WASTE MANAGEMENT SYSTEM

Unit Purpose:

By the time students begin a study of "Waste Management System," they should have a good grasp of what high-level nuclear waste is and why it requires very long-term isolation from the accessible environment. The purpose of this unit is to explain how the elements of the overall management system – transportation, a geologic repository, and the multi-purpose canister – will work together to provide both short-term and long-term protection of people and the environment. Special attention is given to transportation safety and factors that will help students gain an appreciation for the complexity of a geologic environment.

Unit Concepts:

The key elements of the integrated system for high-level nuclear waste management are transportation, disposal at a geologic repository, and use of a multi-purpose canister for containing spent fuel.

1. The safe and permanent disposal of high-level nuclear waste is a complicated process, which involves many steps.
2. Every aspect of transporting high-level nuclear waste is regulated.
3. Spent fuel and high-level waste are potentially hazardous for thousands of years.
4. The high-level waste disposal system is required to include a system of multiple barriers that will protect the public from exposure to these wastes over a long period of time.
5. The repository will have surface facilities for waste handling and subsurface facilities for disposal.
6. A multi-purpose canister (MPC) could be used to store, transport, and dispose of spent fuel from nuclear powerplants.
7. Public meetings and press conferences are held by DOE to inform and involve the public in significant issues relating to the waste management program.

Duration of Unit:

Five 50-minute periods

Unit Objectives:

As a result of participation in this unit of study, the learner will be able to:

1. discuss the measures that ensure the safe transportation of high-level nuclear waste;
2. explain ways in which any geologic site can act as part of the multiple barrier system;
3. summarize the three elements that comprise the multiple barrier system;
4. describe and/or define various aspects of the design, construction, and operation plans for the geologic repository;
5. explain the purpose of the MPC;
6. list the advantages of the MPC;
7. identify concerns of stakeholders regarding the use of the MPC;
8. locate pertinent information in reference materials;
9. understand the issues/concerns of several groups holding a stake in the conceptual design of the MPC:

10. discuss the inportance of scientific understanding and communication for all groups involved in technological advances that affect society.

Unit Skills:

Analyzing, communicating, cooperating, describing, discussing, explaining, group dynamics, listing, matching, reading, roleplaying, summarizing, synthesizing

Unit Vocabulary:

Accessible environment, alloy, backfill, borehole, borosilicate glass, cask, cladding, Code of Federal Regulations (CFR), containment, contamination, corrosion, criticality, cumulative, drift, encapsulated, engulfed, full-scale, grout, host rock, hydrologic, overpack, multi-purpose canister (MPC), Nuclear Regulatory Commission (NRC), polymer, pour canister, shaft, simulated, staging, stakeholder, tuff, zeolites, zirconium

Unit Materials:

Reading Lessons

What Measures Ensure Safe Transportation of High-Level Nuclear Waste?, p. SR-1
What Will a Geologic Waste Repository Be Like?, p. SR-9
The Role of the Multi-Purpose Canister in the Waste Management System, p. SR-17

Activity Sheets

What Measures Ensure Safe Transportation of High-Level Nuclear Waste?, p. 141
What Will a Geologic Repository Be Like?, p. 143
What Is the Role of the Multi-Purpose Canister in the Waste Management System?, p. 147
You Are Invited... The Stakeholders Public Meeting, p. 149
Role Cards, p. 151
The Giventakenne Gazette (blank newspaper master, also available on computer diskette), p. 165

Masters for Transparencies

Where is Radioactive Material Shipped?, p. 127
Standards for Spent Fuel Casks, p. 129
Factors Considered in Selecting Highway Routes, p. 131
Information Provided to States and Indian Tribes about Shipments of Radioactive Materials, p. 133
U.S. Department of Energy Regional Coordinating Offices Emergency Operations Centers, p. 135
Multiple Barriers, p. 137
Rock Strata, p. 139

Videotapes

Engineered for Safety (26 minutes)
The U.S. Department of Energy Office of Civilian Radioactive Waste Management Multi-Purpose Canister System (Order from the OCRWM Information Center, 1-800-225-NWPA)

Fitting the Pieces (12 minutes 45 seconds)
The Science of Yucca Mountain (14 minutes)
Clips from the 1992 and 1994 Nationwide Teacher Teleconferences
(Available free of charge from the OCRWM National Information Center, 1-800-225-6972; within Washington, DC, 202-488-6720)

Enrichment Activities/Readings

Designing for Safety, p. 19
Transporting Hazardous Materials, p. 23
Rock Characteristics Important in Repository Siting, p. 25
Porosity and Permeability, p. 35
Solubility, p. 47
Mineral Solubility, p. 55
Thermal Stability, p. 63
Ion Exchange and Zeolites, p. 71
Topographical Map Skills Part 1, p. 79
Topographical Map Skills Part 2, p. 95
Crossword Puzzle, p. 249
Metric and U.S. Unit Conversions, p. 253

Other

Demonstration/experiment supplies (See individual activity sheets)