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NRSB June 2024: Spent Nuclear Fuel and High Level Waste.

DOE NE-8

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Spent Fuel & High Level Waste Disposition
U.S. Department of Energy

TIMELINE HISTORY OF DEEP GEOLOGIC REPOSITORY PROGRAM

1950s
Active investigation began on the concept of mined geological repositories for disposal of radioactive waste

1970s
U.S. studied feasibility of reprocessing commercial spent nuclear fuel to extract plutonium; approach later canceled, leaving disposal as primary option for managing radioactive waste.

1980
DOE issued the final environmental impact statement: *Management of Commercially Generated Radioactive Waste.*

1981
DOE issued a record of decision announcing its determination to pursue mined geologic disposal for spent nuclear fuel and high-level radioactive waste.

1982
Congress passed the Nuclear Waste Policy Act, establishing a site-selection process for a geologic repository.

1986
DOE issued environmental assessments for five potential sites; recommended three of the five sites for characterization. President Reagan approved the recommendations.

1987
Congress amended the Nuclear Waste Policy Act to direct DOE to characterize only Yucca Mountain as a potential repository.

1995
DOE issued a notice of intent to prepare the Yucca Mountain Repository environmental impact statement.

1999
DOE issued draft Yucca Mountain Repository environmental impact statement.

2001
DOE issued supplement to the draft environmental impact statement. DOE issued documents relevant to site suitability and a potential site recommendation.

2002
DOE issued final Yucca Mountain Repository environmental impact statement. DOE made site suitability determination and recommendation.

2008
DOE submitted a license application to the Nuclear Regulatory Commission.

2010
Yucca Mountain Repository funding ceased.

Program put on pause.

Program ceased before DOE received construction authorization.

Program ceased before repository emplacement operations began.

2024
Federal consolidated interim storage facility (CISF) critical design (CD-0) granted.

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Taxpayer Liability for Spent Nuclear Fuel*

Fiscal Year Ending	DOE's Estimate of Total Liability	Amount Paid from Taxpayer Funded Judgment Fund		DOE's Estimate of Remaining Liability (Total less Amount Paid)
		Cumulative	Annual	
9/30/2023	$ 44.7 Billion	$ 10.6 Billion	$ 500 Million	$ 34.1 Billion
9/30/2022	$ 41.1 Billion	$ 10.1 Billion	$ 1.1 Billion	$ 31.0 Billion
9/30/2021	$ 39.9 Billion	$ 9.0 Billion	$ 400 Million	$ 30.9 Billion
9/30/2020	$ 39.2 Billion	$ 8.6 Billion	$ 600 Million	$ 30.6 Billion
9/30/2019	$ 36.5 Billion	$ 8.0 Billion	$ 600 Million	$ 28.5 Billion
9/30/2018	$ 35.5 Billion	$ 7.4 Billion	$ 500 Million	$ 28.1 Billion
9/30/2017	$ 34.1 Billion	$ 6.9 Billion	$ 800 Million	$ 27.2 Billion
9/30/2016	$ 30.8 Billion	$ 6.1 Billion	$ 800 Million	$ 24.7 Billion
9/30/2015	$ 29.0 Billion	$ 5.3 Billion	$ 800 Million	$ 23.7 Billion
9/30/2014	$ 27.1 Billion	$ 4.5 Billion	$ 800 Million	$ 22.6 Billion

* Source: DOE Nuclear Waste Fund Annual Financial Statement Audit Reports. Over time, these estimates have been based on varying assumptions including when DOE would begin removing commercial spent nuclear fuel from reactor sites. During the ten-year window covered by the table, the date has been pushed out ~ 17 years. In FY 2023, DOE utilized a range approach for "subsequent license renewals" – the numbers in the table above represent the low end of the range.

