

Spent Nuclear Fuel Package Performance Project

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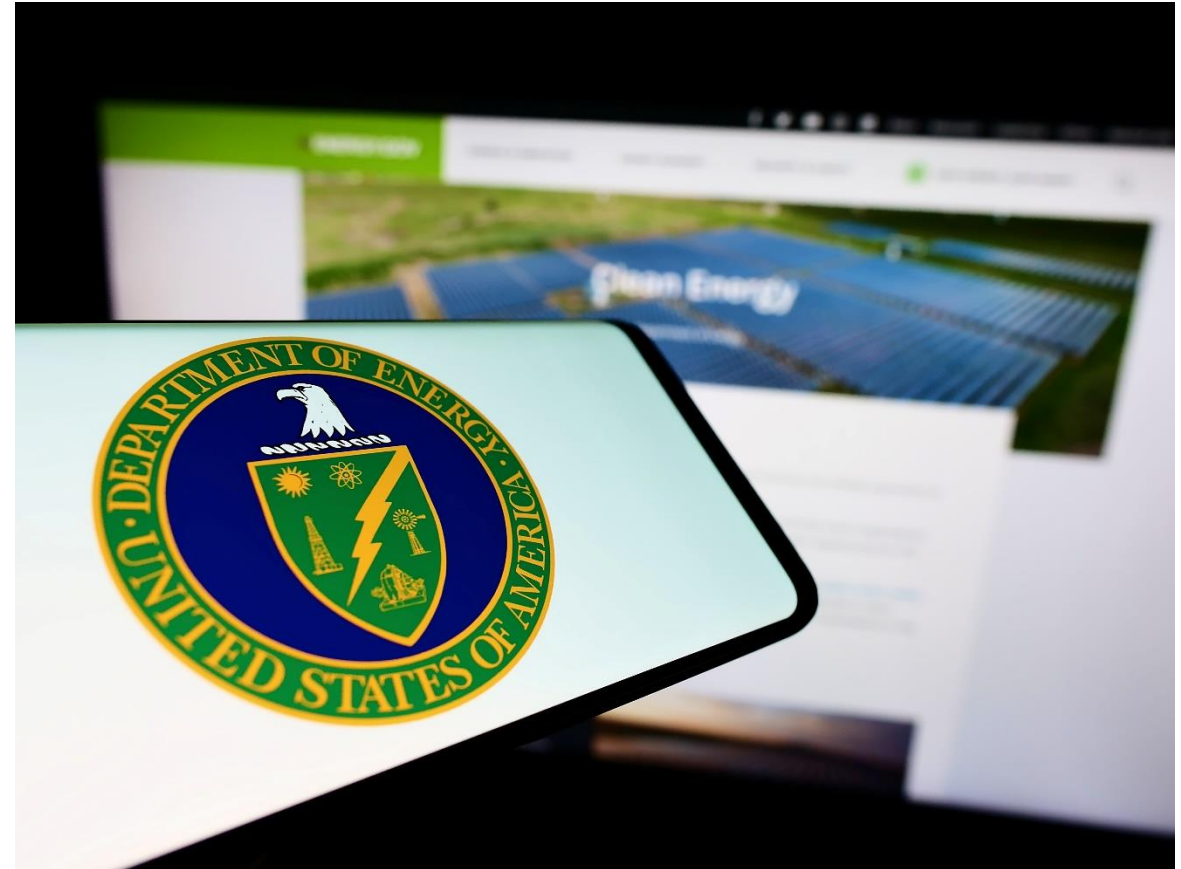


