U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

U.S. Regulatory Program for Low-Level Waste Management and Disposal

Meeting on Development and Review of Romania's Predisposal Waste Management Regulations

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Topics

- Introduction
- International Context for U.S. Program
- LLW Authorities and responsibilities
- Sources and amounts of LLW currently generated
- NRC responsibilities in regulation of LLW
- 10 CFR Part 61 disposal regulation
- NRC LLW resources
- Summary and Conclusions

Introduction

- U.S. has a long history of producing nuclear fuel cycle wastes—more than forty years of commercial nuclear power production and isotope use—and with the safe management of these wastes
- U.S. has a comprehensive set of laws and regulations for the regulation of nuclear materials and wastes, involving multiple organizations
- LLW is being safely managed and disposed of
- National developments in LLW require responses by NRC regulatory program

Introduction Cont'd

- Waste classification in U.S. is largely based on the origin of waste
- U.S. has approximately 20,000 civilian users of radioactive materials. Some produce LLW that requires long term isolation from the environment
- There are currently 100 nuclear power plants in operation, and 17 undergoing decommissioning

International Context

- The IAEA Safety Standards are not binding on Member States, but are mandatory for States receiving assistance.
- U.S. actively participates in IAEA standards development.
- The United States has not adopted the IAEA standards, but the U.S. program is generally consistent with those standards.

Roles & Responsibilities of U.S. Agencies

EPA—sets generally applicable standards for radioactivity in the environment. Issues Federal radiation guidance.

NRC is an independent agency responsible for implementing EPA standards In regulations in commercial applications

DOE's overarching mission is to advance the national, economic, and energy security of the U.S.

Low-Level Waste Authorities and Responsibilities

- Governing legislation
  - Atomic Energy Act of 1954
  - Low-Level Radioactive Waste Policy Amendments Act of 1985

- NRC responsibilities under AEA and LLRWPAA
  - Regulatory framework for LLW disposal
  - Assistance to NRC Agreement States
  - Currently regulate all LLW disposal sites in U.S. and majority of LLW generators and waste processors

LLW Authorities and Responsibilities (continued)

- Agreement States
  - States may enter into agreements with the NRC to regulate possession and use of source, by-product and small quantities of special nuclear material within their borders (Agreement States)
  - 37 Agreement States regulate approximately 90% of the specific material licenses and more than 100,000 general licenses. Agreement States do not regulate reactors, however.
  - All commercial LLW disposal sites and most waste processing facilities are regulated by Agreement States

- LLRWPAA
  - Framework for development of new disposal capacity
  - States responsible
  - Regional compacts
  - Exclusion of out-of-region waste
  - Federal responsibility for GTCC LLW disposal