U.S. Stakeholders

1. Commercial Spent Nuclear Fuel ~ 140,000 tons

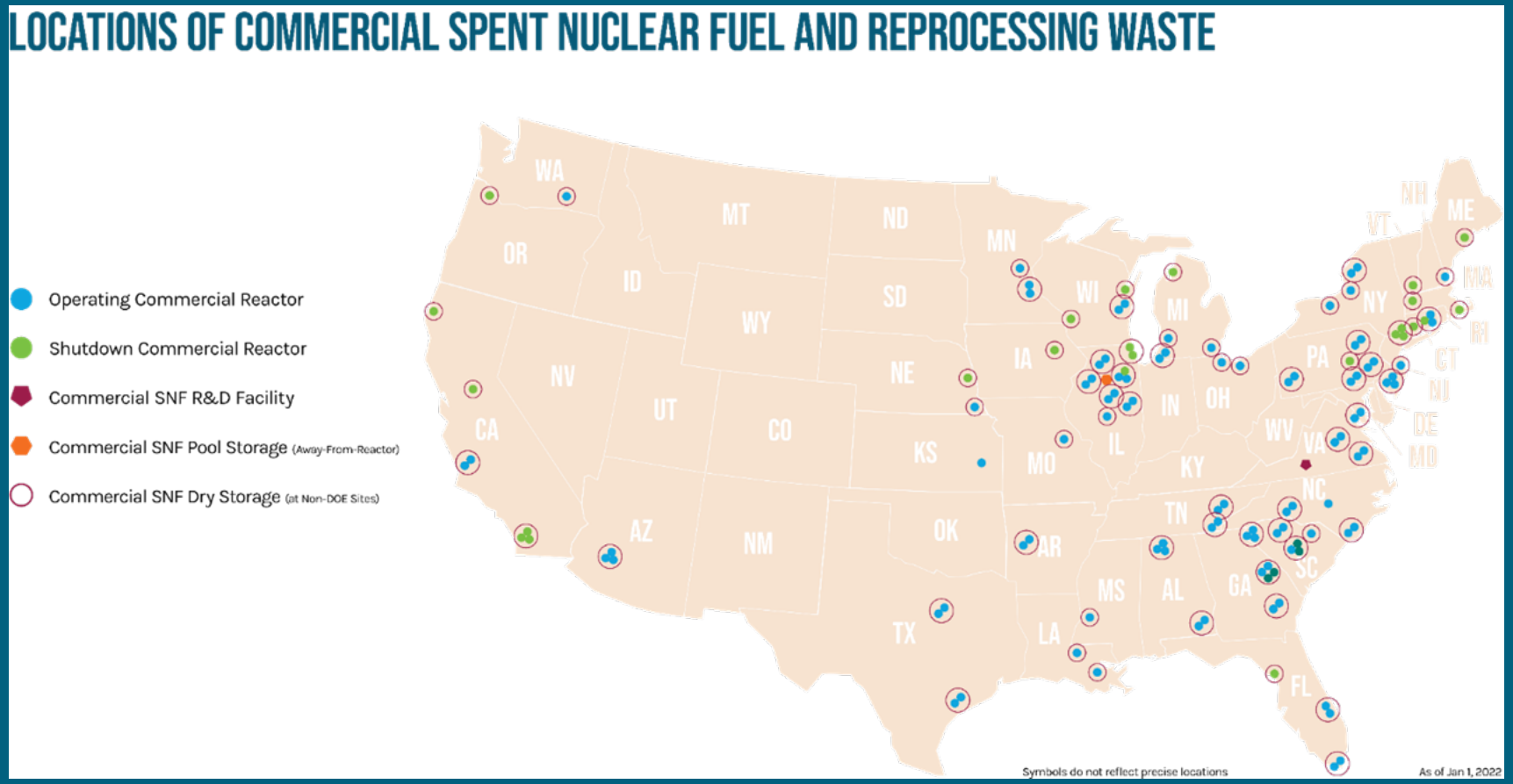
2. DOE Environmental Management High Level Waste from:
   - Vitrified HLW from DOE EM clean-up sites., ~21,000 canisters of vitrified waste.

3. Naval Reactors Spent Nuclear Fuel

4. DOE Spent Nuclear Fuel
   - Hanford., Idaho, Savannah River.

5. Advanced Reactors Spent Nuclear Fuel

U.S. Spent Nuclear Fuel In Context



1958
United States began using commercial nuclear power

2023
93 operating commercial reactors at 53 nuclear power plant sites in 28 states

