The Role of Science Supporting the Waste Isolation Pilot Plant

Peter Swift
Sandia National Laboratories

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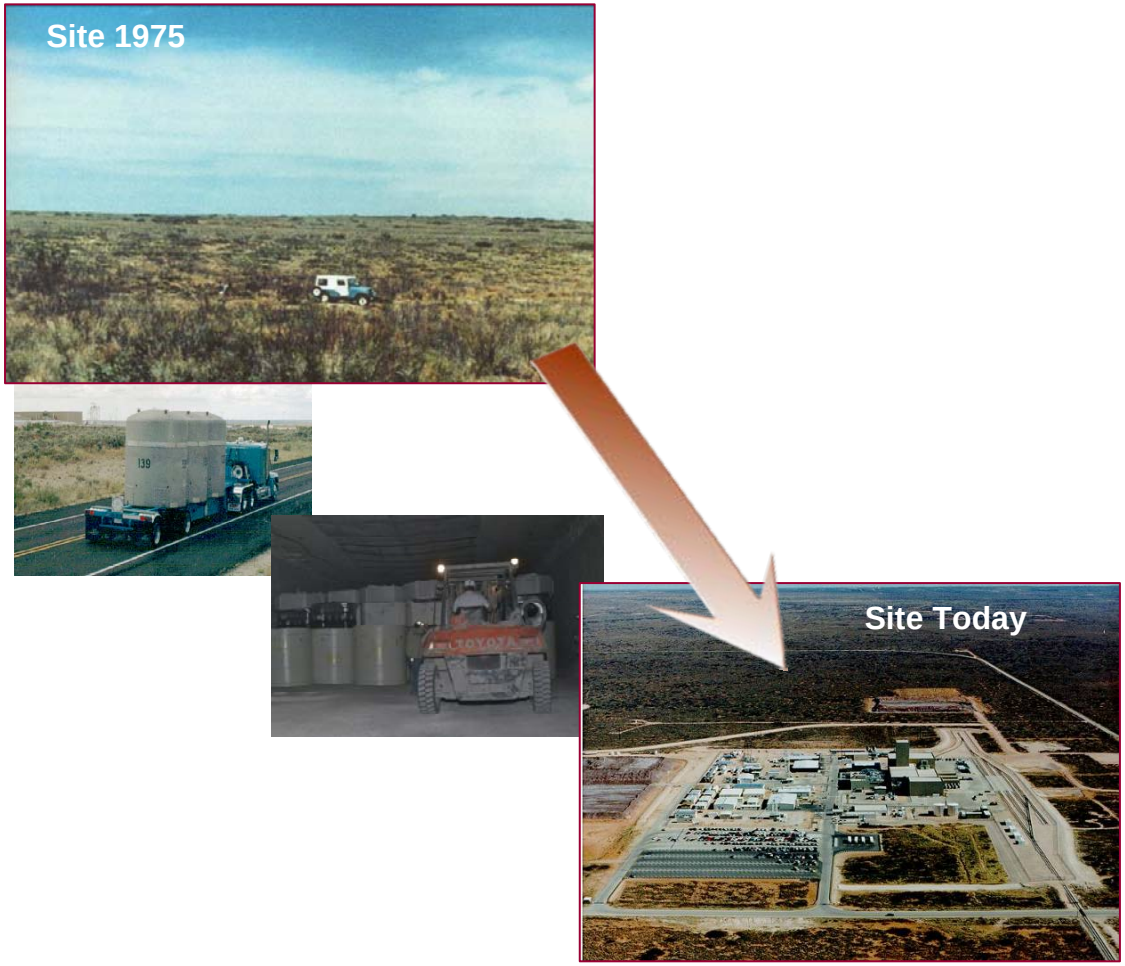
Outline

- Role of science programs supporting the Waste Isolation Pilot Plant (WIPP) Project
- Regulatory requirements for long-term isolation
  - U.S. Environmental Protection Agency (EPA)
    - 40 CFR part 191 and 40 CFR part 194
- Evaluating long-term performance for EPA certification

Science Supporting WIPP



- **Continuity in leadership for science programs 1975-present**
- **Site selection, site characterization and design 1975-1993**
- **Regulatory certification 1994-1998**
- **Science supporting operations and recertification 1998-present**

