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

Overview of the U.S. DOE's Office of Spent Fuel & Waste Disposition Activities

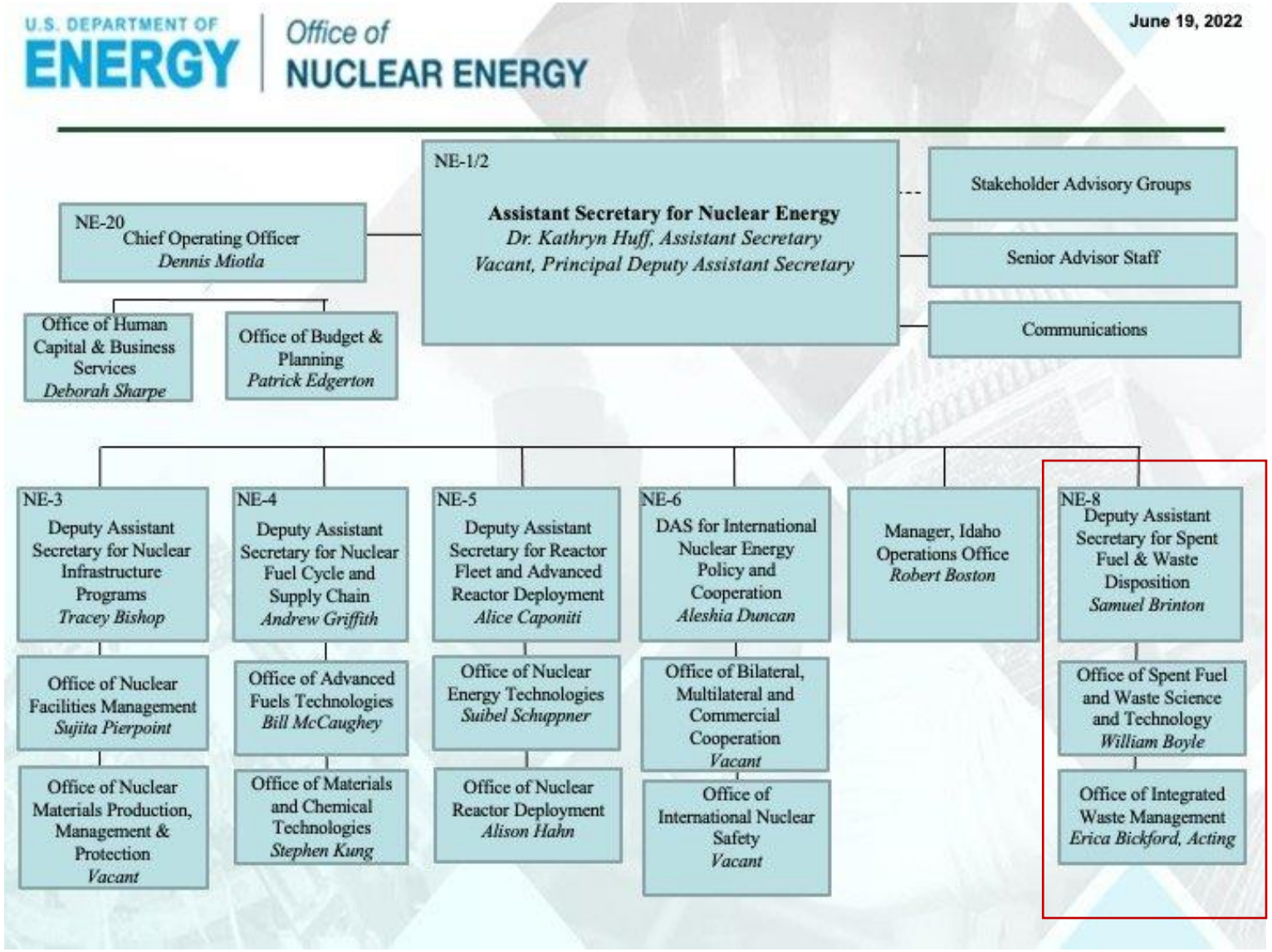
Jorge Narvaez and Natalia Saraeva

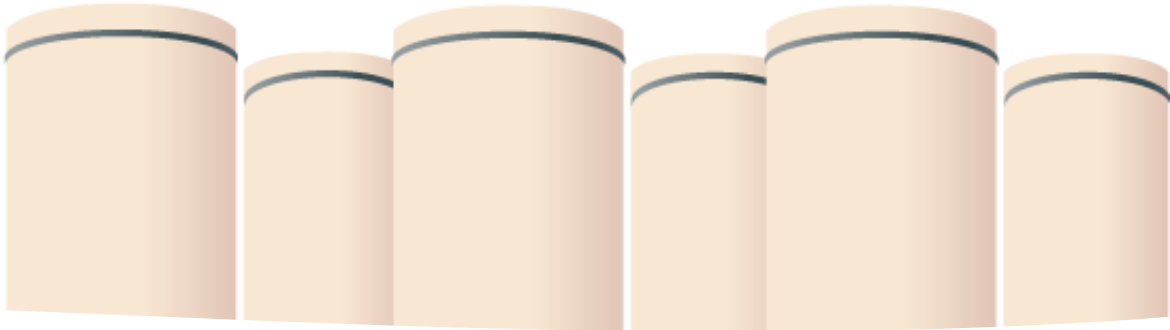
Office of Spent Fuel and Waste Disposition

Office of Nuclear Energy

U.S. Department of Energy

Office of Spent Fuel and Waste Disposition



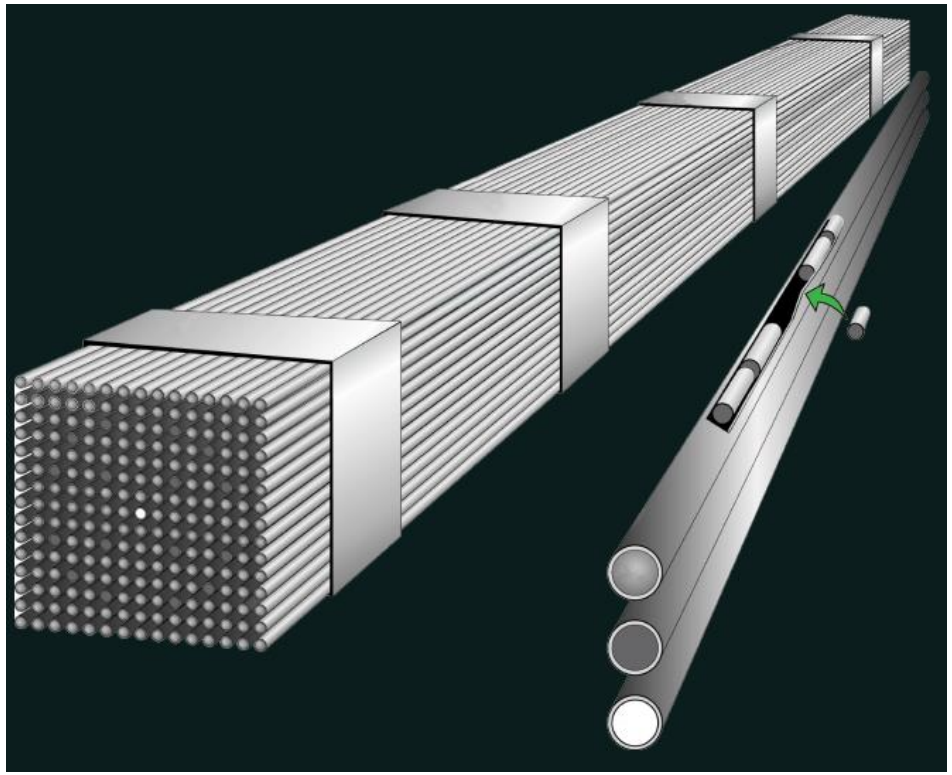


Integrated Waste Management

- As we continue to deploy nuclear energy as a solution for decarbonization, increasing access to energy, and tackling climate change, we need to make progress on the back end of the fuel cycle
- The U.S. Department of Energy is responsible for managing the nation’s spent nuclear fuel and high-level radioactive waste, including finding sites to store and dispose of the spent nuclear fuel
- While spent nuclear fuel is stored safely all over the country, the communities that have the spent nuclear fuel never agreed to host the material long term

Waste Management R&D

- Conduct R&D for eventual geologic disposal, extended storage, and transport of spent nuclear fuel and high-level radioactive waste
- Investigating different geologies and developing generic disposal concepts
- Quantify effects of storage and transportation on spent fuel integrity
- Leverage international collaboration



