U.S. DEPARTMENT OF ENERGY | Office of NUCLEAR ENERGY

# The Federal Consolidated Interim Storage Facility (CISF) Project and Aging Management of Spent Nuclear Fuel (SNF) in the CISF

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June 17, 2024, Virtual meeting of the Vermont Nuclear Decommissioning Citizens Advisory Panel

# Disclaimer

This is a technical presentation that does not take into account contractual limitations or obligations under the Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste (Standard Contract) (10 CFR Part 961).

To the extent discussions or recommendations in this presentation conflict with the provisions of the Standard Contract, the Standard Contract governs the obligations of the parties, and this presentation in no manner supersedes, overrides, or amends the Standard Contract.

This presentation reflects technical work which could support future decision making by the U.S. Department of Energy (DOE or Department). No inferences should be drawn from this presentation regarding future actions by DOE, which are limited both by the terms of the Standard Contract and Congressional appropriations for the Department to fulfill its obligations under the Nuclear Waste Policy Act including licensing and construction of a spent nuclear fuel repository.

# SNF at Commercial Nuclear Power Plants (NPPs)

## Locations of Commercial Light Water Reactor SNF Sites


**1957**: US began using commercial nuclear power plants

**2024**: Over 90,000 metric tons of SNF* in storage at NPP sites

- – 53 commercial NPP sites with 93 operating reactors
- –20 NPP sites are shutdown

**2060**: US estimated to have ~140,000 metric tons of spent nuclear fuel by this date

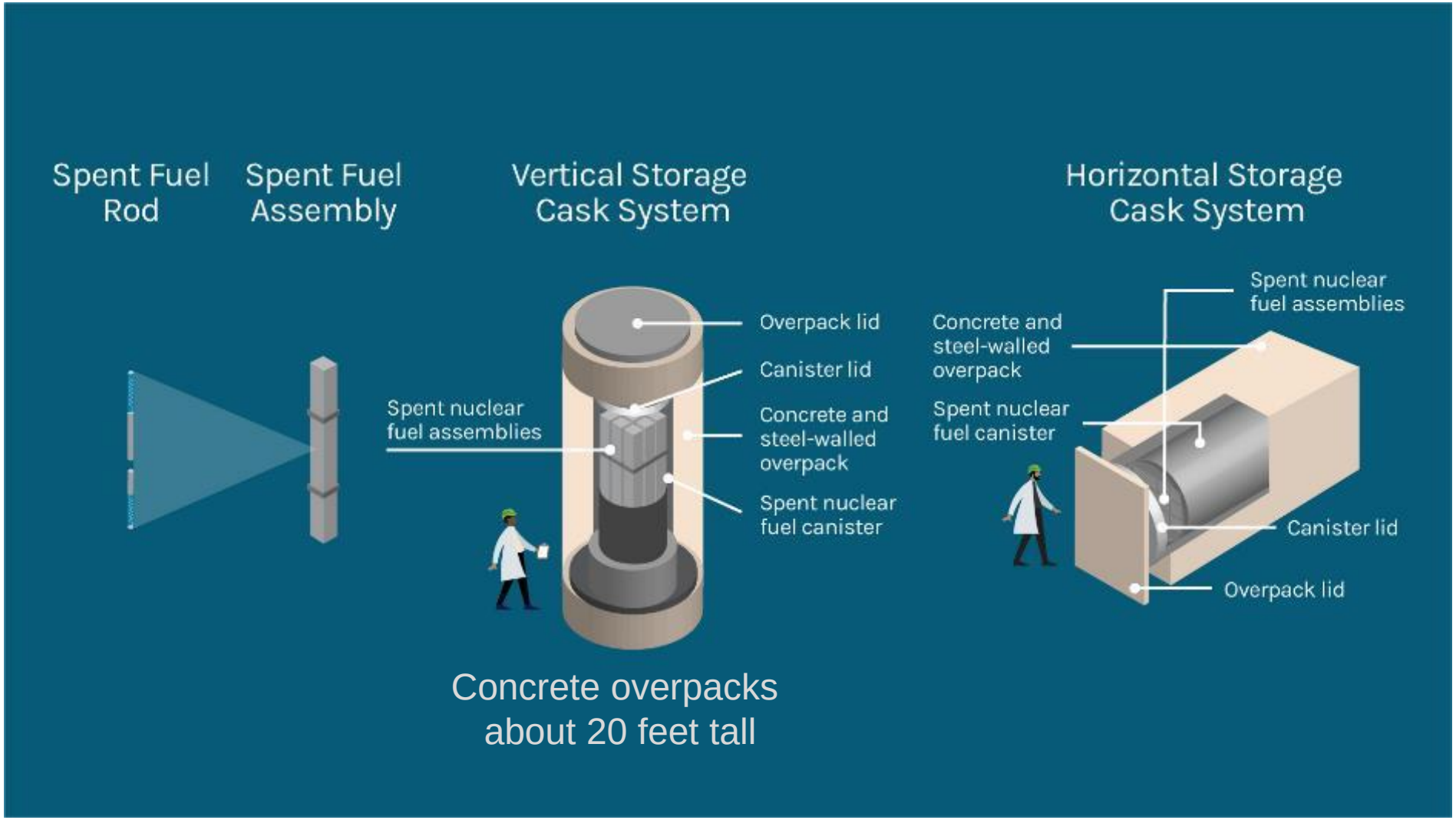
*Metric tons of SNF is commonly referred to as: ”Metric Tons of Heavy Metal – MTHM”