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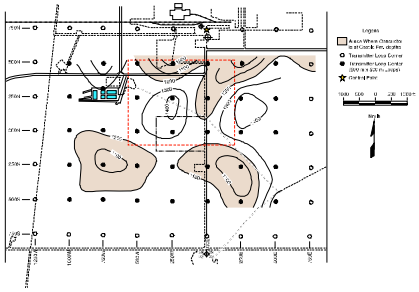
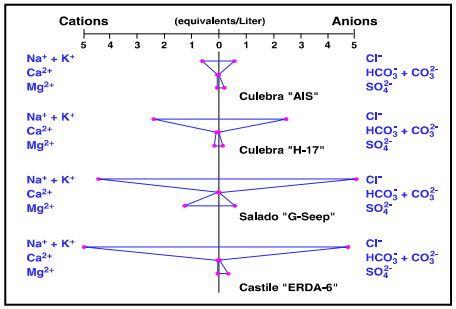
WIPP Site Characterization and Design

Geologic studies

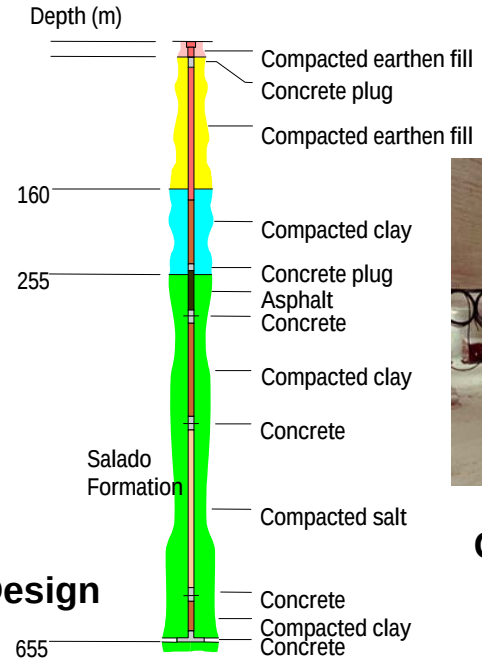


Geophysical surveys

Hydrologic testing

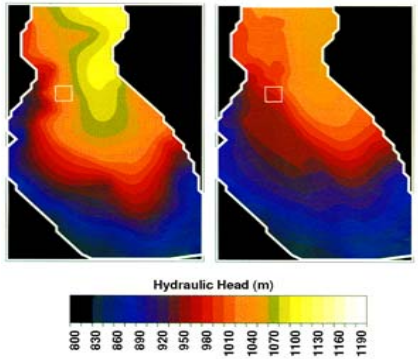


Geochemical sampling and analysis



Seal Design

Geomechanical testing



Numerical modeling

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WIPP Regulations for Long-term Performance

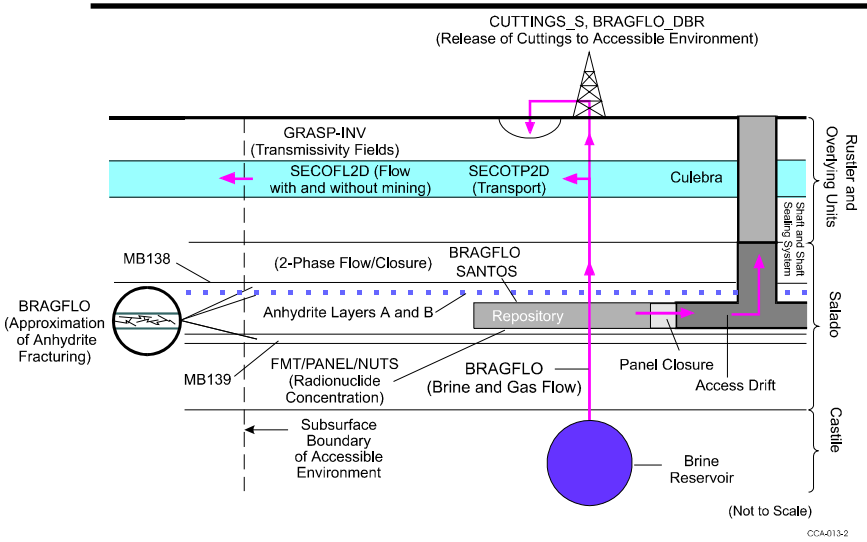
40 CFR part 191 (1985, revised 1994)

