NEA Expert Roundtable

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U.S. Perspective on Developing Safety Cases for Various Radioactive Waste Disposal Facilities

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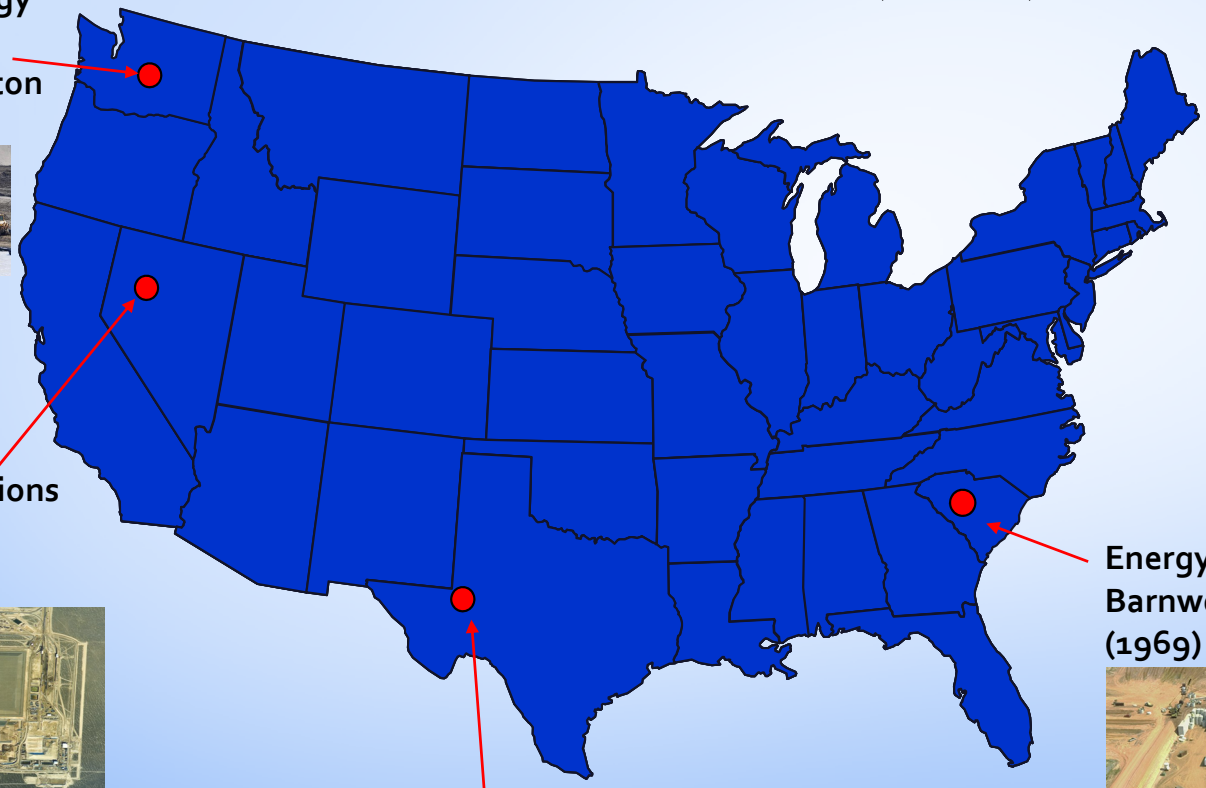
Major Considerations of a Near-Surface Safety Case

- Waste Hazard Considerations
- Role of Engineering for 'Short-lived' (half-life <~30 years) Radionuclides
- Utilization of Features, Events and Processes (FEPs)
- Lessons Learned from Early U.S. Experience
- Human Inadvertent Intrusion
- Community Outreach
- Regulatory Oversight Considerations

Current U.S. Commercial Low-Level Waste (LLW) Sites

US Ecology
Hanford,
Washington
(1965)



EnergySolutions
Clive, Utah
(1990)

Waste Control Specialists
Andrews, Texas (2012)

EnergySolutions
Barnwell, South Carolina
(1969)

All 4 sites regulated by Agreement States

Rough Comparison between IAEA and US NRC Waste Categories

International Atomic Energy Agency Waste Categories	U.S. Waste Categories
High-Level Waste	High-Level Waste
Intermediate-Level Waste	Greater-than-Class C LLW
Low-Level Waste (LLW)	Class A, Class B and C LLW
Very Low-Level Waste	Class A
Very Short-Lived Waste	Material held for decay storage
Exempt Waste	Liquids/Air: Effluent releases Solids: Case-by-case analysis

Waste Hazard Considerations

- Wide Variety of Inventory
  - Large scope of nuclear activities
  - Wide variety of waste treatment methods
- Waste Form
  - Durability
  - Impact on retention and release of radionuclides
- Waste Volume
- Mix of Radionuclides of Interest