# Need for a Federal CISF

- The federal government was to begin commercial SNF disposal from commercial NPPs no later than January 31,1998.
- The federal government is liable for onsite storage costs because it failed to fulfill its contracts
- Liabilities to the federal government due to not picking up SNF from NPPs (as of 2023):
  - Paid judgements (>$10B)
  - Potential future judgements ($34B-$41B or more)
  - Per DOE-OIG-23-05, November 2022, it is:

    "…difficult (for DOE) to reasonably predict the amount of the Government's liability."

# Background: SNF Storage Casks



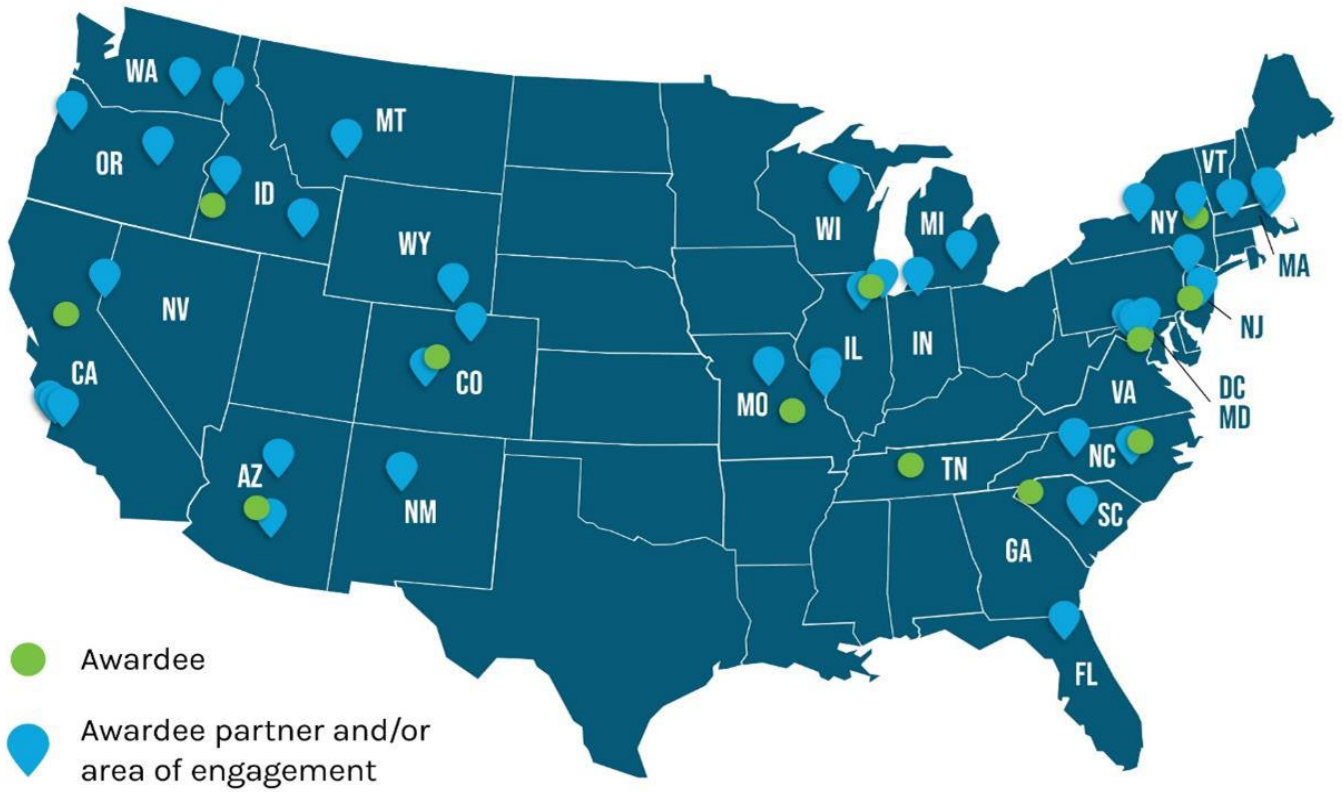

Concrete overpacks about 20 feet tall

# Consent-Based Siting

- Beginning in 2021, Congress authorized the Department to pursue consolidated interim storage using a consent-based siting process
- Consent-based siting is an approach to siting facilities that focuses on the needs and concerns of people and communities
- Communities participate in the siting process by working carefully through a series of phases and steps with the Department (as the implementing organization)
- From the Blue Ribbon Commission, 2012:

**“Siting storage or disposal facilities has been the most consistent and most intractable challenge for the U.S. nuclear waste management program.”**