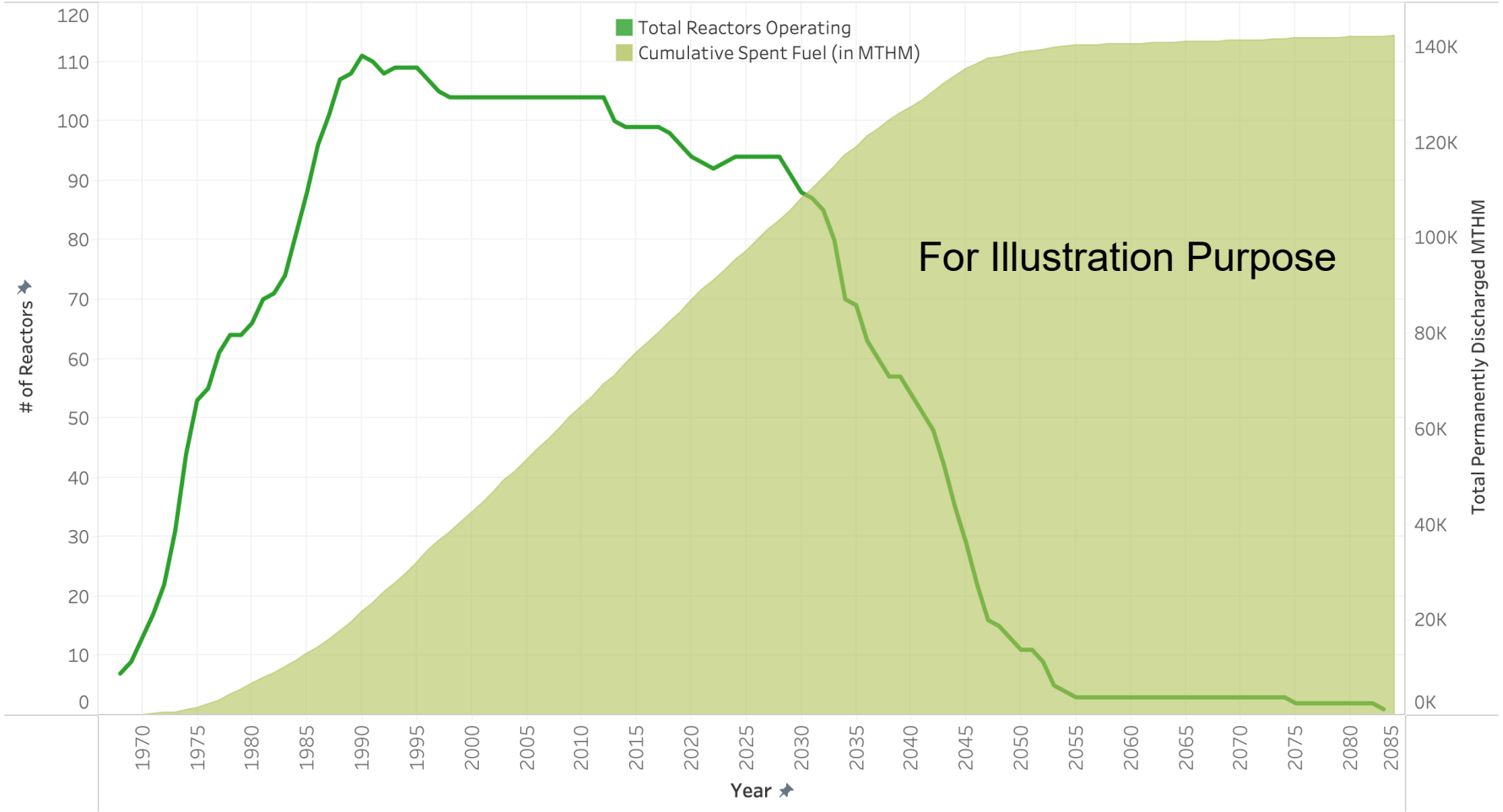
- 20 nuclear power plants have shut down
- 90,000+ metric tons of spent nuclear fuel

End of Current Fleet
United States estimated to have ~140,000 metric tons of spent nuclear fuel

Who is responsible for the management of SNF?

Total Reactors Operating vs Cumulative Spent Fuel

Commercial Reactors in the United States; Including Vogtle 3 and 4; 60-Year operating life is assumed for currently operating reactors except six reactors that obtained license extension to 80 years