Cell Operations at Waste Control Specialists, Andrews County, Texas

Role of Engineering to Contain 'Short-Lived' Radionuclides

- Most facilities rely on a combination of features to contain 'short-lived' radionuclides, including:
  - Site Characteristics
  - Waste Form
  - Disposal Cell Design
  - Engineered Covers
- Concentrations in waste may be controlled by operational considerations

FEPs in Near-Surface Disposal

- FEP Analysis coupled with Barrier Analysis is important in near-surface disposal
- Supports conceptual model development
- Supported by early regulations (e.g., 10 CFR 61.12 requires specific technical information)
- Hazard profile with time along with being in the biosphere leads to different primary FEPs (vs geologic disposal facilities)

Lessons Learned from Early Experience in the U.S. for Near-Surface Performance Issues

Hydrology Issues

- Water Retention in Disposal Cells -> 'Bathtubbing'
- Unidentified Fast Flow Groundwater Paths

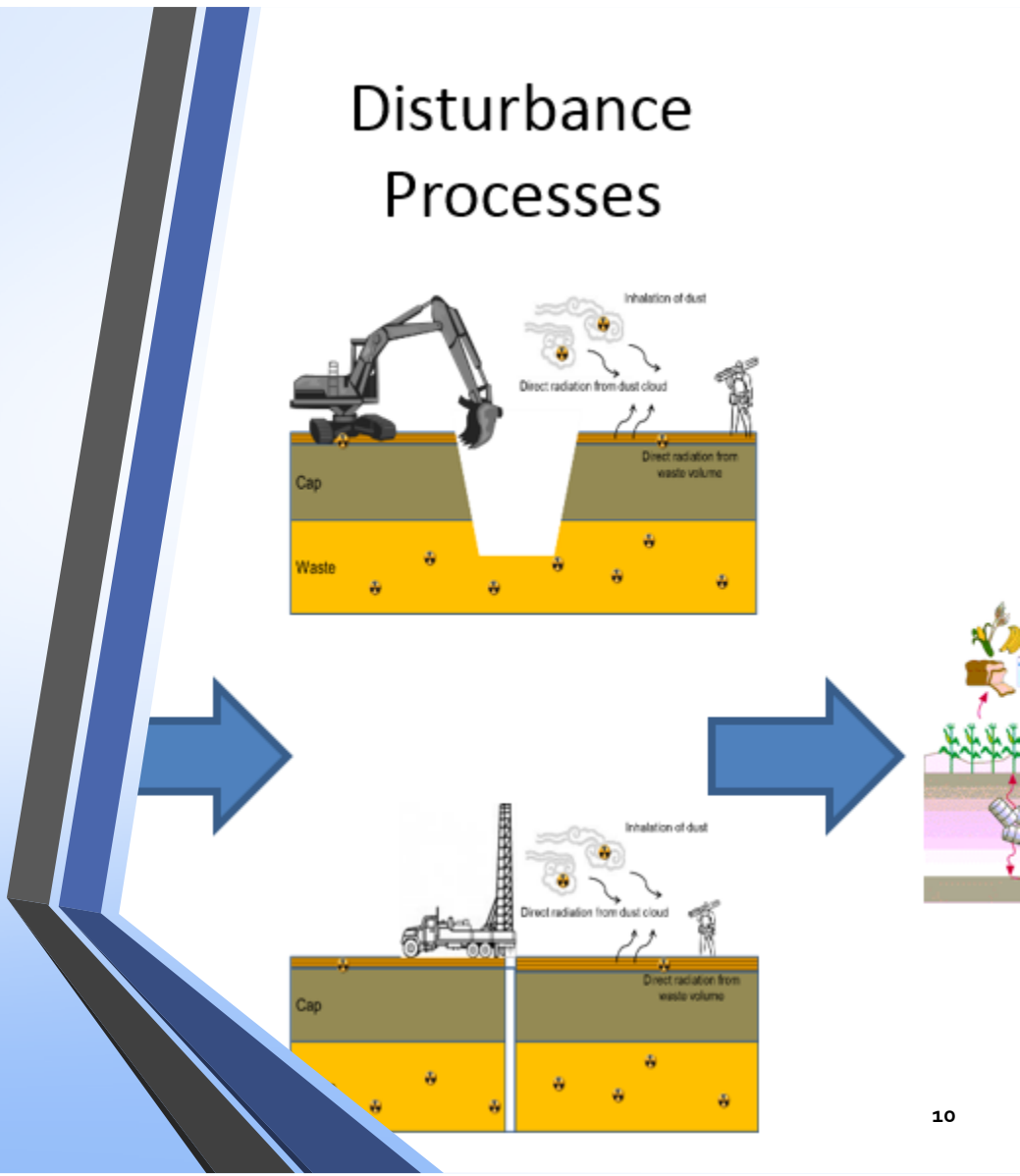
Waste Inventory Concerns

- Appropriate Concentration Limits
- Waste Forms
- Presence of Hazardous Material
- Presence and Treatment of Liquids