# Consent-Based Siting Consortia – 12 Awardees



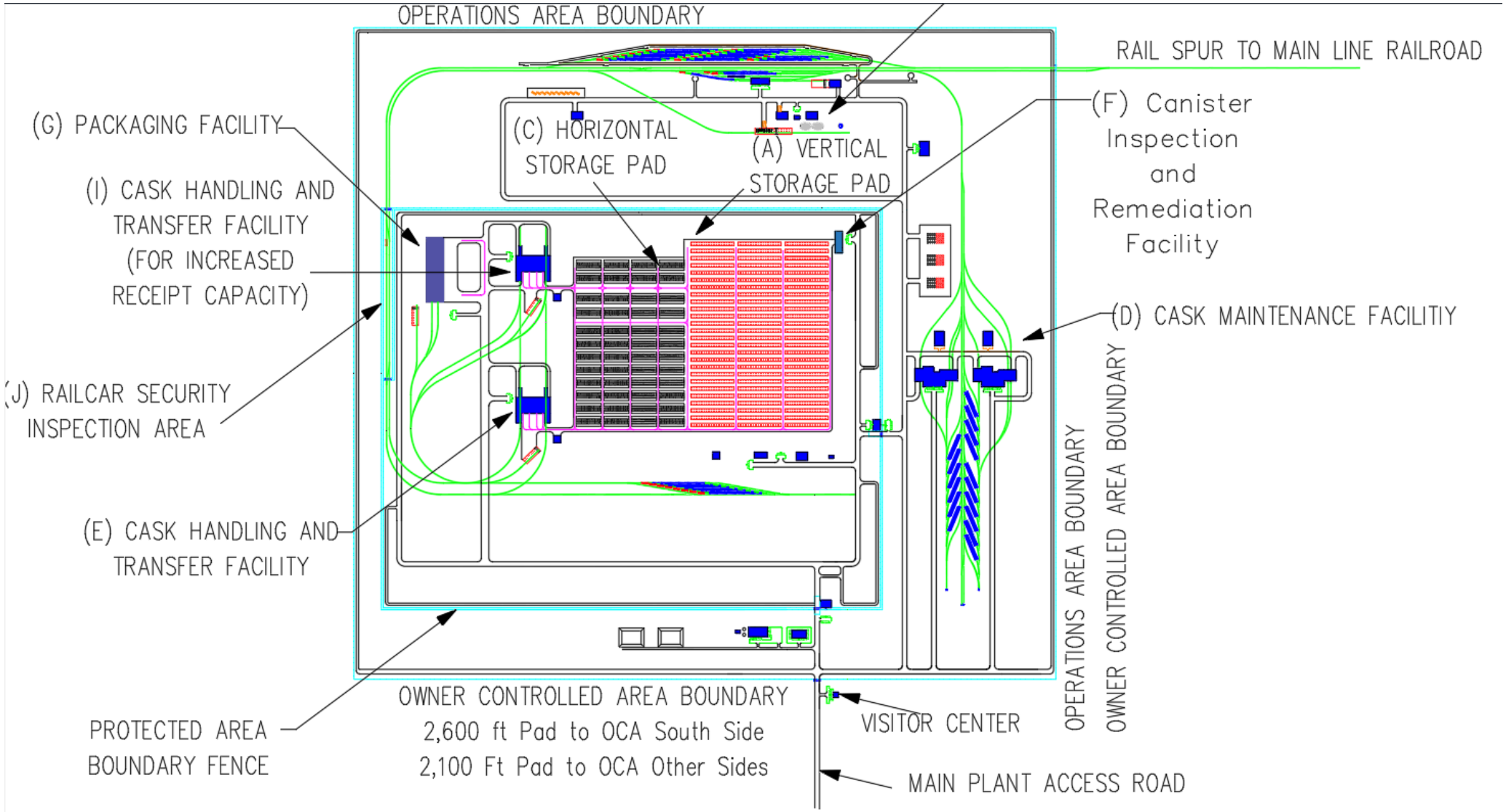

The estimated timeline to identify a willing and informed host community for a CISF is ~7 years (FY 2031)

# CISF: Key Capabilities and Progress

- **On May 3, 2024 DOE Deputy Secretary Approved Critical Decision 0 for the CISF capability which includes:**
  - CISF – A site for receipt and storage of SNF and small amounts of Greater than Class C (GTCC) waste
  - Transportation assets – railcars (e.g. Atlas) and transportation casks