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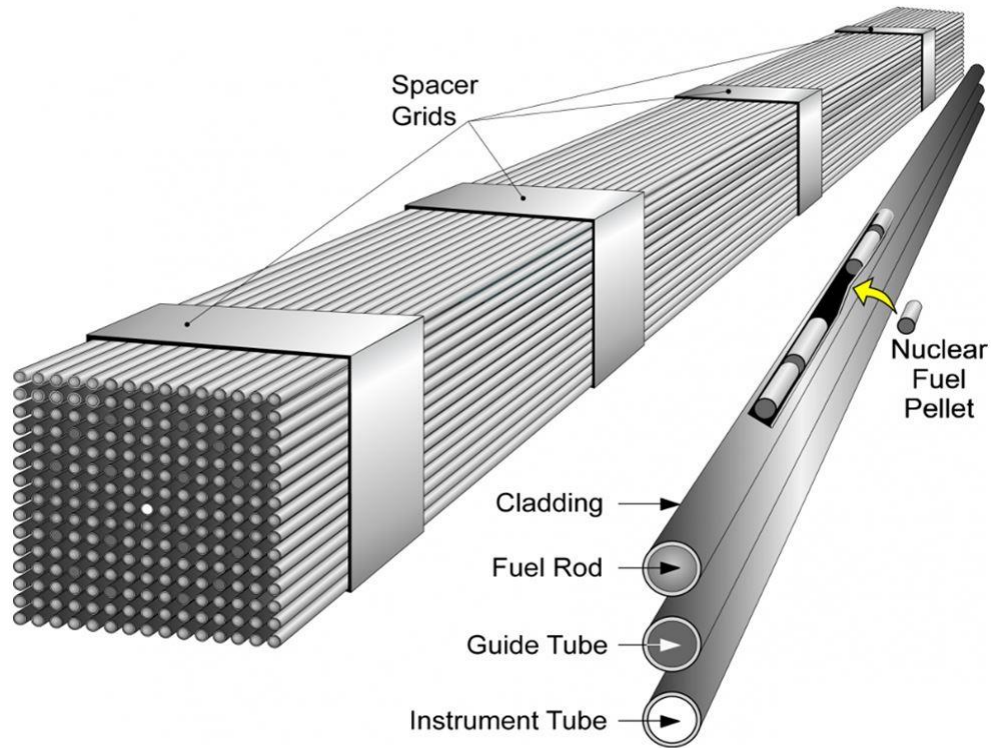
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To the extent discussions or recommendations in this presentation conflict with the provisions of the Standard Contract, the Standard Contract governs the obligations of the parties, and this presentation in no manner supersedes, overrides, or amends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

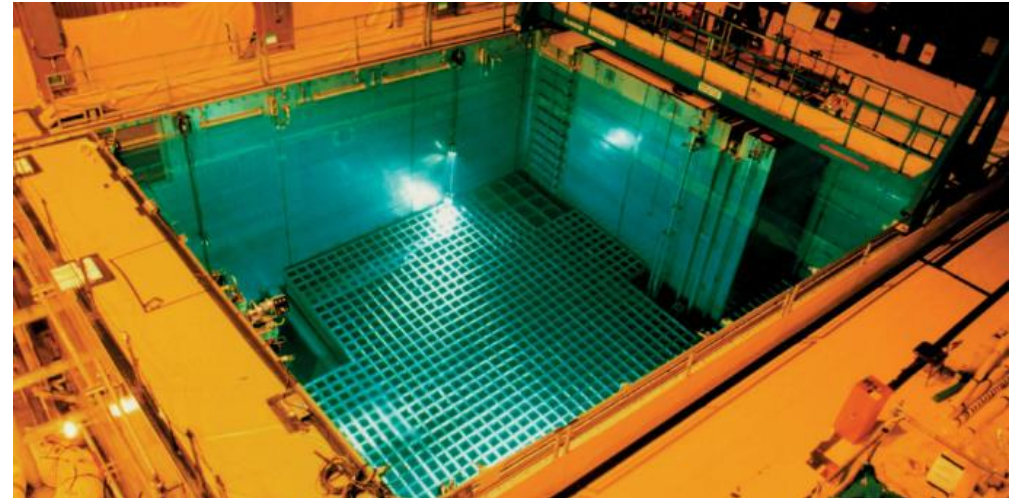
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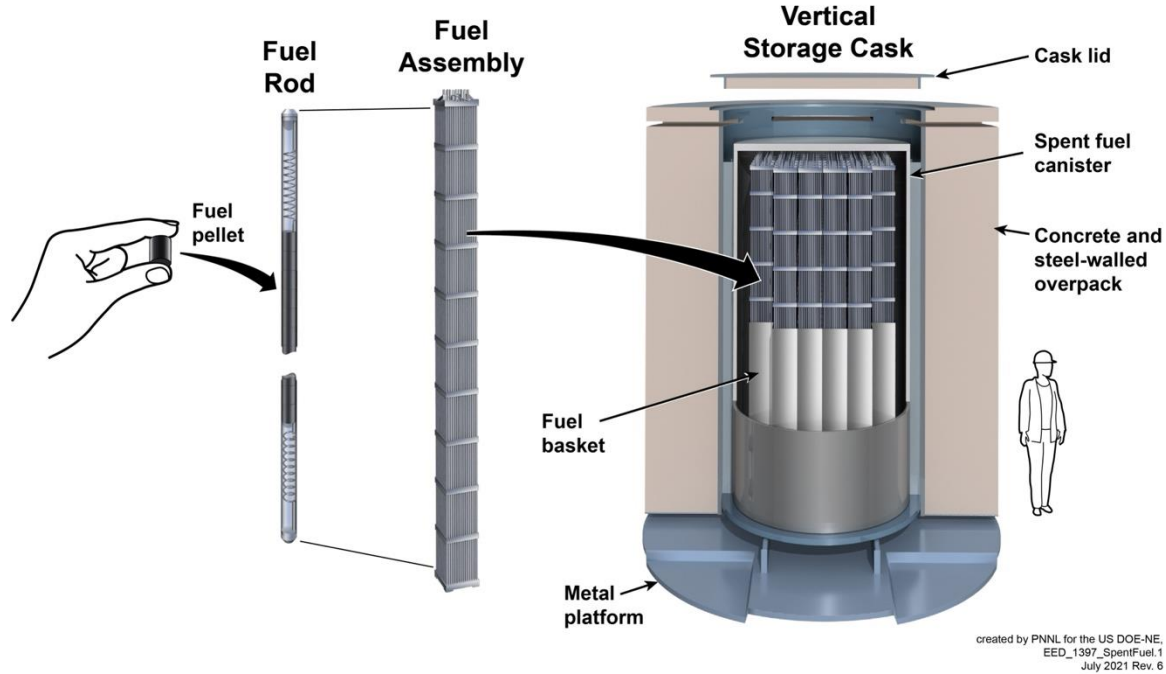
What is Spent Nuclear Fuel?