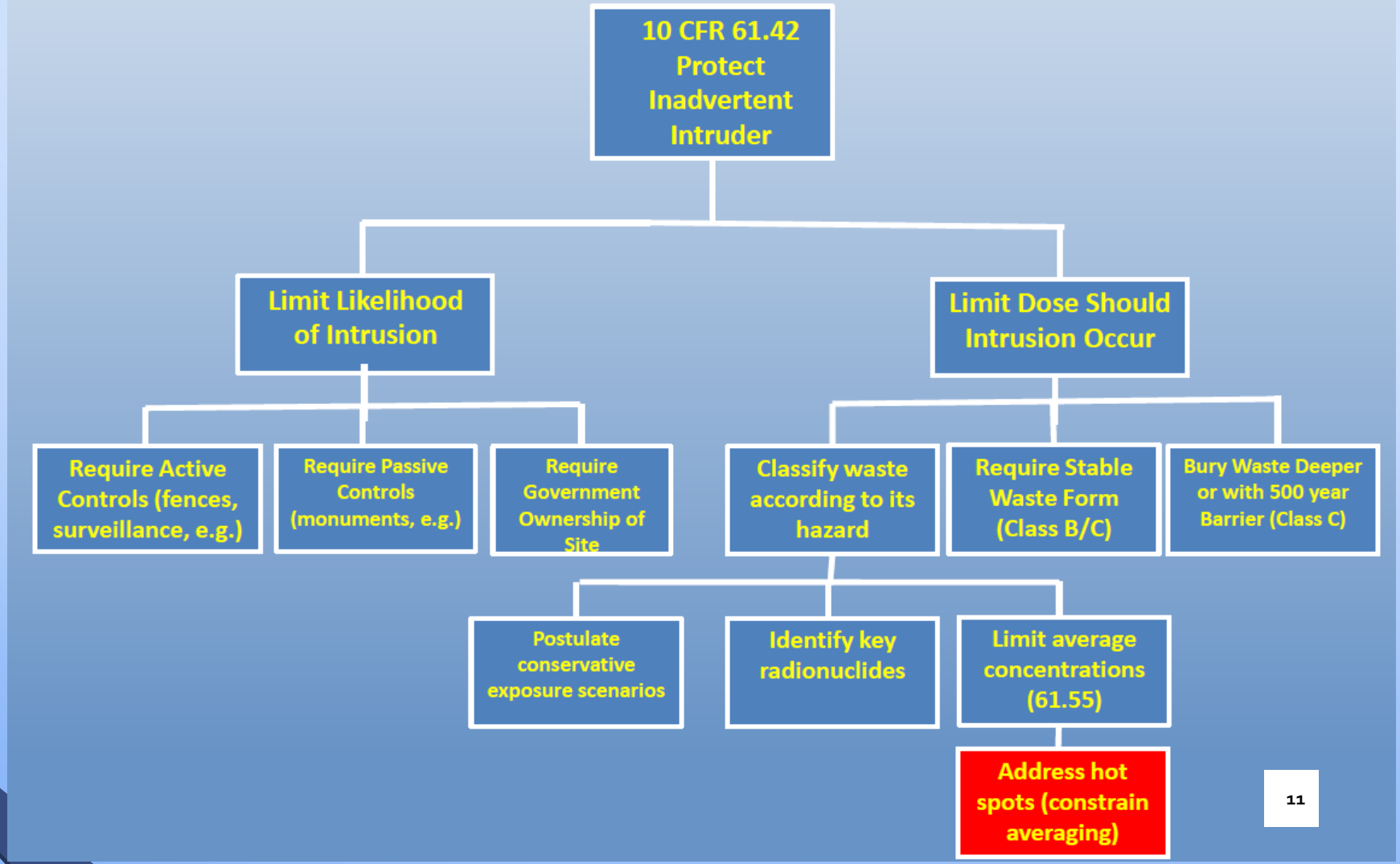
See NUREG-1853, "History and Framework of Commercial Low-Level Radioactive Waste Management in the United States", https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1853/index.html

Human Intrusion Scenarios

- Near surface more accessible for potential intrusion
- Loss of knowledge of sites still an issue with near surface disposal
- Larger variety of methods of disturbance



Human Intrusion



Community Outreach and Involvement

- Most of the outreach managed by the licensee/developer/operator
  - May establish citizen advisory panels
  - Work with local organizations
- Regulators focus
  - Explaining regulations and allowing public comment
  - Identifying hearing opportunities
  - Discussing the decision-making process
  - Announcing review findings and decisions

Regulatory relationship between U.S. Federal and Agreement States

NRC

- Establishing generic regulations and guidance
- Providing technical assistance, if requested by the State requests
- Evaluate general approaches to new waste streams
- Evaluate State programs for consistency
- License material not part of State agreements

State programs

- License and oversight of material within their State
- Assist in evaluating other State and national program for consistency

Conclusions

Safety cases for near-surface have same range of considerations as high-level waste

- Inventory
- Site Conditions
- Engineering
- Need for Community Outreach

Differences include

- Additional Focus on Inadvertent Intrusion
- Lessons Learned from Previous Sites' Operations

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