9. Flanges and Connections
10. Rotating Equipment
11. Sampling
12. Drains, Sewers, and Wastewater Emissions Control
13. Liquid Storage and Transfer
14. Dust Control
15. Major Process Hazards
16. Exposure Assessment

I read several sections and was surprised (and pleased) to read excellent write up on common pollution control units: oilwater separation, air flotation unit, cyclones and baghouses. That's my field of expertise and what was written was very good.

GARY F. BENNETT

Nuclear Waste Cleanup Technology and Opportunities, by R. Noyes, Noyes Data Corp., Park Ridge, NJ, 1995, $76.00, 454 pp., ISBN: 0-8155-13881-X

Radioactive events and radiation-contaminated material generation of past activities involving the production of nuclear weapons and research into nuclear power production have left the U.S. Department of Energy with a complicated and expensive cleanup problem; one that my personal notes say could well exceed $300 billion (US).

To be addressed at DOE sites are the following major problems:

1. Groundwater contamination
2. Plutonium-contaminated soil
3. Uranium processing residues
4. High-level waste in tanks
5. Buried transuranic waste
6. Mixed (waste containing both radioactive and hazardous chemicals) waste

Chapter 1 of this book outlines these problems, discusses DOE's organizational strategies for tackling them (i.e., Environmental Management Organization) and tells the reader how to interact with DOE in this massive cleanup project.

Chapter 2 is a short chapter that discusses (and defines) the different types of nuclear waste:

- high-level waste/spent nuclear fuel
- spent nuclear fuel
- transuranic waste
- low-level waste
- mixed waste

Sites to be cleaned up are discussed in the next two chapters. Chapter 3 treats DOE sites on a state-by-state basis. Chapter 4 discusses only federal agency sites, i.e., Department of Defense.

The discussion begins in earnest in Chapter 5, entitled "Storage and Disposal". Yucca Mountain and the Waste Isolation Pilot Plant (WIPP) come in for much attention.

Destined (hopefully) to be the ultimate storage sites for high level and transuranic wastes, respectively, construction of the federal disposal facilities is much behind schedule.

One of the major problems discussed in this chapter is what to do with the relatively large amount of plutonium stored at Rocky Flats. The best idea, I feel, is supported by the Natural Resources Defense Council (NRDC) that supports converting the plutonium into mixed oxide (mox) fuel, a mixture of plutonium and uranium oxide. This fuel could then be sold to utilities in Europe and Japan that are now paying companies in the UK and France to reprocess their fuel. In exchange, the U.S. would store the utilities' spent fuel. This path has two advantages, says the NRDC. It would put U.S. plutonium into a form that is not easily used in weapons. At the same time, it wold stop the world-wide build-up of civilian plutonium now taking place as a result of reprocessing.

Contaminated Soils and Sediments are the subject of Chapter 6. Specifically discussed are potential remediation techniques such as in situ, barriers, mechanical separation (such as air-sparged hydrocyclones, dissolved air flotation, etc.), soil washing, dust suppression, chemical extraction, covers and liners, ex situ vitrification, permeable barriers, grouting, soil freezing, electrokinetics, in situ vitrification, impoundments and landfill stabilization.

Thermal Processes are discussed in Chapter 7 with an emphasis on volume reduction obtained by destroying (combusting) the nonradioactive portion of low-level and mixed waste, allowing disposal of the radioactive portion as a much smaller volume. Several thermal processing techniques are discussed: incineration, supercritical water oxidation, plasma destruction and oxidation in molten salt media. Unfortunately, the discussion of each thermal process was very limited, especially the discussion of plasma technology. The chapter could have been tripled in size to be more useful.

Groundwater contamination is a problem common to hazardous chemicals and radioactive materials handling sites. The latter often results in groundwater contamination by radionuclides. Their removal by ion exchange extraction, precipitation, microbiology and membrane processes is discussed in Chapter 8.

Given that DOE facilities are aging and their mission is changing (and being reduced), the retirement of unneeded facilities is of importance. And retired equipment and buildings must necessarily be decontaminated. This task is the topic of Chapter 9.

It has been estimated that 3.1 million cubic meters of waste are located on DOE sites in trenches and pits, buildings, and storage units, approximately one half of that waste predates 1970 when disposal regulations were very different from today. The new regulations and problems caused by inadequate past disposal practices and their cleanup is a challenge to DOE. Other challenges, and the methods of meting them, are discussed in Chapter 10.

If wastes are retrieved (as discussed in the previous chapters), they have to be reburied; to do this, most of the contaminants in those wastes must be immobilized by incorporation into a stable host material. Various immobilization techniques, such as cementation (solidification), bitumen solidification, polymer encapsulation and vitrification are discussed in Chapter 11. Also discussed are thermal (melting) technologies such as joule heating, thermal process heating (incineration), plasma heating, microwave heating and electric arc furnace heating.

Chapter 23 discusses the remediation of mine tailings which are the primary residuals of uranium milling operations that separate uranium from uranium ore. These sites are being addressed pursuant to the 1978 act of the U.S. congress, the Uranium Mill Tailings Radiation Control Act (UMTRCA). The U.S. DOE is responsible for cleaning up mill sites. Cleanup processes being considered are in situ leaching, aquifer restoration, site reclamation, pile location and configuration and radon barriers.

High Level Waste Treatment is the topic of Chapter 13. Much of the DOE's high level waste is liquid waste stored in 332 underground storage tanks at DOE complexes. These tanks range in size from 5,0000 to 1,300,000 gal at five DOE sites.

The treatment of mixed waste which is radioactivity contaminated hazardous waste is the subject of the 14th chapter. DOE has more than 130,000 cubic meters of mixed waste stored at 48 sites in 22 states. Much of this waste is highly heterogeneous. Pretreatment processes discussed are incineration, plasma hearth furnace thermal treatment, steam reforming and vitrification, among others.

The final chapter (15) discusses low-level waste treatment. Included are discussions of volume reduction technologies and chemical treatment/conditioning technology.The book ends with approximately 60 pages of appendices devoted to:

1. DOE Long-Term Expenditures
2. DOE Addresses and Telephone numbers
3. Foreign Nuclear Waste Management Organizations and Activities
4. Acronyms
5. Biblioqraphy

GARY F. BENNETT

Hazardous Materials and Waste Management: A Guide for the Professional Hazards Manager, by N.P. Cheremisinoff and P.N. Cheremisinoff, Noyes Data Corp., Park Ridge, NJ, 1995, $54.00, 265 pp., ISBN: 0-8155-1372-0

In a gross understatement, the preface of the book notes that the management of hazardous materials and industrial waste is complex, requiring a high degree of knowledge over very broad technical and legal subject areas. Given that complexity, the Cheremisinoffs wrote this book as a desk reference for the Professional Hazards Manager, who has the responsibility of insuring that his/her facility is in compliance with environmental statutes and regulations. To do so requires a knowledge of the very complex aspects of federal, state and local environmental regulations and working knowledge of the best available remediation and pollution control activities and their cost.

The initial part of the book describes waste treatment systems — hazardous waste, wastewater, sludge and recovery systems. Of what use this material is I am not sure: the discussion is terribly basic and simplistic and **old** — I recognize many diagrams that have long rested in my files.