A cutaway figure of a nuclear fuel rod and rod assembly (left), a photo of a nuclear power plant (top right), and a photo of a spent fuel pool for storage of spent nuclear fuel after removal from a nuclear power plant (bottom right).



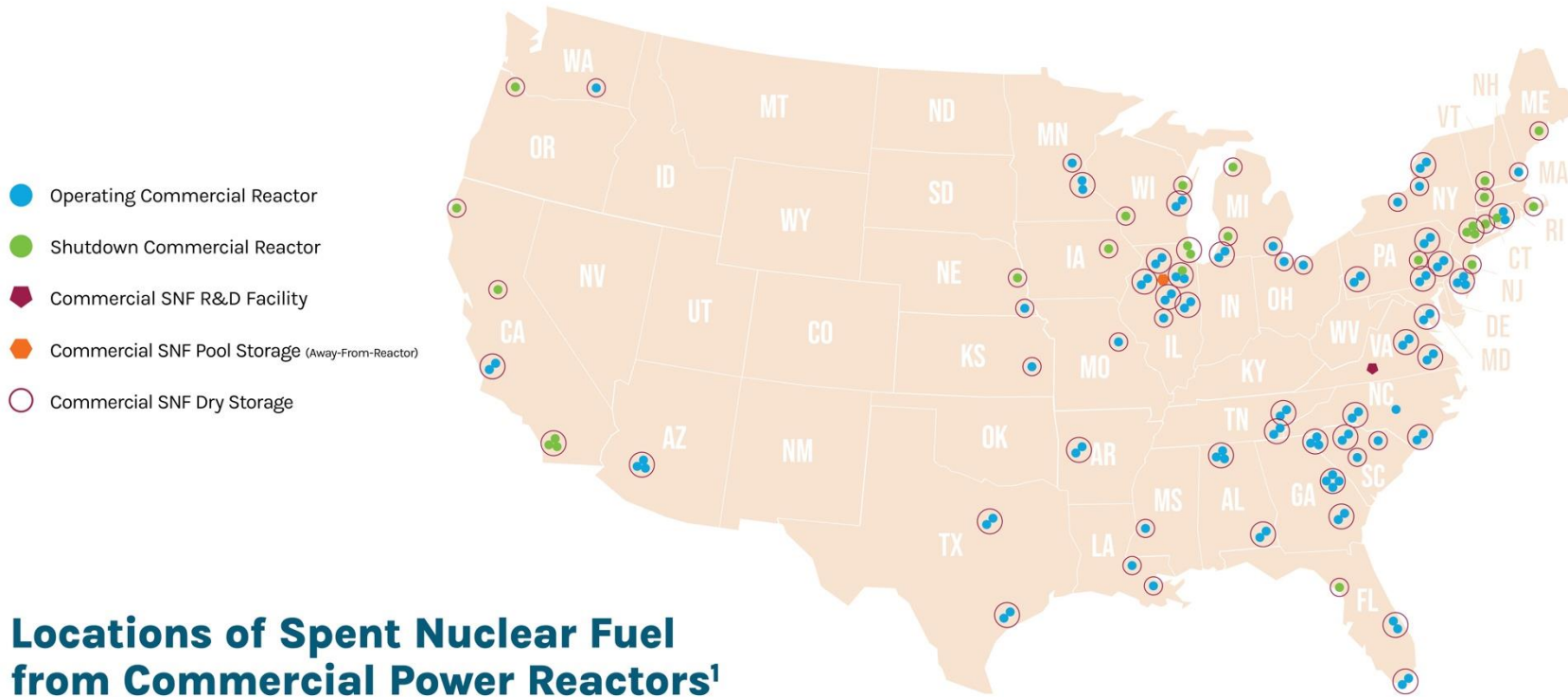
Storing Spent Nuclear Fuel



A diagram of nuclear fuel pellets stacked into a fuel rod and fuel assembly with a cutaway figure of a vertical spent nuclear fuel storage cask (left) and a photo of vertical and horizontal spent nuclear fuel storage casks (right).



U.S. Spent Nuclear Fuel in Context



¹Excludes spent fuel located at DOE Sites

Symbols do not reflect precise locations

As of April 29, 2024

1958

United States began using commercial nuclear power

2024

94 operating commercial reactors at 54 nuclear power plants in 28 states

- 20 nuclear power plants have shut down
- ~95,000 metric tons of spent nuclear fuel (SNF)

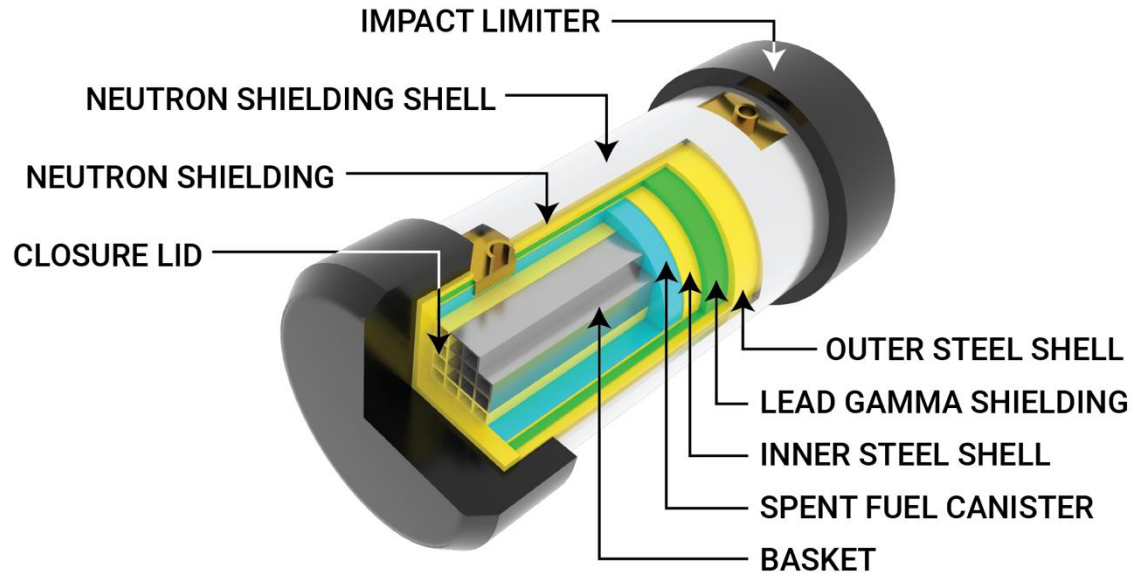
End of Current Fleet

United States estimated to have more than 140,000 metric tons of spent nuclear fuel

Movement of SNF

Moving 3,000t of SNF a year will take approximately 50 years.

Spent Nuclear Fuel Transportation



A cutaway figure of an example transportation cask (left) and a photo of a transportation cask with impact limiters loaded on a railcar (right).

Spent Nuclear Fuel Transportation



The United States has a **well-established regulatory framework** for transporting SNF.



The U.S. Department of Transportation (DOT) and U.S. Nuclear Regulatory Commission (NRC) regulate commercial SNF transportation through a combination of safety and security requirements, certification of transportation casks, inspections, and a system of monitoring to ensure requirements are met.



The NRC reviews and certifies SNF transportation casks in accordance with requirements found in Title 10 of the Code of Federal Regulations, Part 71 (10 CFR Part 71.)



For a transportation cask to be certified by the NRC, it must be shown by physical testing, computer analysis, or a combination of both, to **withstand a series of hypothetical accident conditions**. Physical testing can be completed on “sub-scale models.”

DOE Package Performance Project (PPP)

What is the PPP?