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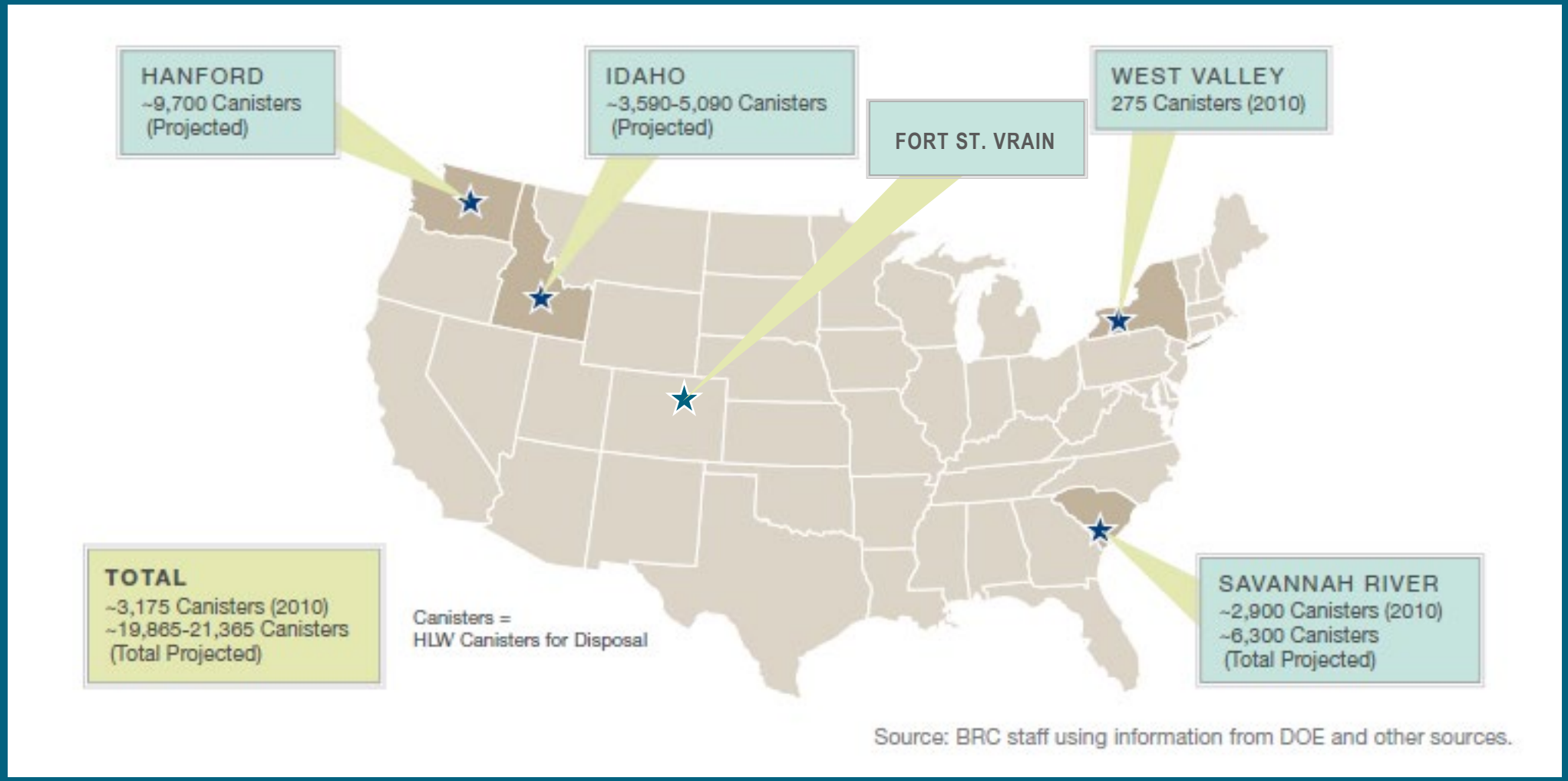
DOE SNF and HLW