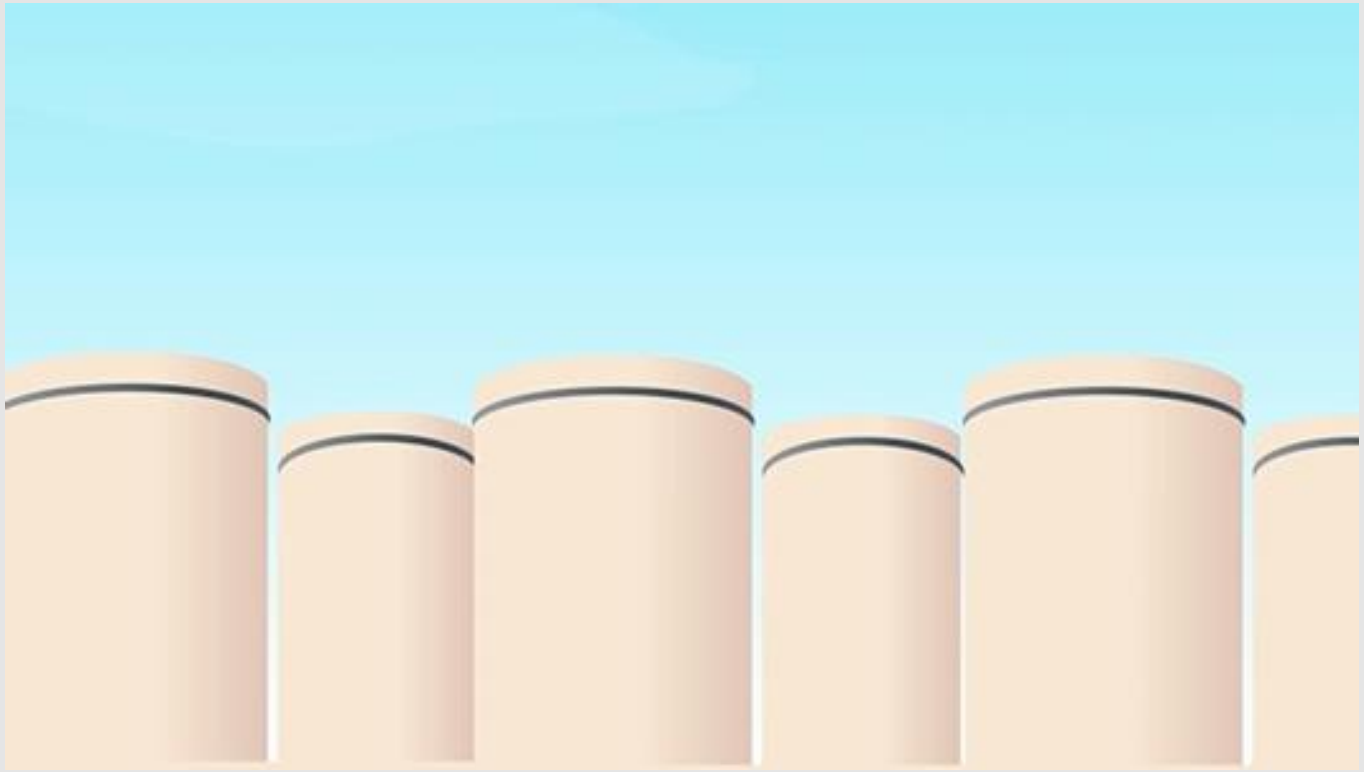
International Collaboration

- International Atomic Energy Agency
  - Joint Convention on the Safety of Spent Fuel and on the Safety of Radioactive Waste Management
  - Nuclear fuel Cycle Options and Spent Fuel Management Technical Working Group
  - Various consultancy and technical meetings
- OECD/NEA Radioactive Waste Management Committee (RWMC)
- International Association for Environmentally Safe Disposal of Radioactive Materials (EDRAM)
- Participation in multinational collaboration projects (e.g. underground research laboratories R&D, transportation research, other)
- Participation in international workshop on intergenerational equity
- Bilateral R&D collaborations

Image Source: U.S. Mission to International Organizations in Vienna

Integrated Waste Management, Interim Storage & Transportation

- Plan for transportation of spent nuclear fuel
- Perform system analysis and integration
- Generic design of facilities
- Consent-based siting