- Physical demonstrations on a rail-sized spent nuclear fuel (SNF) transportation cask
- Previously referred to as a package performance study (PPS) and recently renamed from Package Performance Demonstration (PPD)

Photos reproduced from National Academy of Sciences, *Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States*, 2006.



Truck tractor-trailer with SNF shipping cask.



Locomotive impacting a tractor-trailer system.



SNF package mounted in a railcar.

Previous Package Performance Projects



Image from Bernhard Droste, "Experiences and Perspectives of Package Testing Under Hypothetical Accident Conditions," PATRAM 2007, Miami, Florida. (Conducted at PATRAM 2004).

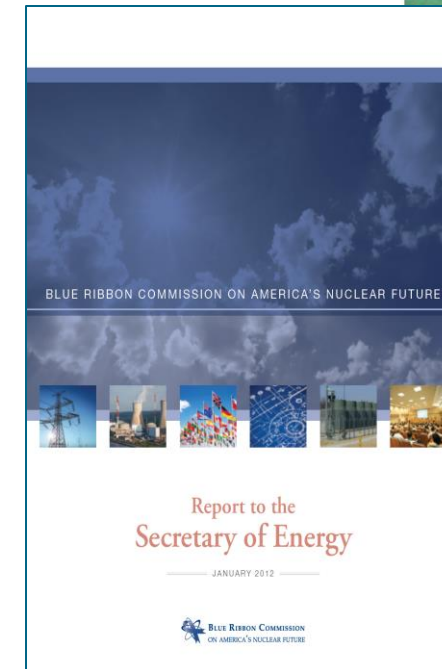
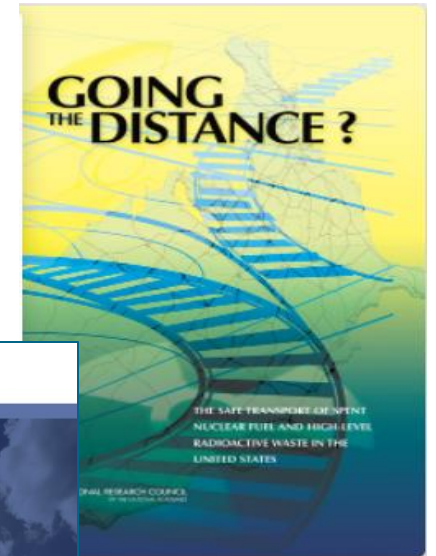
- Four impact tests conducted at Sandia National Laboratories in 1970's (cask transport systems in highway and rail transport modes)
- Central Electricity Generating Board (CEGB) Flask Test Project (aka "Operation Smash Hit") from 1981-1984 in the U.K., conducted with Magnox spent fuel flask (cask)
- Drop tests in Germany at PATRAM conference in 2004 – German and Japanese casks



CEGB public demonstration test. Image from, "Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States," The National Academies Press, Washington, D.C. (2006).

Previous Efforts and Endorsements for a PPP

- Early 2000's Plans by U.S. Nuclear Regulatory Commission
 - *Published NUREG/CR-6768 (Issues Report) and NUREG-1768 (Test Protocols)*
- 2006 National Academy of Sciences (NAS) *Going the Distance?* Report
 - *Recommended full-scale package testing; Endorsed the NRC's PPS approach*
- 2012 Blue Ribbon Commission on America's Nuclear Future
 - *Recommended conducting the PPS with full-scale rail cask for the purpose of building public trust and confidence*
- 2018 Western Interstate Energy Board
 - *Endorsed full-scale tests on production models of a rail cask and truck cask*



DOE Package Performance Project (PPP)

Why is DOE planning a PPP?

- Build trust and confidence in the safety of SNF transportation casks and SNF transportation
- Gather technical data to further support computer models
- Record high-resolution video to use in DOE communication products and public outreach
- Explore additional opportunities to strengthen relationships

External Engagement Expected Outcomes

Short Term:

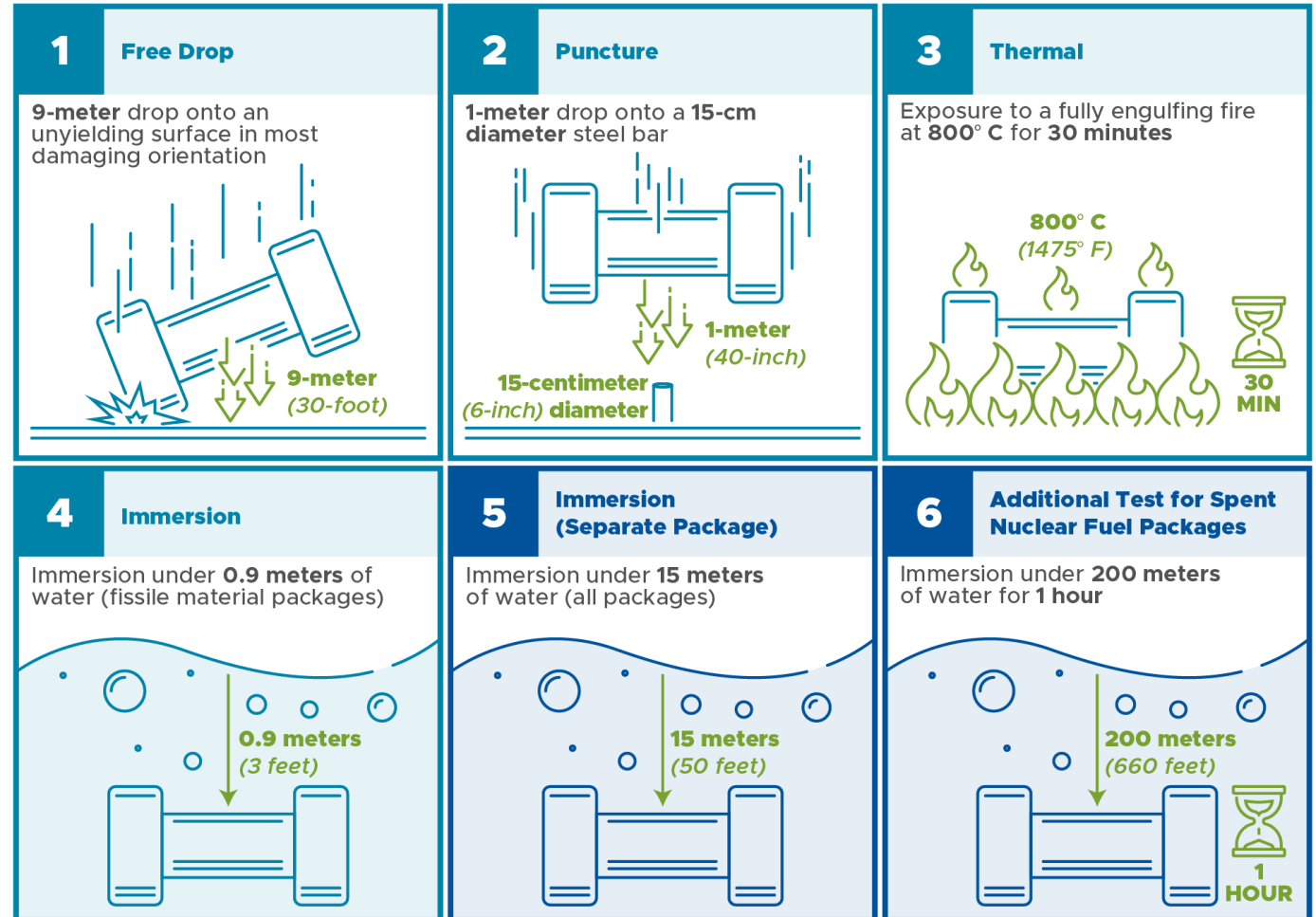
- Input into which demonstrations to perform and other parameters, where possible
- Input into how results are used and distributed
- Identify potential success paths and pitfalls

Long Term:

- Improved knowledge base
- “Shareable” confidence
- Facilitated communication during future transportation campaigns

Potential Demonstrations

Considering demonstrations based on tests described in U.S. Nuclear Regulatory Commission's (NRC's) 10 CFR Part 71



Tests 1-4 are done in sequence on the same transportation cask. Tests 5 and 6 are done on separate transportation casks.

Potential Demonstrations

Considering other demonstrations; for example:

- Train collision with transportation package in a “realistic” type of scenario
- Immersion demonstration in a body of water/waterbody retrieval demonstration



DOE PPP: Preliminary Plans

DOE continues to seek your input on:

- Potential demonstrations to be performed
- Potential transportation casks
- Potential testing facilities/sites
- Potential analytical tools, instrumentation, data collection, and videography

Completion of a PPP depends on continued availability of funding



Preliminary Parameters and Considerations

- DOE-NE intends
 - To use a cask that is likely to be relevant to future SNF transportation operations scenarios to Federal storage and/or disposal facilities
 - (a) a high-capacity design and with a loaded weight between 136,000 kg (300,000 lb) to 193,000 kg (425,000 lb)
 - (b) a design that involves a canister overpack transportation configuration
 - (c) anticipated to be used frequently or regularly for transport
 - To consider conducting potential full-scale demonstrations based on the tests described in 10 CFR Part 71 as well as scenario demonstrations, and these various demonstrations may be conducted at a single facility/site or multiple facilities/sites, depending on the demonstration(s) selected
 - To ensure that instrumentation and high-resolution videography are incorporated into a demonstration plan
 - To conduct a PPP in as open and transparent a manner as possible, which may include (but is not limited to) measures such as inviting observers to the demonstrations, publicly sharing information about how demonstrations were designed and conducted, publishing reports about demonstrations and results, inviting or contracting independent verification, potentially sharing live video of PPP demonstrations via digital platforms, etc.

