovative Technologies, edited by David J. Wilson and Anne N. Clarke, Marcel Dekker, Inc., Monticello, NY, 1994, 567 pages, price US$ 165.00, ISBN 0-824709107-X

Given the enormous costs facing the United States for cleanup of contaminated sites, the number of new books being published on this topic is not surprising. This new book deals, as the title suggests, with "innovative technologies" – and innovative technologies are needed if contaminated site cleanup costs are to be constrained.

And the audience to which the book is directed is not the usual audience, one might expect from a technical treatment. The intended audience is not (though I believe it will probably include) remediation site engineers. The book, according to the editors, "is directed to environmental managers and regulators and to engineers who are not necessarily experts in remediation technology" with a goal to allow them to work with

the above noted experts (cleanup specialists) and especially work with them on cleanups, through proposals, reports and recommendations.

Of the 14 contributors to the book, seven are members of or are associated with the firm of Eckenfelder, Inc. in Nashville, Tennessee. The other contributors are from academe, government, engineering firms or research laboratories.

The first two chapters discuss the fundamental principles on which remediation exists. The first chapter addresses groundwater hydrology and contaminated transport that provide the basis on which remediation occurs. Much of the chapter is devoted to DNAPLs (dense, nonaqueous phase liquids) which are difficult to remove from the subsurface. The second chapter discusses pump-and-treat processes, addressing some of the difficulties encountered in that technology entitled, "Problems with the Remediation of Diffusion-Limited Fractured-Rock Systems." The authors review some of the problems inherent in attempting to control and remediate contaminated fractured rock aquifers.

The truly innovative technology discussion material begins with Chapter 3. Discussed in that and subsequent chapters are the following technologies:

- chemical stabilization of contaminated soil
- soil vapor extraction
- thermally enhanced vapor stripping
- thermal desorption
- enhanced biodegradation
- saturated zone sparging
- in situ vitrification
- soil surfactant flushing/washing

Clearly the topic of contaminated waste site remediation is an important one – and this book is an important addition to the literature. It is timely, well written, well referenced and well focused on the topic of innovative technologies. Surprisingly, for a user-focused book it contains a goodly amount of theoretical material.

The editors are to be commended for their balance.

GARY F. BENNETT

In Situ Bioremediation: When Does It Work? Committee on In Situ Bioremediation, Water Science and Technology Board, Commission on Engineering and Technical Systems, National Research Council, National Academy Press, Washington, DC, 1993, 207 pages, price US$ 29.95, ISBN 0-309-04896-6

The United States faces costs in the billions to clean up contaminated sites. Bioremediation offers the prospect of being a cheaper, faster, safer way of accomplishing the task.

Bioremediation is a rapidly developing field – but in common with all fast-moving technologies, it lacks scientific backup. As such, its application is more often an art than a science. Thus, the study carried out under the rigorous peer-reviewed