Two Different State Roles in Commercial LLW Disposal

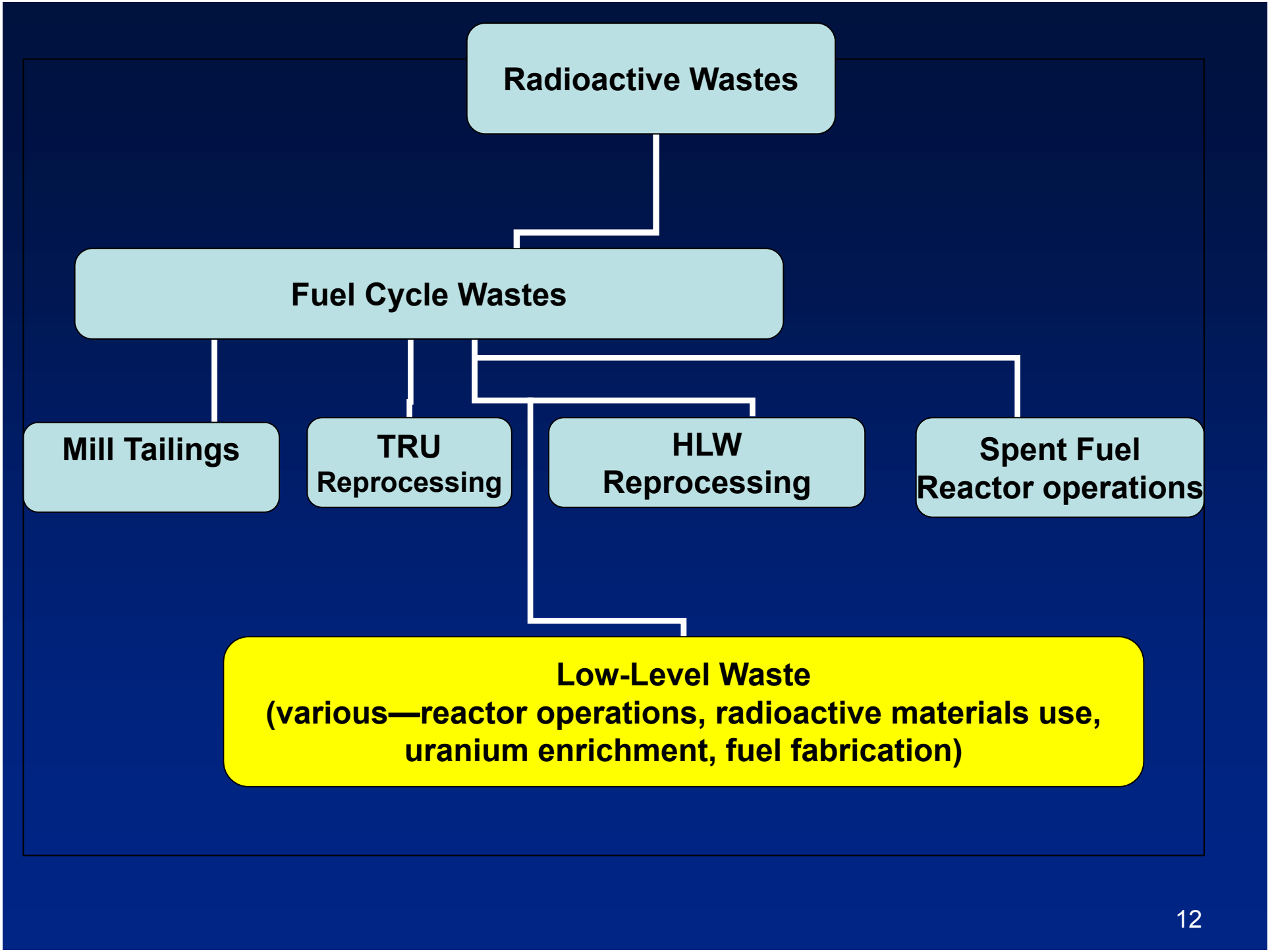
- NRC Agreement States regulate the use of radioactive materials in their States (universities, hospitals, etc.) *to ensure safety*
- NRC Agreement States also regulate all of the operating commercial LLW sites to ensure safety
- States have also entered into LLW compacts, and have the authority to regulate the *import and export* of LLW from the Compact.
- There is no relationship between States that have joined Compacts and those that are Agreement States.

Low-Level Radioactive Waste

- Almost all U.S. LLW is disposed of in near surface disposal facilities
- Two basic types of facilities are used:
  - AEA approach—performance objectives, variations based on climate and geology, e.g.
  - Resource Conservation and Recovery Act (RCRA) approach—based on hazardous waste disposal requirements. Explicit engineering and construction criteria specified by EPA in its regulations.
- Both approaches can contain and isolate waste to protect public and the environment

AEA (commercial) Low-Level Waste Facilities

- Shallow land disposal specified
- 25 mrem/yr (0.25 mSv/yr) performance standard for radiation exposure to a member of the public
- Three other performance objectives for intruder protection, public protection during operations, and stability of the site
- Some detailed criteria -- waste form, site features, waste classification


Radioactive Wastes
Fuel Cycle Wastes
Mill Tailings
TRU
Reprocessing
HLW
Reprocessing
Spent Fuel
Reactor operations
Low-Level Waste
(various—reactor operations, radioactive materials use,
uranium enrichment, fuel fabrication)