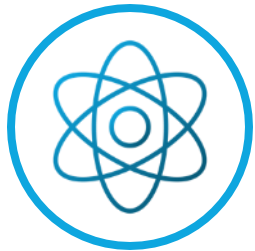
Preliminary Parameters and Considerations

- DOE-NE does not intend
 - To consider scenarios that would simulate specific terrorism or sabotage scenarios such that security-related information would be integral to the demonstration
 - To use casks loaded with SNF in a PPP. Casks may be loaded with simulated fuel content to replicate real loaded conditions
 - To conduct demonstrations that apply forces to a SNF cask beyond those prescribed in 10 CFR Part 71 regulations (i.e., no extra-regulatory or beyond design basis testing)

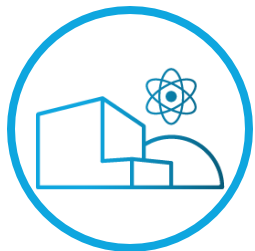
PPD Request for Information (RFI) Published July 2024



Category A.
Stakeholder Input and Feedback



Category B.
Cask Vendors



Category C.
Testing Facilities, Sites, and
Services to Conduct
Demonstrations



Category D.
Instrumentation, Data Collection,
and/or High-Resolution Videography
Services



Category E.
Miscellaneous Questions for
Potential Vendors and Service
Providers

The RFI served as:

- An opportunity for input from interested parties
- Market research for potential vendors for materials, facilities, and services for conducting a PPP

New Opportunity for Input

- Requests from interested parties for a simpler avenue for input
- In response, DOE providing new opportunity for input
- Streamlined background and questions available on <https://curie.pnnl.gov/DOE-PPD>
- 2 sections with 10 questions each
- Focuses on what demonstrations to conduct and how



A photo showing a Sandia National Laboratories package performance demonstration with a train colliding with a cask on a flatbed trailer. Image courtesy of Sandia National Laboratories.

New Opportunity for Input

- Send in responses by January 31, 2025
- Simply email responses to DOE-PPD@id.doe.gov
- Answer as many or as few questions as you would like
- For transparency, responses will be published (do not include personal information)
- No need to resubmit previous RFI responses; additional input welcome



Sample Questions



Should DOE conduct a PPD? Why or why not?



What concerns could a PPD address? For example, are there specific real-world accident scenarios or aspects of SNF transportation of particular concern to you? Please describe how a PPD could help alleviate these concerns.