Interim Storage

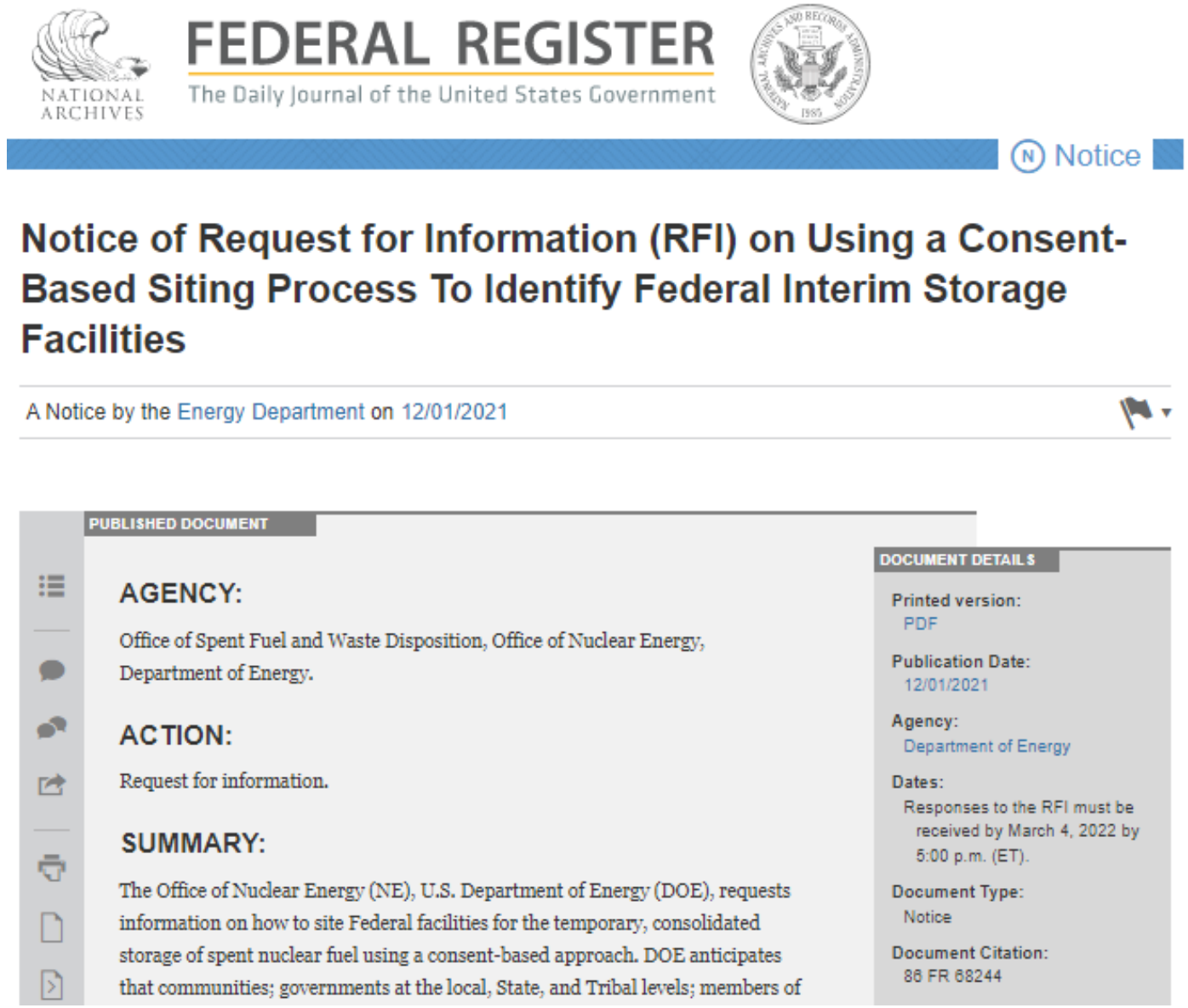
- Allow for removal of spent nuclear fuel from reactor sites
- Provide useful research opportunities
- Build trust and confidence with stakeholders
- Begin to address taxpayer liability

Consent-Based Siting

- Consent-based siting is an approach to siting facilities that focuses on the needs and concerns of people and communities.
- By prioritizing communities and people, we believe we can find a solution to the decades-long stalemate on managing the nation’s spent nuclear.
- A consent-based approach, driven by community well-being and community needs, is both the right thing to do and our best chance for success.