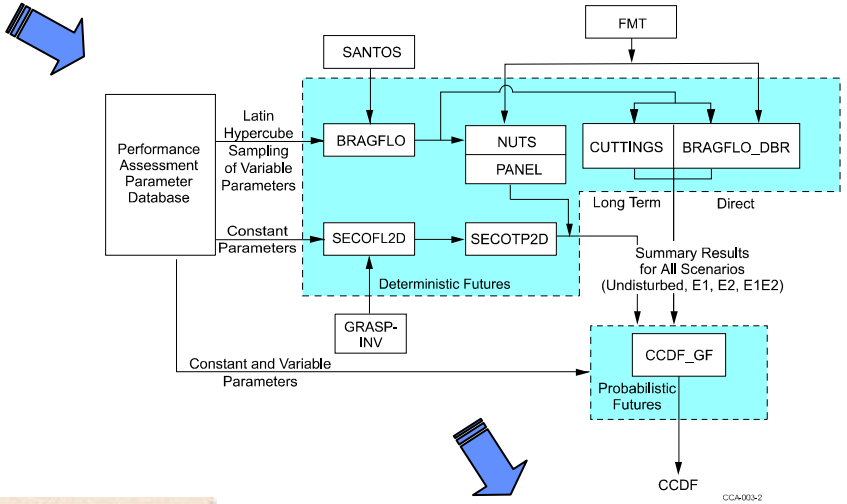
- **Compliance is based on "reasonable expectation"**
- **10,000-yr Containment Standard (cumulative release)**
  - **Requires consideration of human intrusion**
  - **Release limits normalized to initial inventory**
  - **Cumulative limits remove uncertainty associated with exposure pathways and future human lifestyles**
- **10,000-yr Individual Protection Standard (15 mrem/yr)**
  - **Undisturbed performance only (no intrusion)**
- **10,000-yr Groundwater Protection Standard**
  - **Undisturbed performance only (no intrusion)**

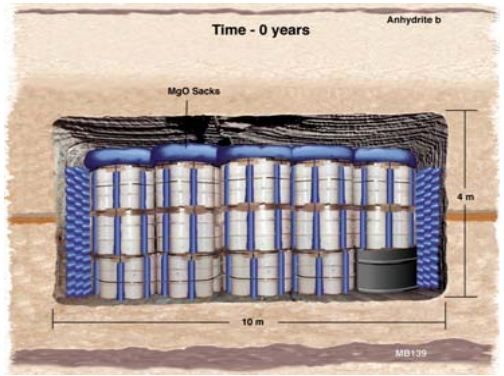
40 CFR part 194 (1996, WIPP-specific implementation)

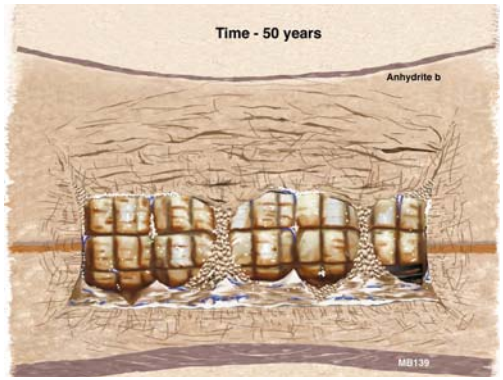
- **Provides framework for certification**
- **Specifies approach to determining rate of future human intrusion**

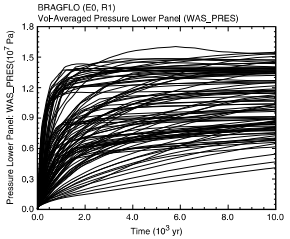
Evaluating Long-Term Performance











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WIPP Overall Performance Summary

- Essentially no 10,000-yr releases are anticipated from undisturbed performance
- Uncertainty in natural and engineered systems contributes little to uncertainty in overall performance
  - i.e., the site performs very well under a broad range of conditions
- Modeled performance is most sensitive to assumptions about future human actions
- Estimated releases from human intrusion are well below EPA Containment Standard

Concluding Thoughts on the Process of Developing a Disposal System

- Establish the regulatory framework
- Build confidence in the scientific foundation
  - Viable concept and a good site
  - Sound science
  - Sound analysis, full documentation
  - Independent external review
    - New Mexico Environmental Evaluation Group
    - National Academy of Science WIPP Committee
    - International Peer Review
- The regulator has a critical role

backup

WIPP Transuranic Waste

- **Derived from defense-related activities**
  - **Laboratory and industrial trash contaminated with transuranic radionuclides**
- **175,000 m^3 total volume (~820,000 drums)**
  - **Primarily alpha-emitting radionuclides, relatively little gamma emission**

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Dose vs. Cumulative Release Standards

- **Mean Annual Dose**
  - **Emphasis on low annual dose or risk**
  - **Can be open-ended in time (or to peak dose)**
  - **Uncertainty in human behavior (e.g., water use and diet) is large**
  - **Encourages dilution and gradual release as well as isolation**
  - **Encourages smaller initial inventories in multiple repositories**
- **Cumulative Release**
  - **Emphasis on isolation**
  - **Meaningful only for specified time period**
  - **Allowable limit is a function of time**
  - **Focuses on uncertainty in barrier system performance**
  - **No benefit for dilution**
  - **Normalization to initial inventory (as in 40 CFR 191) removes incentive for smaller repositories**