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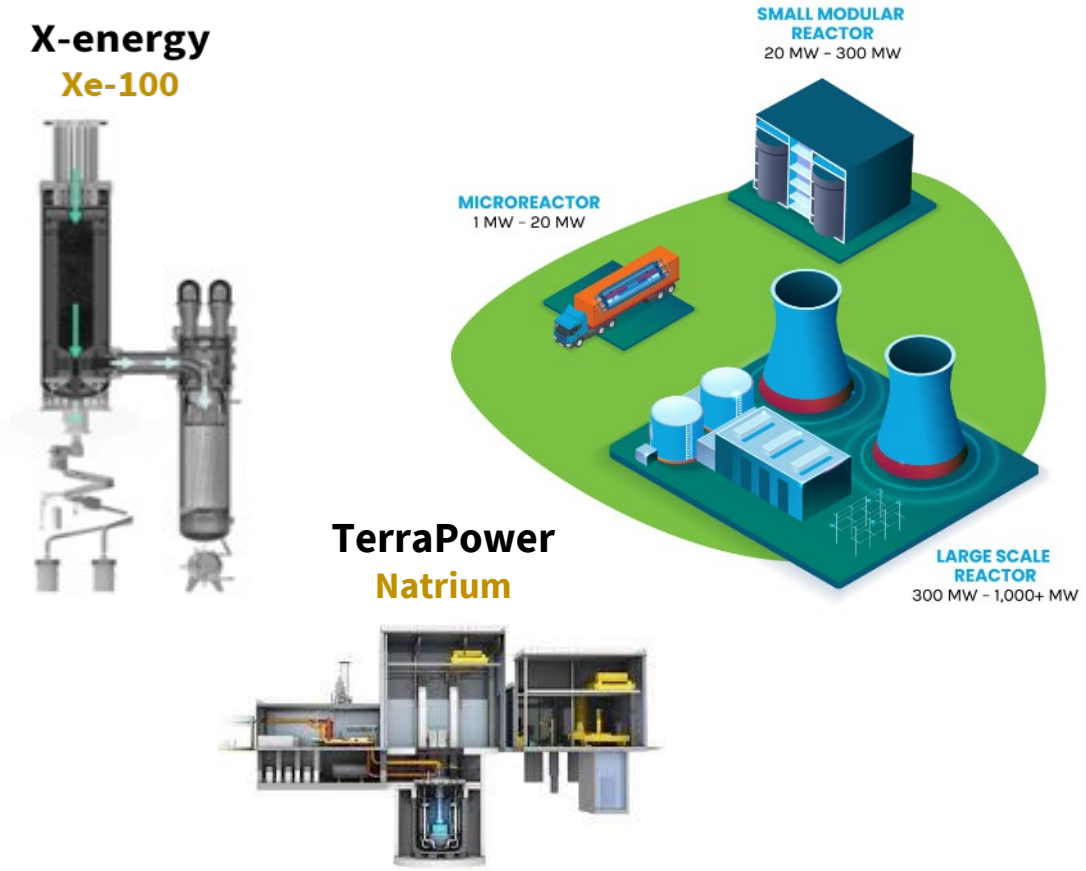
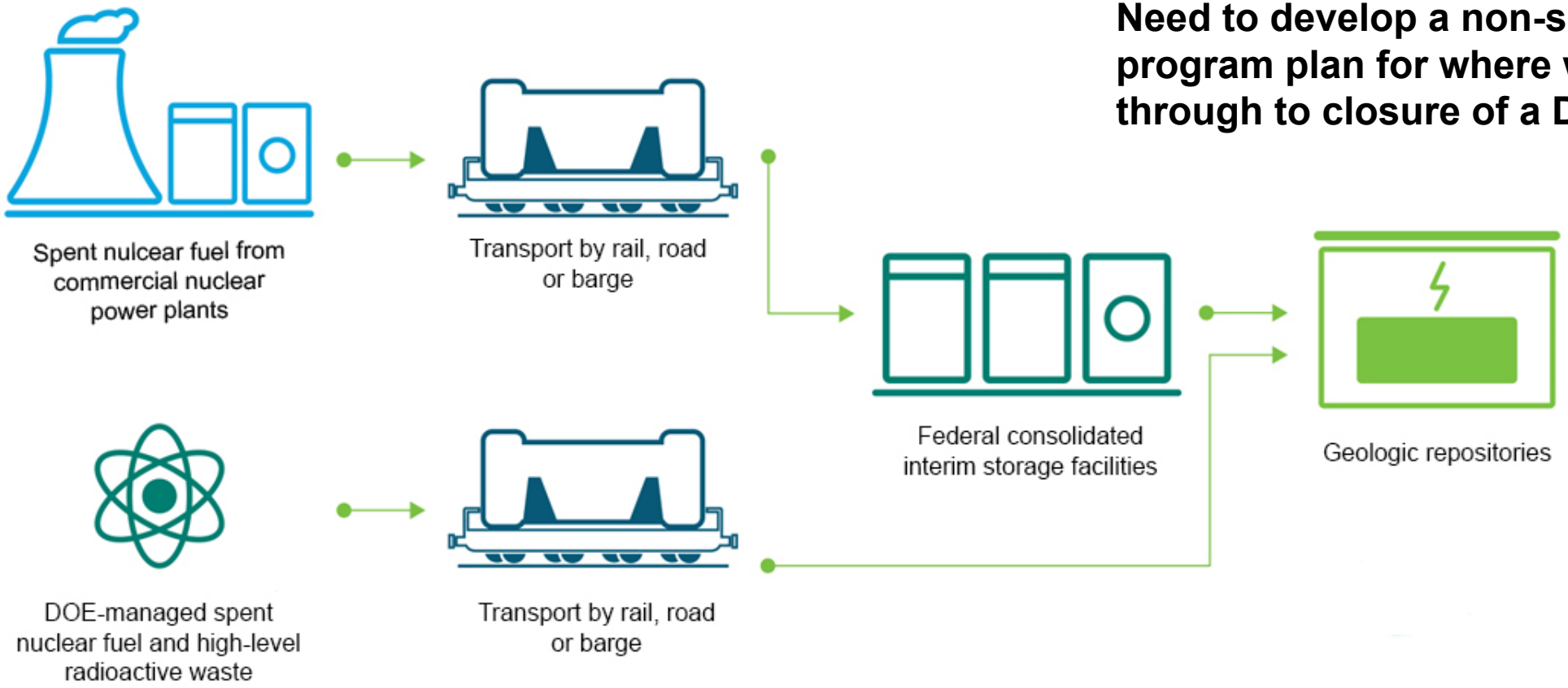
Considering Waste Management for Advanced Reactors

- Topic that is always forgotten
- SNF from advanced reactors is an important topic
- DOE is required to sign an amended standard contract with reactor operator that provides confidence the SNF can be disposed of in a DGR
- Working to mitigate risk to deployment of advanced reactors
- Collaborating with international partners, UK, France, Canada and Japan



Integrated Waste Management System



Need to develop a non-site specific program plan for where we are today through to closure of a DGR?

Atlas Railcar

High Burn-up Demonstration Cask

- Supporting the safe long term dry storage of high burn-up fuel at utility sites
- All SNF is now high burn-up
- Important to license renewal applications for over 60 of the current commercial fleet.
- Need to move the cask from operating reactor site to new home in 2027
- ~15t of SNF.
- Upcoming NRC “Toll Gates” require cask to be opened in 2029 to supply data in 2038
- Working on options for where to move the cask.

Package Performance Demonstration

Why is DOE planning a PPD?