Request for Information

- Questions on:
  - the consent-based siting process itself
  - removing barriers to meaningful participation—especially for groups and communities who have not historically been well-represented in these conversation
  - interim storage as a component of the nation's waste management system
- Special focus on ensuring issues of equity and environmental justice are built into the consent-based siting process, as well as the waste management system as a whole



NATIONAL ARCHIVES

FEDERAL REGISTER

The Daily Journal of the United States Government

Notice

Notice of Request for Information (RFI) on Using a Consent-Based Siting Process To Identify Federal Interim Storage Facilities

A Notice by the Energy Department on 12/01/2021

PUBLISHED DOCUMENT

AGENCY:

Office of Spent Fuel and Waste Disposition, Office of Nuclear Energy, Department of Energy.

ACTION:

Request for information.

SUMMARY:

The Office of Nuclear Energy (NE), U.S. Department of Energy (DOE), requests information on how to site Federal facilities for the temporary, consolidated storage of spent nuclear fuel using a consent-based approach. DOE anticipates that communities; governments at the local, State, and Tribal levels; members of

DOCUMENT DETAILS

Printed version:
PDF

Publication Date:
12/01/2021

Agency:
Department of Energy

Dates:
Responses to the RFI must be received by March 4, 2022 by 5:00 p.m. (ET).