  - Near NPP infrastructure – Relatively small supporting projects to upgrade rail, roads, bridges, ports near NPPs to allow movement of SNF

- **The CISF project builds on decades of knowledge developed in the private sector:**
  - 70 commercial SNF storage installations already built and in operation utilizing their NRC licenses
  - The CISF assumes previously licensed storage technologies will be used, but the CISF will have unique canister receipt inspection and handling capabilities

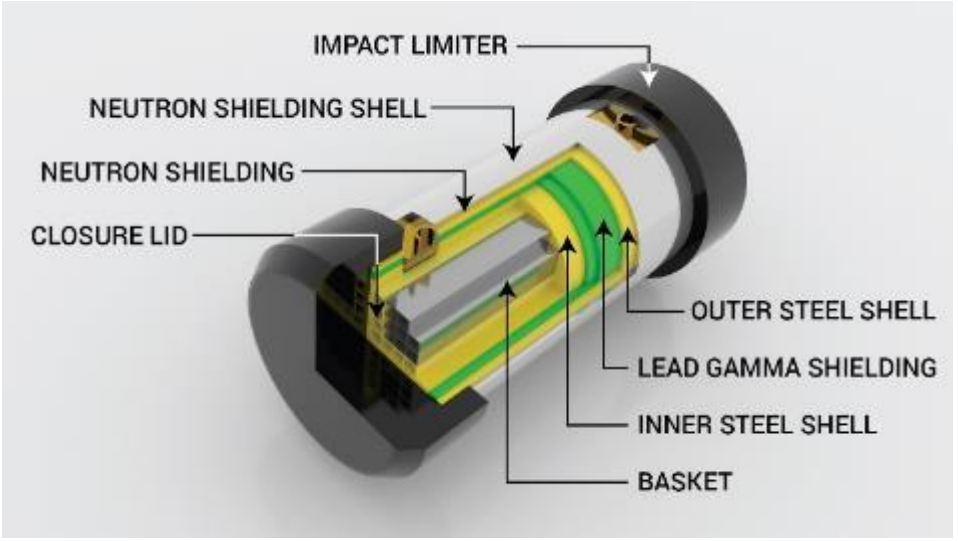
# CISF: Owner Controlled Area at Completion