- Build trust and confidence in the safety of SNF transportation casks and SNF transportation by rail
- Record high-resolution video to use in DOE communication products and public outreach
- Explore additional opportunities to strengthen relationships

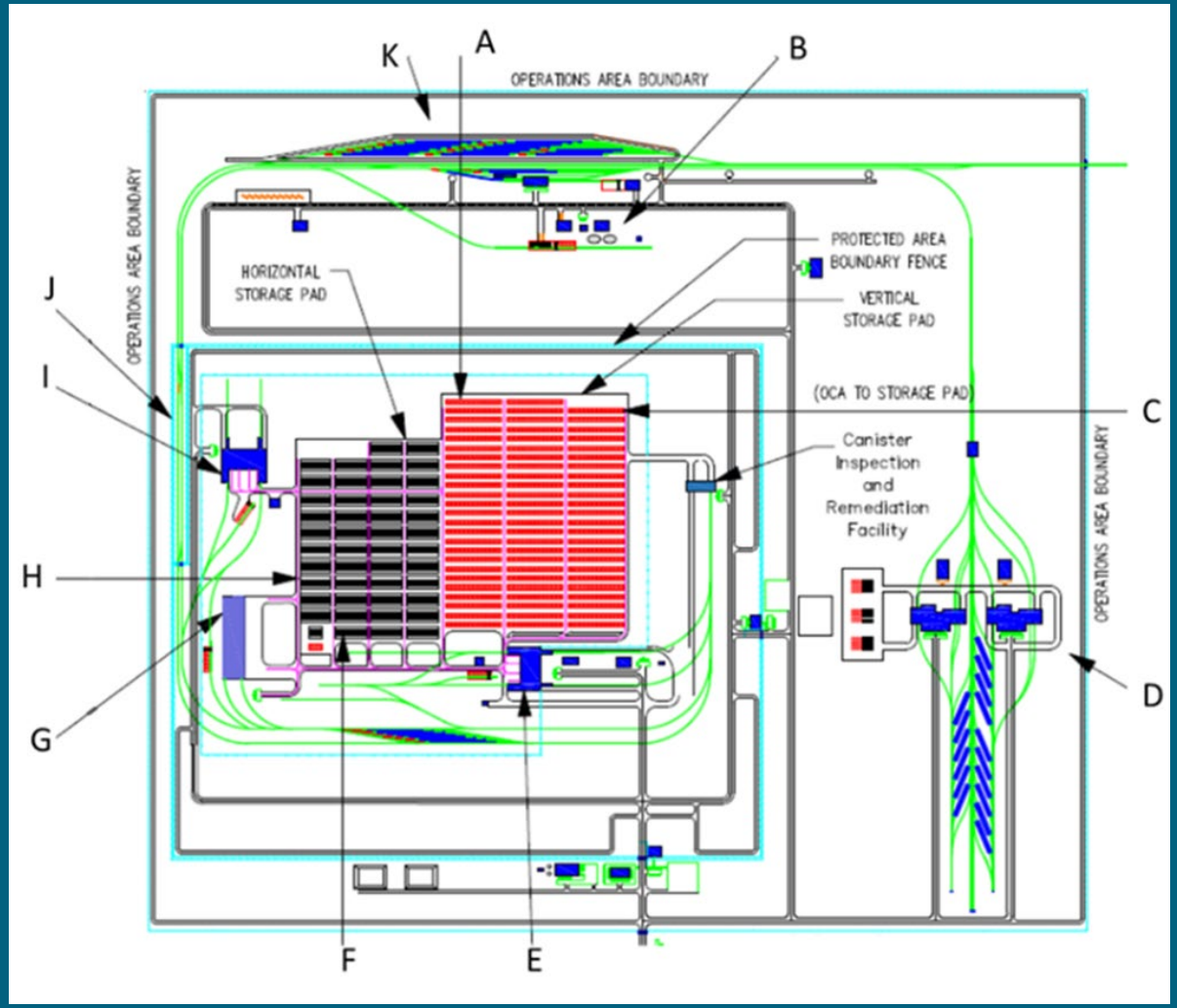
DOE is considering:

- Potential tests to be performed
- Potential test sites
- Potential transportation casks
- Potential analytical tools

Federal Consolidated Interim Storage

- Design proceeding on schedule.
- May 2024 approved to move to detailed design.
- Liabilities estimate assumes start of operations in 2038. Any later will increase the nation's liabilities.
- Operational 2038-2042.

- Consider BRC recommendation to move between shutdown sites?