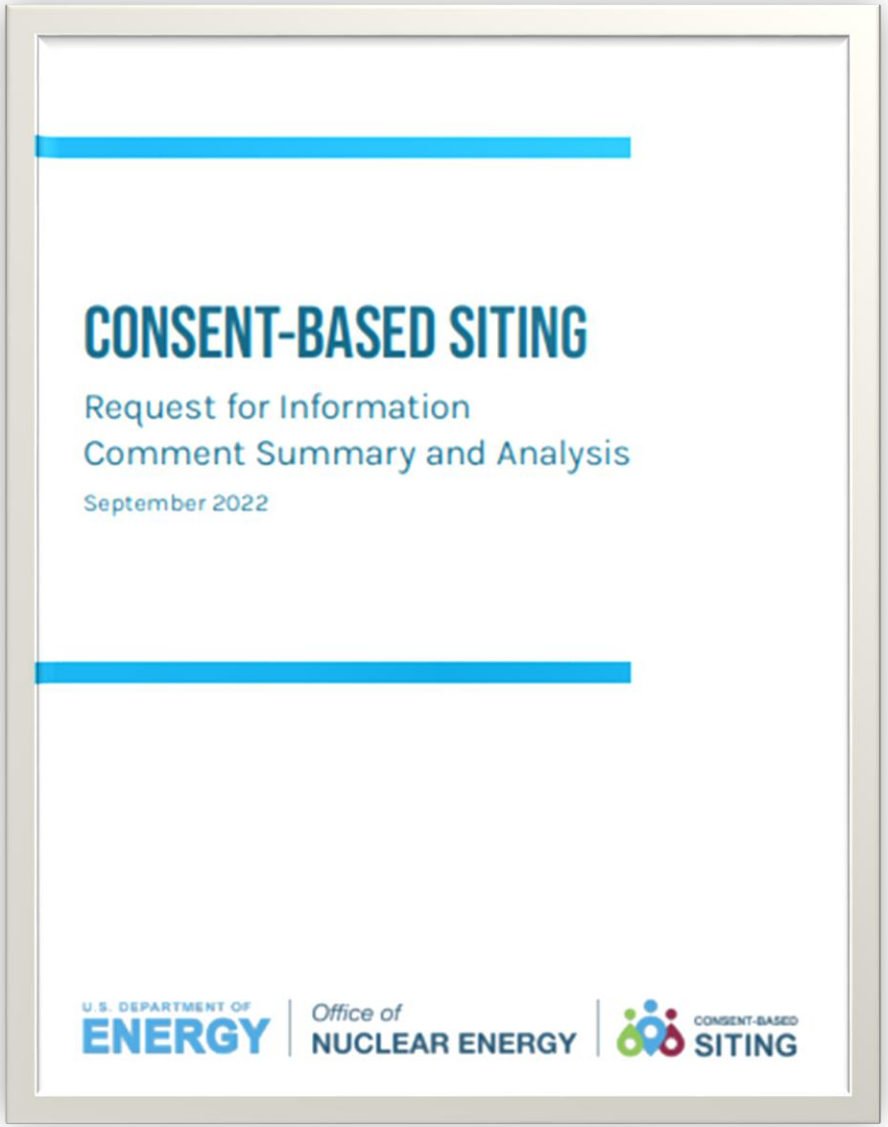
Document Type:
Notice

Document Citation:
86 FR 68244

Summary of Feedback

~225 comments as follows:

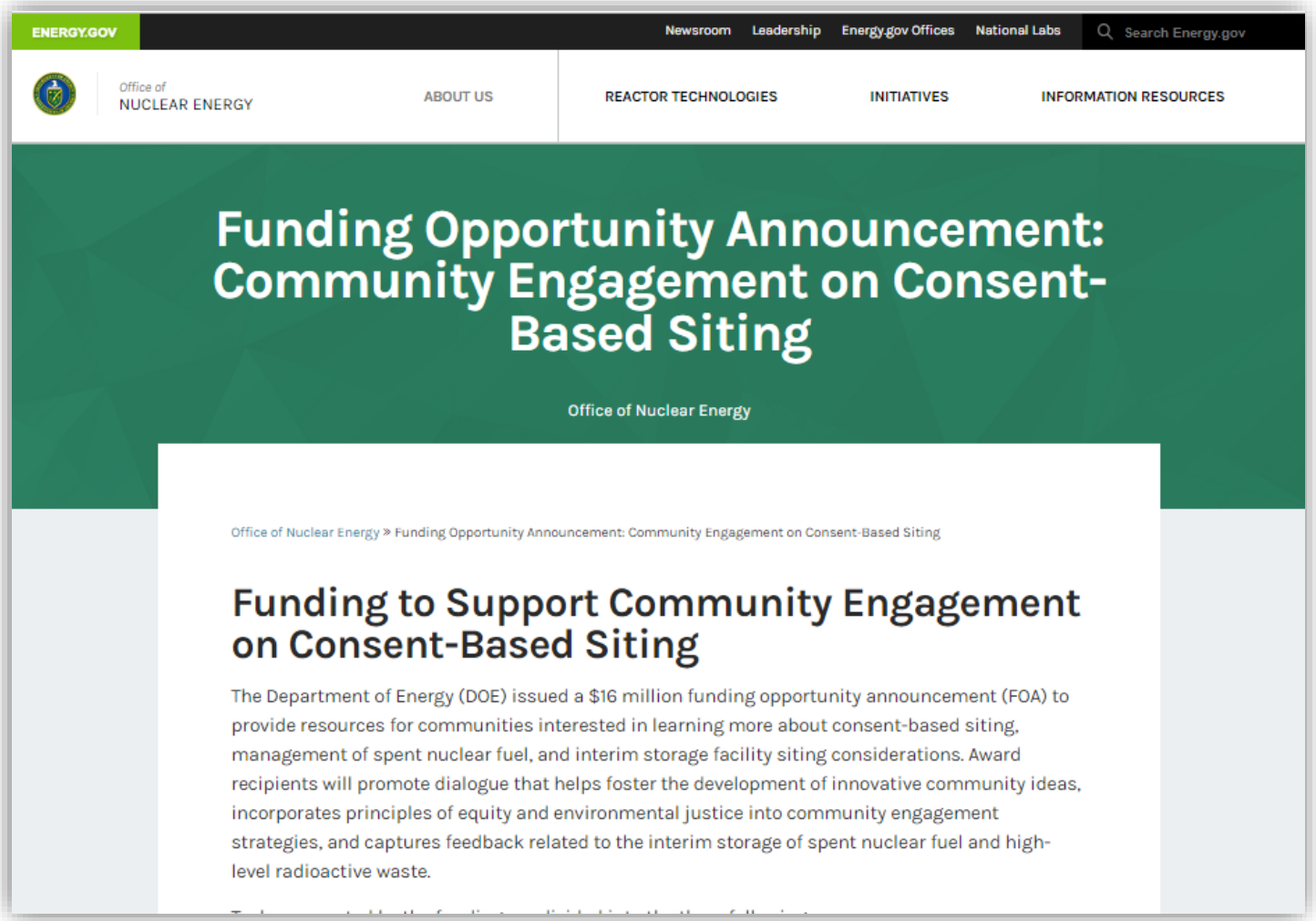
- **Tribes**: 3 from Tribal groups, 3 from Tribes
- **States**: 12 State government organizations, 3 State and Regional Groups, and 3 groups representing State governments or their interests
- **Local governments**: 7
- **NGOs**: ~35
- **Environmental Justice organizations**: 2
- **Industry:** ~12
- **Members of Academia**: ~7
- **Labor Union**: 1
- **Private Citizens**: ~132 (including 45 “form” letters)