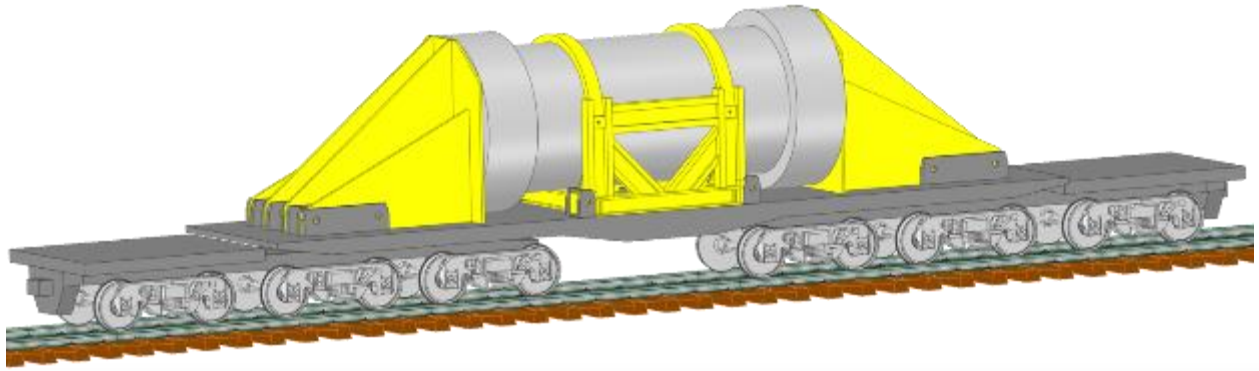


# CISF: Transportation Assets

Click to the right: One of the Safest Trains Ever Built? Atlas Railcar Completes Final Testing (youtube.com)

- Establishing the SNF transportation equipment is a necessary part of deploying a CISF
- The current CISF project will build out all the rail rolling stock needed for the duration of the project
- Elements of transportation system
  - Transportation casks
  - Rolling stock (cask car, buffer, escort cars)
  - Ancillary equipment
  - Cask and fleet maintenance capabilities
  - Route selection and readiness
  - Emergency response training
  - Security and material accountability



# CISF: NRC Licensed Facility

- The CISF is planned to be an NRC-licensed facility, consistent with the Nuclear Waste Policy Act (NWPA) of 1982, as amended, and will utilize design, construction and operating requirements per the NRC license
  - The NRC is the federal regulator for commercial SNF storage and transportation
  - See: 10 Code of Federal Regulations Part 72 (10 CFR Part 72): "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste"
- Independent safety and environmental oversight (outside of DOE) is important to enhance public confidence as part of the consent-based siting process

(NRC Commission spokesman) Sheehan said the nuclear waste may have to remain there in Vernon for decades, because the country does not yet have a long-term storage site for nuclear waste.

Sheehan said the NRC has licensed the casks for 20 years, and Entergy can seek 40-year extensions. But, he said, the casks can last for much longer.

“The fuel could stay there essentially indefinitely," Sheehan said. "But generally, the idea is that after about 100 years the fuel would have to be loaded into a new cask…”

Vermont Public

Vermont Public
Morning Edition

NEXT UP

# Vermont Yankee Moves Last Of Its Spent Nuclear Fuel Into On-Site Storage Casks

Vermont Public | By John Dillon
Published August 3, 2018 at 5:08 PM EDT

Entergy, Courtesy

Vermont Yankee transferred the last of its spent nuclear fuel this week for storage in steel and concrete casks.

WINDHAM COUNTY

# Vermont Yankee decommissioning continues at full speed, but no plan for spent fuel

"As it stands today, spent fuel is going to sit where it's been sitting for some time," said Scott State, chief executive officer at NorthStar, the company that owns the former nuclear plant.

By Emma Cotton
October 12, 2023, 12:48 pm

https://vtdigger.org/2023/10/12/vermont-yankee-decommissioning-continues-at-full-speed-**but-no-plan-for-spent-fuel/**

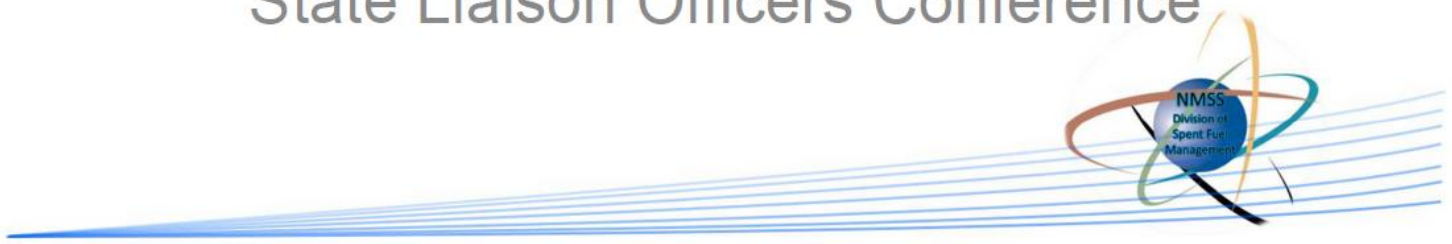
**The CISF must follow the same rules as other NRC-licensed facilities**