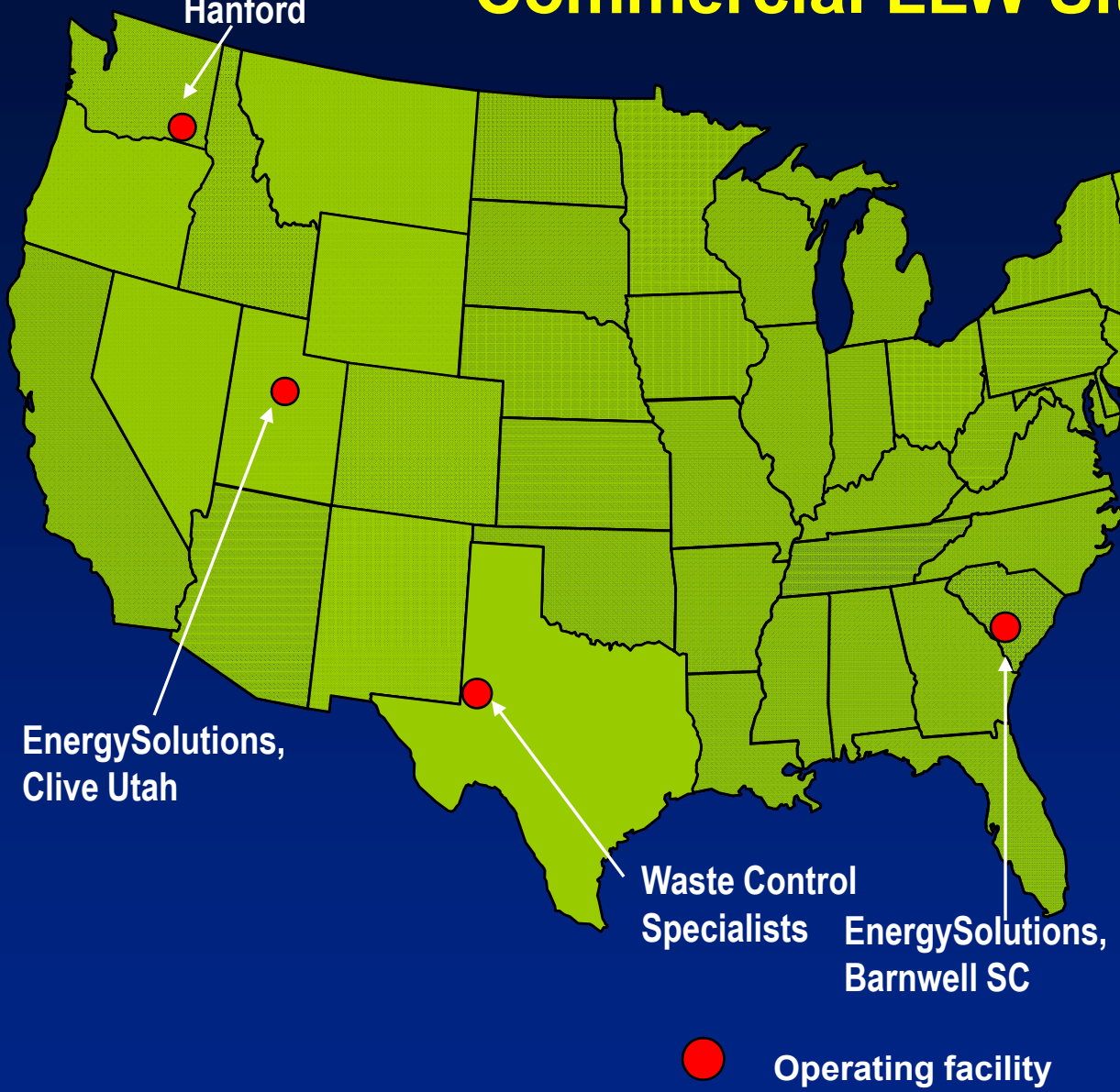
Current LLW Generation in U.S.

- Nuclear power reactors
  - 100 operating, 11 shut down
  - Only 4 plants in active decommissioning
- Research and test reactors
  - 31 operating, 11 in decommissioning
- Fuel cycle facilities
  - 7 major fuel cycle facilities, one undergoing partial decommissioning
- Materials users
  - 20,000+ total
  - A fraction generates LLW for disposal

Current Commercial LLW Generation Rates

Waste Category	Examples	Annual Generation Rate, ft^3/yr	Disposal Options
GTCC	Sealed sources, activated metals from NPP's	Several thousand	None
Class B/C	NPP resins, activated metals, sealed sources	About 10X GTCC volumes	Limited
Class A	Decommissioning debris, steam generators, dry active waste	About 1000X GTCC volumes	Licensed disposal sites
Low-activity waste	Decommissioning debris, contaminated soil	On same order as Class A Volumes	Hazardous waste facilities and landfills

Commercial LLW Sites in U.S.



