

## Book Reviews

*The Scientific and Regulatory Basis for the Geological Disposal of Radioactive Waste*,  
D. Savage, ed., Wiley, West Sussex, England, 1995, £35.95, 437 pp., ISBN: 0-471-  
96090-X

This book evolved from the course notes of the staff of the Environmental Division of Intera Information Technologies that has worked for many years on a wide variety of scientific and regulatory problems related to the geological disposal of radioactive wastes.

The editor notes at the beginning of the book that because of the public's perception that nuclear weapons and nuclear exposure result in cancer, any activity dealing with radioactive material will be suspect. And the environmental movement has spotlighted the industry, demanding the highest environmental standards.

In this book, the authors explore the whole spectrum of geological disposal beginning with an overview of the regulatory criteria, the goals of waste management and the disposal options that are available. Chapter two provides an overview of the major sources of radioactive waste, the type of waste derived from each source and the important characteristics of different waste forms in the context of their disposal options.

Chapter three is entitled, "Repository and Barrier Concepts". Its purpose is "to describe the types of geological disposal which have been proposed, with emphasis on the leading concepts involving a combination of natural and engineered barriers". The chapter is well illustrated with a series of excellent diagrams.

After looking at the types of waste generated and the design of ultimate disposal systems, the various components of these systems are examined in detail, describing the process which lead to the degradation of the depository and leakage of the wastes.

Chapter four is entitled "The Near-Field". Its purpose is to identify and characterize the processes that affect the near-field sub-system, especially calculations involving the source-term or release rates of radionuclides to the geosphere.

Chapter five continues the release discussion by considering the far-field (or geosphere or geological barrier) which can be defined as the rock mass surrounding the repository as far as the surface.

The third and final chapter dealing with release (or impact of the disposal site on the surroundings) is entitled "The Biosphere and Radiological Effects" (Chapter six). Discussed are the migration and accumulation of radionuclides; calculations of radiation doses; timescales; environmental change and human activities; uncertainty and variability; and the surface environment assessment programme.

Having well defined the problem in Chapters one to six, Chapter seven begins a discussion of the solution. Entitled “Selection of Waste Disposal Sites”, the author notes (especially for deep disposal) substantial reliance on the geological and hydro-geological environment to provide long-term confinement of the waste. The goal of the selection process is to select a site which is suitable by meeting criteria defined in the following areas:

- long-term safety
- safety of the repository operating system (short-term safety)
- technical feasibility of the repository system.
- environmental considerations
- social acceptance (public acceptability)
- considerations of cost.

The key to this chapter is the summary discussion of “Lessons to be Learned”. Eight main points are made in the sections entitled “General Points, and Socio-Economic and Political Matters”, and two points entitled “Geological Factors”. As an example, Lesson 1 under “General Points, and Socio-Economic and Political Matters” is reported here:

“It is important not to have any rigid criteria in the selection of sites for waste disposal, except where this is absolutely necessary. It is important to develop a site selection process that remains flexible and is based on *guidelines*. These guidelines need to encompass all the important factors, from geological through to socio-economic, that need to be taken into account, but they must not be prescriptive. This is where the U.S. site selection programme has its most serious shortcomings, although it would appear the European cultures are less likely to develop such a prescriptive, legalistic and adversarial system”.

Once a candidate site has been selected, a detailed characterization of it must be carried out. This topic is discussed in Chapter eight. Such a process will produce the data necessary for the models used in the performance assessment and so that the repository can be designed and located precisely within the rock mass.

Once the site has been chosen, two further tasks await; they are covered in Chapter nine, “Performance Assessment”, and Chapter ten, “Uncertainty and Confidence Building”.

The final chapter (eleven) in the text looks to the future with the rhetorical title “Where Next?” The author notes that despite attempts to find a home for nuclear waste, “At present there are no operating deep geological repositories for high-level wastes or spent fuel in the OECD countries”. But the delay in siting has not been all bad as we have learned a great deal about how to approach the non-technical details of disposal in the period in comparison to little change in our knowledge of repository design. And on a final note, this positive statement:

“We believe that it is now fair to say that there really is a *scientific basis* for geological disposal, and that a solution to the waste problem actually exists. The next step is to implement this solution.”