**The CISF will need an Aging Management Program and Plan as part of the license**

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

## Aging Management During Spent Fuel Storage

Darrell Dunn
NRC/NMSS/DSFM/RMB
State Liaison Officers Conference



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# Key elements of an aging management process for NRC licensed facilities prior to license renewal

## Aging Management Review for Spent Fuel Storage Renewals

U.S.NRC
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- Applicants are required to identify aging mechanisms and effects that could affect the ability of the systems, structures, and components (SSCs) from performing their intended functions
- Identification of relevant aging mechanisms:
  - Review of site maintenance records
  - Lead system inspection results (NUREG-1927 Revision 1 Appendix C)
  - Maintenance and inspection records from ISFSI sites with similar SSC materials and operating environments
  - Review of industry records and operational experience
  - Applicable consensus codes and standards
  - NRC reports and generic communications






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# Aging Management Program requirements per NRC regulations

## Guidance on Aging Management Programs (AMPs)

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- Specific activities to monitor and control the degradation of SSCs so that aging effects will not result in a loss of intended functions
- Includes all activities that are credited for managing aging mechanisms or effects for specific SSCs
- An effective AMP mitigates or detects the aging effects and includes timely corrective actions
- Required per 10 CFR 72.42(a), 72.240(c)

AMP Elements

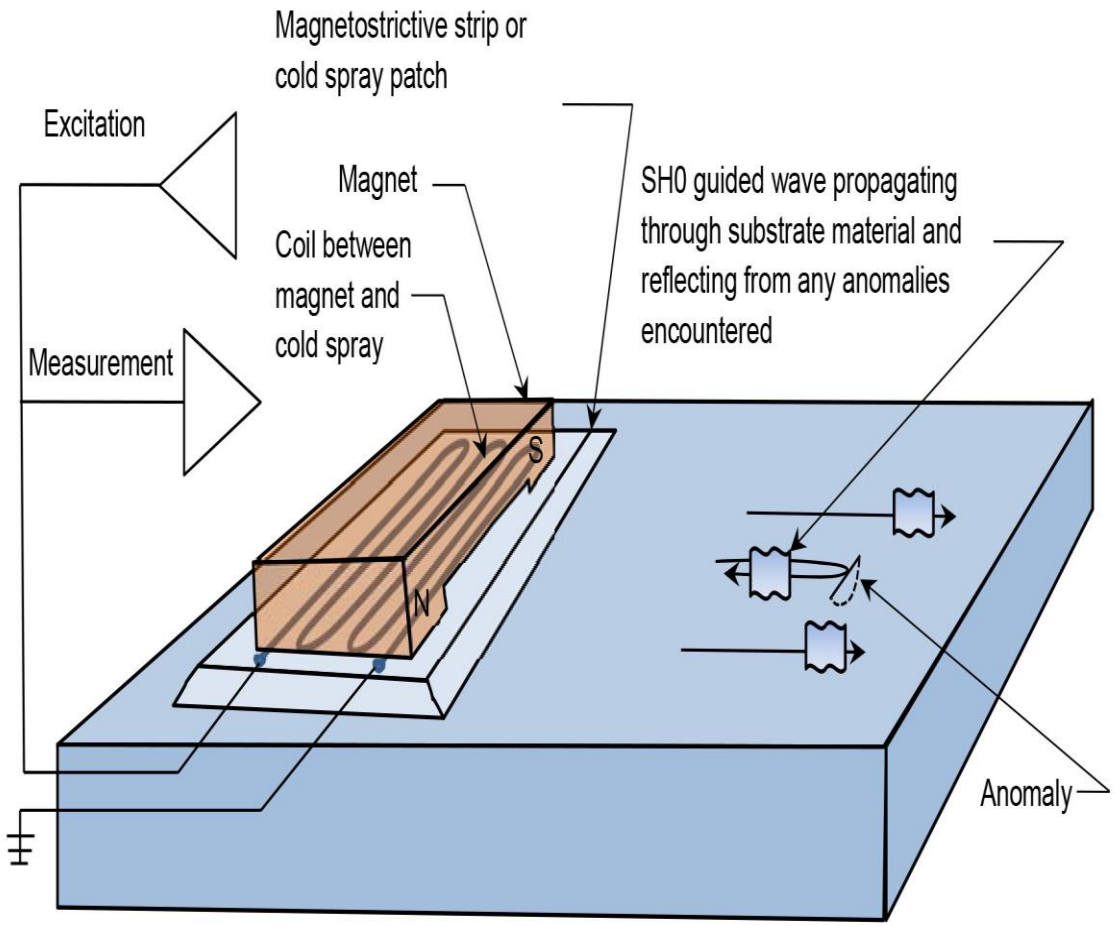
| | |
|---|---|
| 1. Scope of the Program | 6. Acceptance Criteria |
| 2. Preventive Actions | 7. Corrective Actions |
| 3. Parameters Monitored/Inspected | 8. Confirmation Process |
| 4. Detection of Aging Effects | 9. Administrative Controls |
| 5. Monitoring and Trending | 10. Operating Experience |