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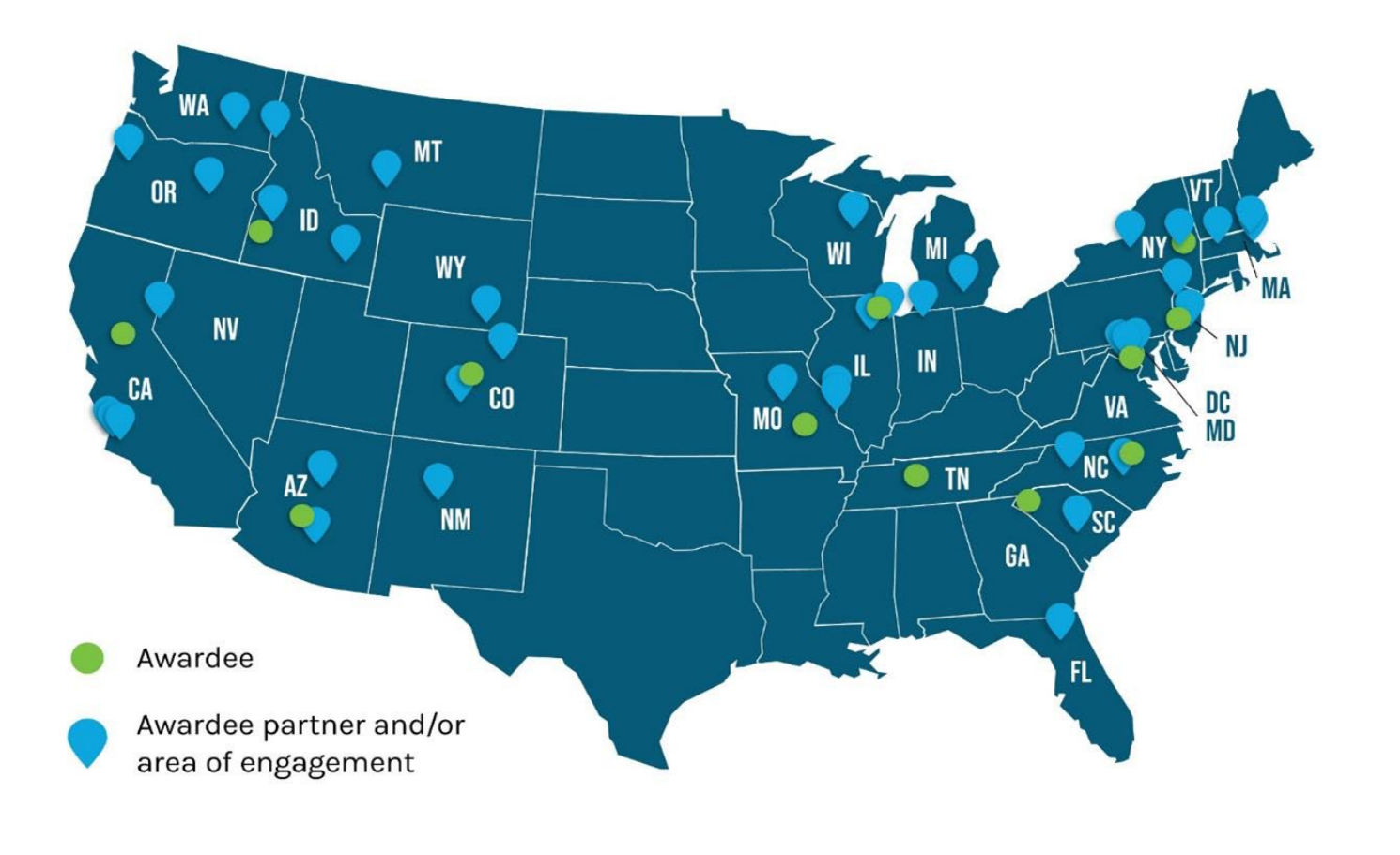
Consent-Based Siting Consortia



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CONSENT-BASED SITING CONSORTIA PROGRESS

Consent-based siting consortia support DOE's efforts to facilitate inclusive community engagement and elicit public feedback on consent-based siting, management of spent nuclear fuel, and federal consolidated interim storage. The 12 awardees are comprised of various organizations to help reach communities across the country and remove barriers to participate in DOE's consent-based siting process. **Awardees have made significant progress in carrying out community engagement activities and providing direct grants to communities wanting to learn more.**

30 Consortia Public/Media Engagements Held

21 New Team Members Brought into the Consortia Effort

3 Community Sub-Grant Programs Issued

20 Information Resource Projects

9 Government Engagements Held (Tribal, State, Local, Federal)

Progress: DOE's Consent-Based Siting Process General Timeline

Progress: Consent-Based Siting Consortia Timeline

Updates reflect activities from September 2023 up to mid-March 2024.