Facility	Waste	Compact Restrictions
Hanford, WA	Class A, B, C	11 western states in 2 LLW Compacts only
Clive, UT	A only	None, all US generators OK (NW and RM Compacts must approve)
Barnwell, SC	A, B, C	SC, NJ, CT as of mid-2008 (Atlantic Compact)
Andrews Cty, Texas	A, B, C	Texas and VT only (Texas Compact)

Barnwell LLW Disposal Site

Core Responsibilities

- Regulatory framework for LLW disposal
- Assistance to NRC Agreement States and other stakeholders
- LLW licensing, as necessary, esp. for GTCC facility and import/export

10 CFR Part 61 – Purpose and Scope

- Establishes, for land disposal of radioactive waste, the procedures, criteria, and terms and conditions upon which the Commission issues licenses for the disposal of radioactive wastes containing byproduct, source, and special nuclear materials.
- The regulations in Part 61 do not apply to: (i) disposal of spent fuel HLW as provided in Part 60 or Part 63; and (ii) disposal of U/Th tailings or wastes;
- Was developed in response to problems at operating LLW sites in the U.S. in the 1970's.
- Agreement States have adopted similar regulations for LLW disposal.

Waste Classification Table 2
10 CFR 61.55

Radionuclide	Concentration, Ci/m^3		
	Col. 1 (Class A limit)	Col. 2 (Class B limit)	Col. 3 (Class C limit)
Total of all radionuclides with < 5 yr half-life	700	n/a	n/a
H-3	40	n/a	n/a
Co-60	700	n/a	n/a
Ni-63	3.5	70	700
Ni-63 in activated metal	35	700	7000
Sr-90	0.04	150	7000
Cs-137	1	44	4600

If concentration does not exceed column 1, waste is Class A. If concentration is > col. 1 and < col. 2, waste is Class B. If concentration is > col. 2 and < col. 3, waste is Class C. If > col. 3, waste is not acceptable for near-surface disposal

Summary and Conclusions

- U.S. has a large number and variety of generators of LLW
- U.S. has extensive regulatory program for ensuring safe management and disposal of LLW
- NRC and Agreement States have major roles

Policies, Practices and Scope

National Policy is safe permanent geologic disposal of spent fuel, high-level waste radioactive waste and transuranic waste, and surface or subsurface disposal of low-level radioactive waste and mill tailings to ensure long-term containment and isolation from the environment.