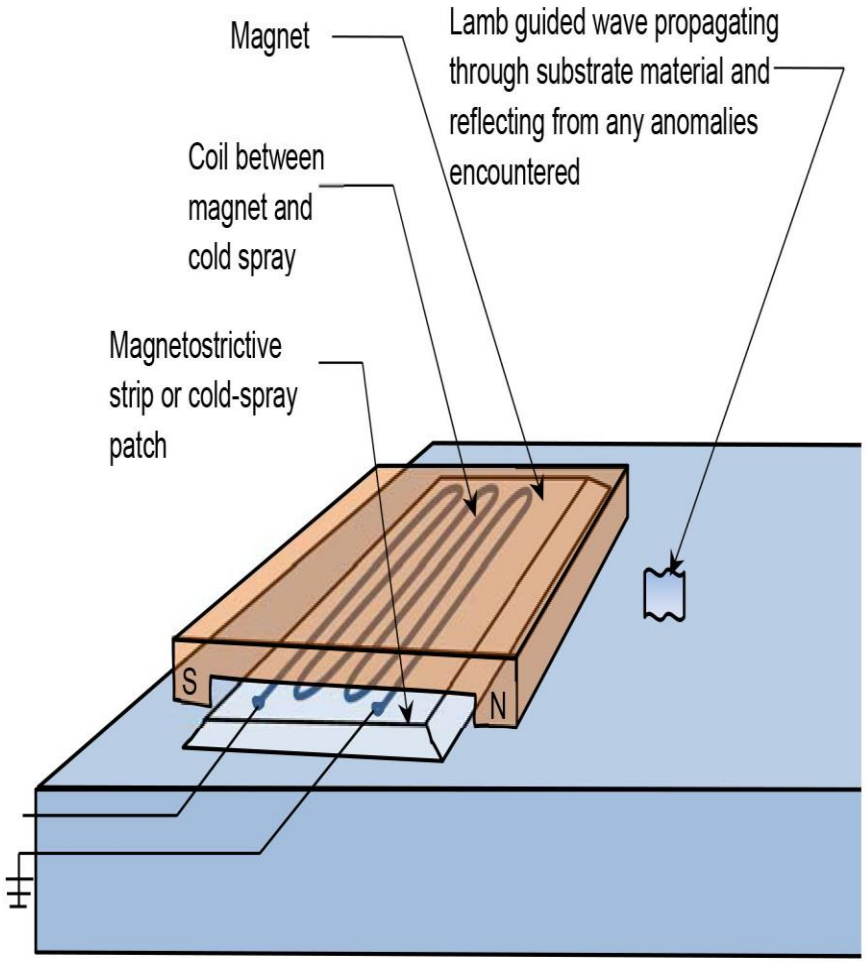
# CISF: One Potential New Technology

**Electro Magnetic Acoustic Transducer, or "EMAT"**

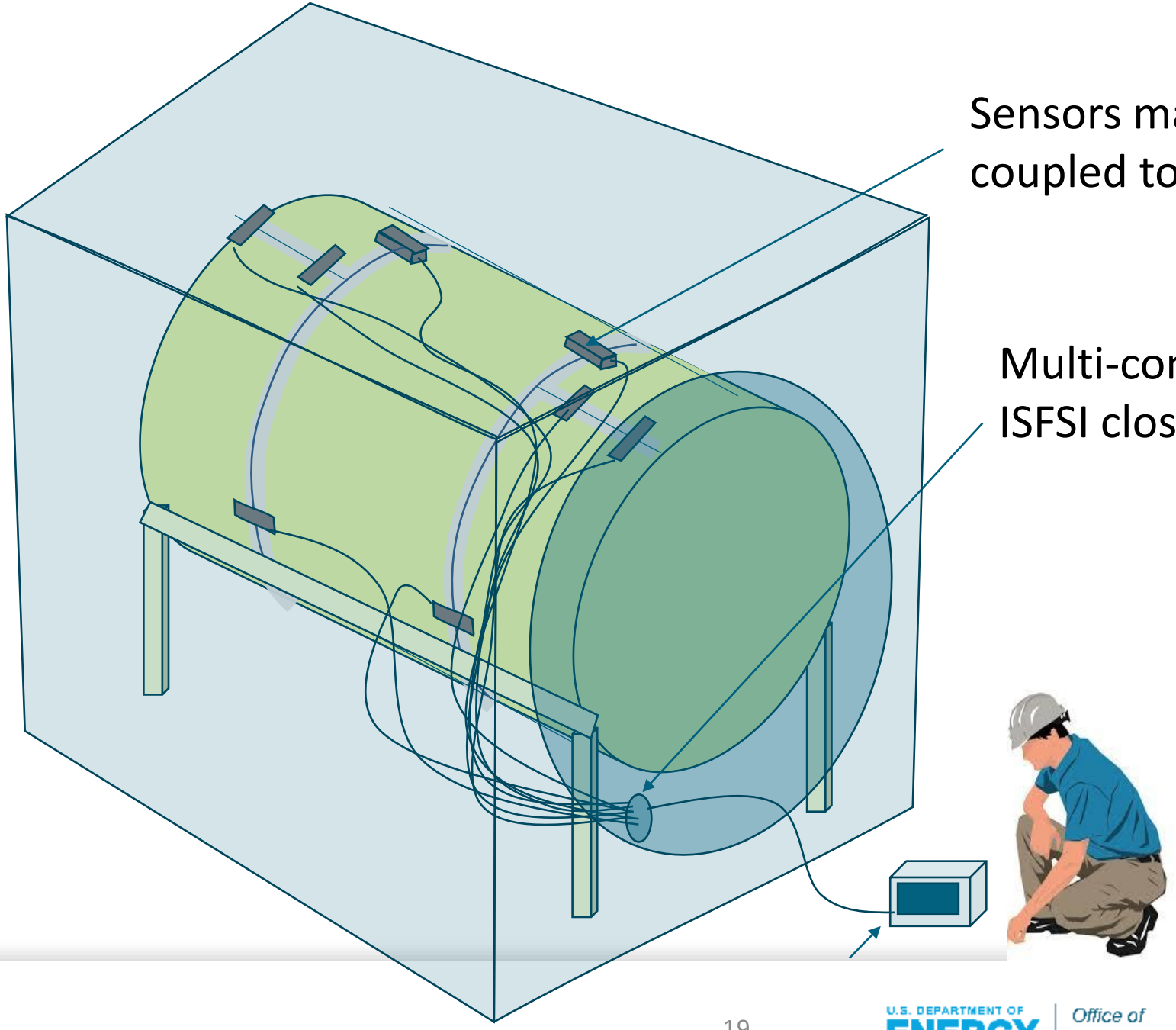
- Magnetostrictive EMAT is an Ultrasonic technique(UT) that generates a sound wave in the inspected part by disturbing the magnetic field acting on a Ni (highly magnetostrictive) coating.
- A Cold-Spray Ni coating metallurgically bonds to the stainless steel canisters and not only provides a protective coating to mitigate possible stress corrosion cracking (SCC) but also serves as an integral part of the EMAT sensor.
- Tests show that critical flaws can be detected up to 2-m away from the sensor.
- Full coverage of the weld heat affected zone (primary locations for possible appearance of SCC flaws) of a spent fuel canister requires only 20 sensors.
- The sensors are paired and generate multiple inspection angles leading to >80% redundant coverage thereby increasing measurement confidence.

# EMAT: Magnetostrictive Sensor Configurations



# Multiplexing EMAT instrument connected every 10-20 years



# Status of the CISF project

- The next step in the construction process is having an approved "conceptual design" (referred to in DOE as Critical Decision 1, or CD-1). This is anticipated in the 2028/2029 timeframe
- We intend to ask universities and industry to develop concepts for what the facility could look like. As we move into the next phase of Consent Based Siting we will use these concepts to get public input
- We are considering a Blue Ribbon Commission recommendation to move SNF between shutdown sites
- We are working to develop a scope of work for a business school to develop a social economic model for the CISF. We hope to have this released later this year
- Our office is in the process of signing an MOU on aging management with the Electric Power Research Institute (EPRI) by early July, 2024.
- We will hold a workshop with EPRI on aging management in late July

# Thank you for your consideration

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