To learn more about these metrics, please visit energy.gov/ne/consent-based-siting-consortia or send an email to consentbasedsiting@hq.doe.gov

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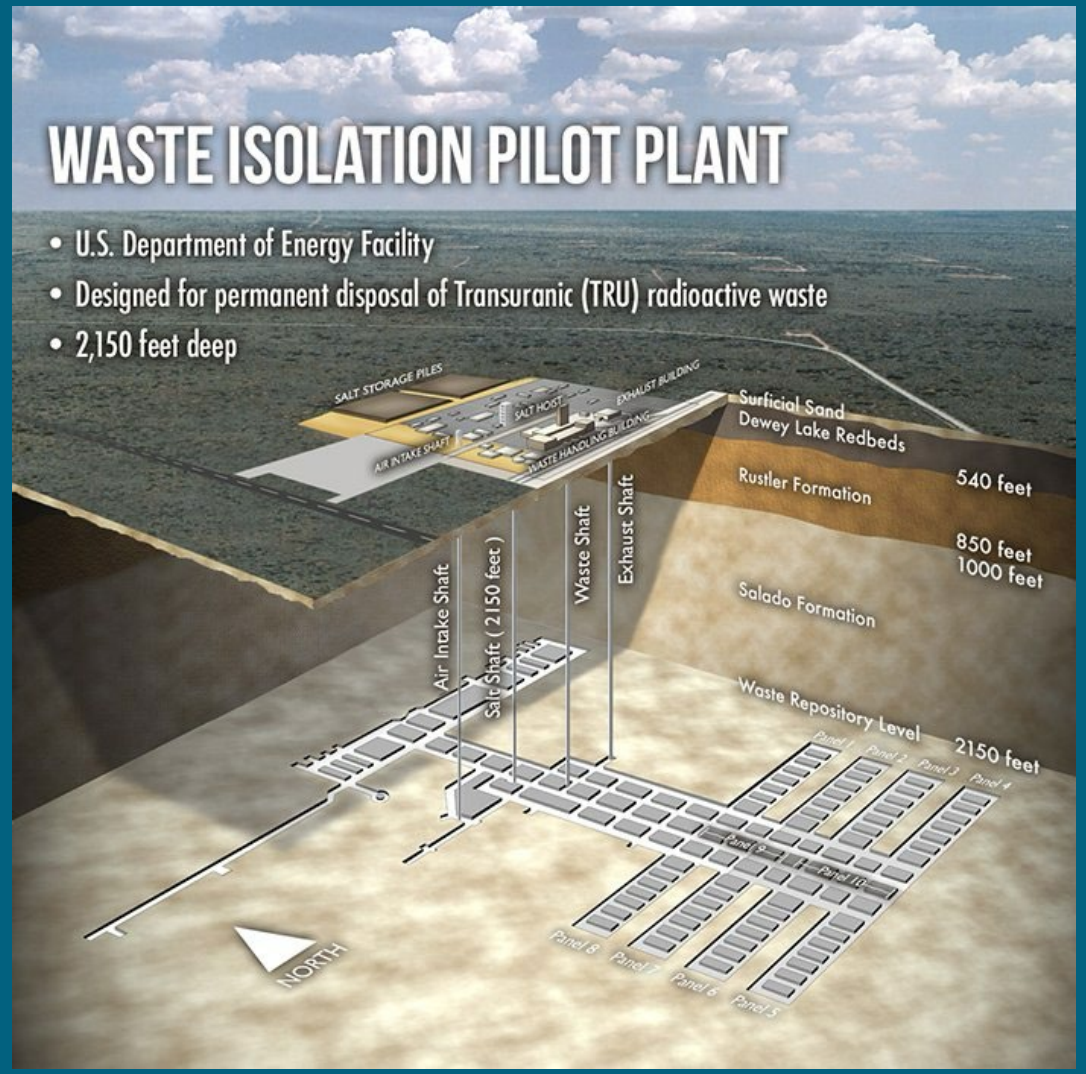
Waste Isolation Pilot Plant



- The **facility**'s disposal rooms are nearly a half mile, or 2,150 feet, below the surface
- For 25 years operated by DOE Environmental Management for the disposal Transuranic Waste from clean-up of the weapons sites
- Recently granted a permit extension for a further 15 years of operation
- Approximately 96 percent of the total volume of waste to be disposed at WIPP will be contact-handled TRU waste. The remaining 4 percent will be remote-handled TRU waste

Repository Program

- Consider all options for the program in line with the Nuclear Waste Policy Act
- Continue to support international R&D related to repository studies
- Evaluating sending DOE engineers and managers to work on international programs
- Build capability in US industry to support the start of a future program
- Exploring how to collaborate with EM.

Opportunities

- Slow controlled steady progress that builds public and political trust
- Strong engagement with Tribal representatives.
- Engage with multiple stakeholders
  - Controlled and consistent engagement
  - Seek input to decisions where possible
- A simple vision that everyone can understand and measure progress
- At the right time reestablish a dedicated office for management of SNF and HLW

Risks

- Communication

- Schedule slips increasing the liability to the US Tax payer
  - In last 10 years we have slipped 17 years
  - Risk we will slip significantly again adding billions to the liability

- Clearly explain the project schedule from when we restart the program through to closing repository

- When to amend the Nuclear Waste Policy Act? The existing authorization allows us to move forward, make incremental steps to build trust and political support for the change

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Back-up Slides