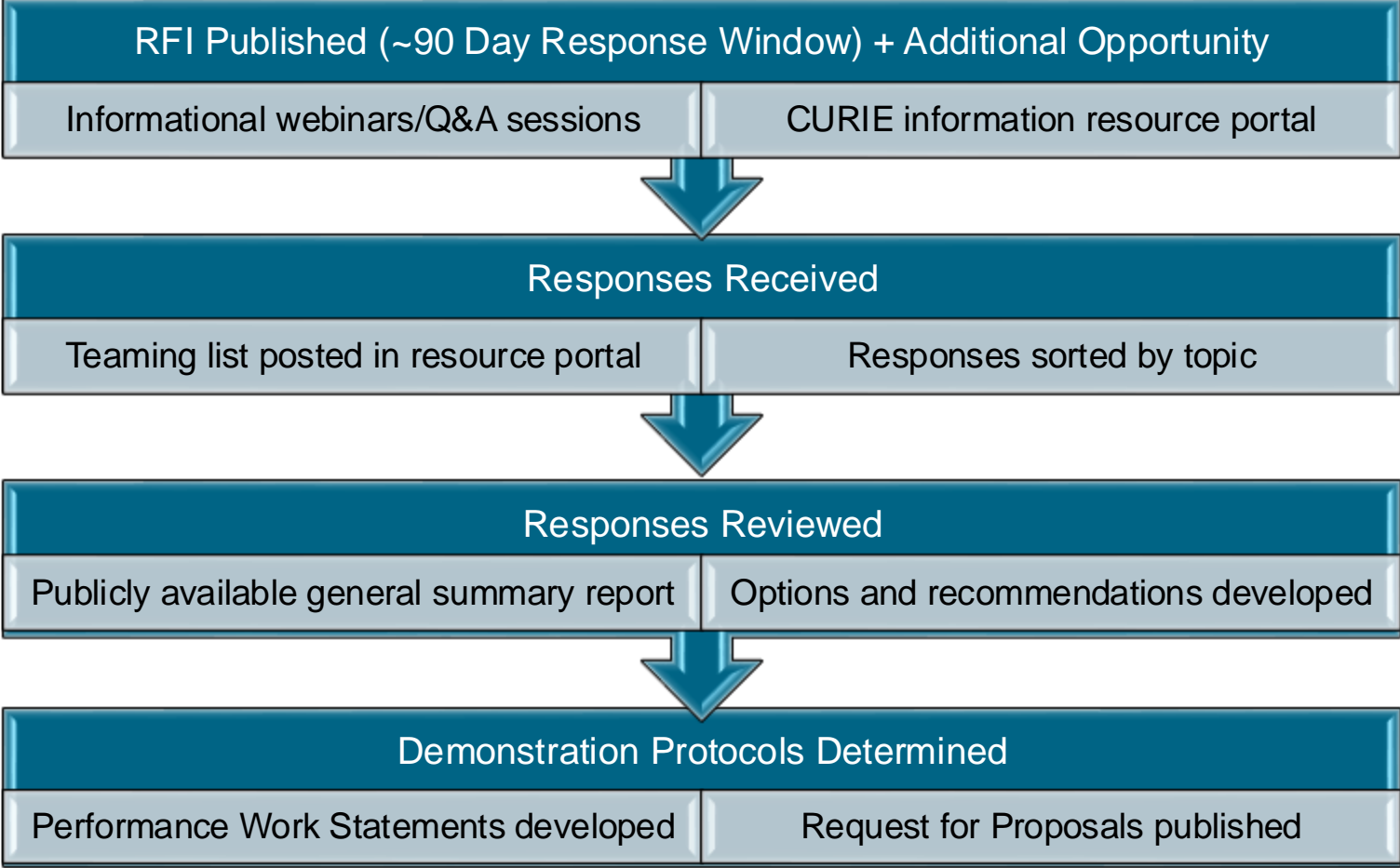


What would make a PPD credible to you (or your constituents/members)? For example, should DOE consider having specific parties with appropriate technical expertise (such as universities, the International Atomic Energy Agency, the NRC, or other entities) witness a PPD in person or having independent reviewers provide input to demonstration plans and data gathered as part of the demonstration(s)?



How would you or your organization recommend that information and results from a PPD be used and shared? How should those potential outcomes be considered in the design of a PPD?

Information Request Process



Phased Engagement Approach

Phase 1: Preliminary Outreach (Pre-RFI)

- Initial engagement
- Develop preliminary technical considerations
- Develop information portal
- Advises Request for Information (RFI) development

MID-2023 – SUMMER 2024

Phase 2: RFI and Comment Period

- RFI published, gather responses, review feedback
- Increase breadth of outreach
- Webinars, listening sessions
- Informs request for proposal (RFP)

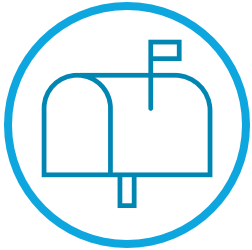
SUMMER 2024 – SUMMER 2025

Phase 3: RFP through PPP Implementation

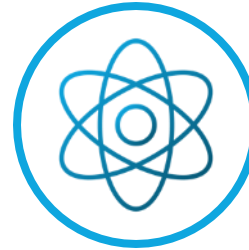
- RFP issued, responses received, DOE decisions on demonstrations
- Broadest outreach
- Educational/informational webinars, updates
- Informs PPP and post-PPP communications

FALL 2025 – 2028 (TARGET)

Stay up to Date on the PPP



Subscribe to our [email list](#) for updates



Tune in to future DOE webinars and conference events



Learn more on our PPP information portal: <https://curie.pnnl.gov/DOE-PPD>



Respond to the additional information request opportunity by January 31, 2025. Simply respond by email to DOE-PPD@id.doe.gov.



Q&A

U.S. DEPARTMENT OF
ENERGY

Office of
NUCLEAR ENERGY

SPENT FUEL & HIGH-LEVEL
WASTE DISPOSITION

Thank you!

More info: <https://curie.pnnl.gov/DOE-PPD>
Submit questions to: DOE-PPD@id.doe.gov

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