Typical ISFSI

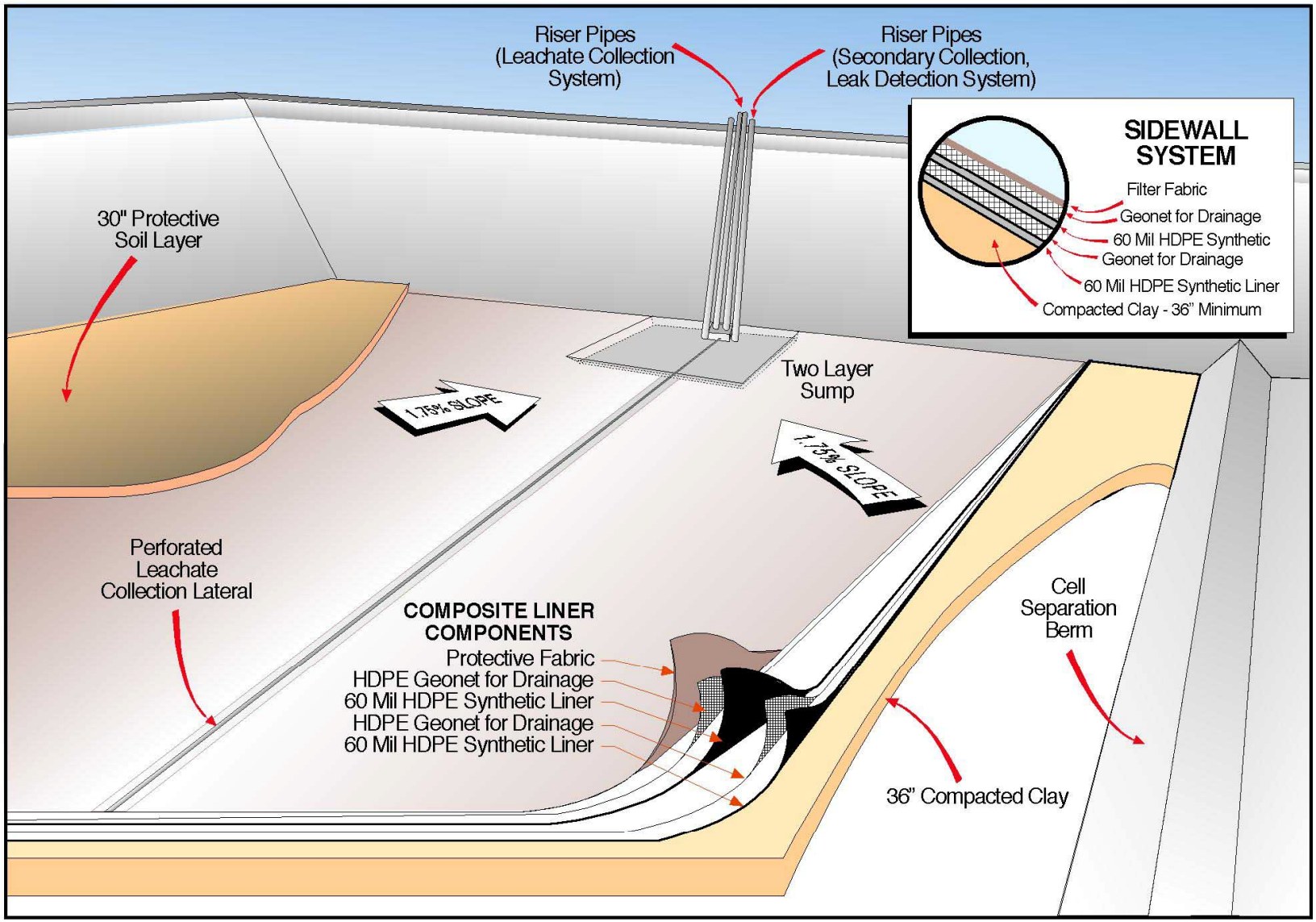
Hazardous Waste Facilities

- Containment and technology may be suitable for low-activity LLW
- Technology used
  - Disposal cell cap to minimize infiltration and erosion, promote drainage, and accommodate settling and subsidence
  - Liner system beneath cell
  - Leachate collection and removal system
  - Leak detection system
- Used for LLW disposal by DOE under CERCLA law

Hazardous Waste Disposal Facility

Grand View, Idaho Facility
Photo courtesy of U.S. Ecology

Hazardous Waste Cell 15 Design



Waste Classification in U.S.

- U.S. system for waste classification developed before IAEA Safety Guide was published.
- U.S. system similar but not identical to IAEA.
- DOE and NRC systems similar but not identical

Comparison of US vs. IAEA Waste Classifications

Table B-1. Correspondence of U.S. Commercial Radioactive Waste Classifications with IAEA Proposed Waste Classifications

Commercial Waste Class	IAEA[1] HLW	IAEA LILW-LL	IAEA LILW-SL
HLW	100%		
Greater than Class C LLW		100%	
Class C LLW		25%[2]	75%
Class B LLW			100%
Class A LLW			100%

Table B-2. Correspondence of U.S. DOE Radioactive Waste Classifications with IAEA Proposed Waste Classifications [3]

DOE Waste Class	IAEA[1] HLW	IAEA LILW-LL	IAEA LILW-SL
HLW	100%		
TRU		100%	
LLW		0.5%	99.5%

[1] IAEA, Classification of Radioactive Waste; A Safety Guide, Safety Series No. 111-G-1.1.

[2] A reasonable estimate of the split of Class C waste into the IAEA categories is by the fraction of waste classified as Class C by long-lived radionuclides per 10CFR61.55 Table 1 to compare with IAEA LILW-LL. Percentages determined based on commercial disposal data for 1998–2000.

[3] IAEA, Classification of Radioactive Waste; A Safety Guide, Safety Series No. 111-G-1.1

Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA)

- In 1970s many uranium mills were shut down and tailings were unstabilized
- Congress passed the Uranium Mill Tailings Radiation Control Act of 1978 to ensure tailings were stabilized and controlled
- For inactive sites, DOE to remediate with NRC concurrence (known as “Title I sites”)
- For active sites, EPA to set environmental standards to be implemented by NRC or Agreement States (Known as “Title II sites”)
- NRC regulations in App. A to 10 CFR Part 40