Funding Opportunity Announcement

- Informed by public feedback
- $16 Million, 6-8 awardees, period of performance 18-24 month
- Not a call for volunteers to host a site
- Reduce barriers for participation
- Increase outreach, enable mutual learning and start building capacity
    - Learning about spent-nuclear fuel and spent nuclear fuel management, consolidated interim storage, consent-based siting and more.

energy.gov/consent-based-siting



Public Feedback is Informing Next Steps in Consent-Based Siting

1

Further developing consent-based siting process

2

Implementing funding opportunity for interested groups and communities to learn more

3

Clarifying our broader strategy for an integrated waste management system

Looking Ahead

- Consent-based siting and addressing societal challenges
- Need for a disposal pathway
- Extended storage research
- ***Foreseeing waste management from advanced reactors deployment***
- Knowledge management

energy.gov/consent-based-siting

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

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

Overview of the U.S. DOE's Materials Recovery and Waste Form Development Activities

Stephen Kung and James Willit

Office of Nuclear Fuel Cycle and Supply Chain

Office of Nuclear Energy

U.S. Department of Energy

Back-End of Fuel Cycle – Used Fuel Recycling

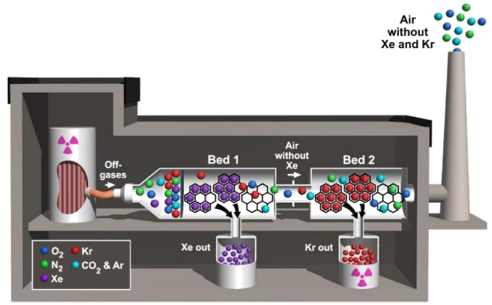
Mission – Develop advanced fuel recycle technologies to improve resource utilization, reduce repository burden, and limit proliferation risk.

Goals

- Demonstrate recycling technologies to produce HALEU materials for advanced reactor fuel-fabrication R&D needs.
- Address nuclear materials separation and recovery challenges for various advanced reactor designs.
- Develop efficient and economical technologies for commercially viable future industrial deployment.
- Steward and expand the capabilities and knowledge in nuclear chemistry for a broad range of nuclear applications.

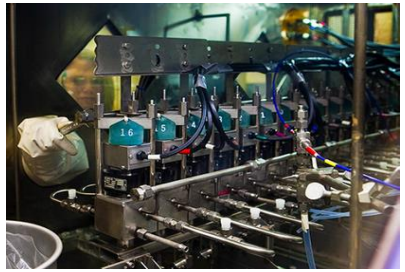
Program Focus Areas

- Aqueous technologies
- Molten salt technologies
- Off-gas and waste form technologies



Conceptual off-gas system configuration for 2-bed noble gas separation

Uranium recovered from EBR-II fuel



Courtesy of PNNL - Bank of 2 cm centrifugal contactors in glove box

Aqueous Recycling Technologies

Solvent extraction technologies to separate fission products and to recycle Pu and U. NE activities focus on developing simplified process.

Examples of current RD&D scopes:

- Advanced vol-oxidation to directly dissolve fuel to organic phase – skipping nitric acid dissolution and improved off-gas management,
- AI/ML aided ligands design and synthesis for tailored actinide separations to enhance separation efficiency,
- Vapor phase extraction of Zr and Al cladding materials to eliminate the generation of acid wastes,
- Innovative control of reagent and solution chemistry to minimize irradiation damage.
- Real-time characterization of chemical species.

Molten Salt Recycling Technologies

Recent accomplishments

- Joint Fuel Cycle Study demonstration activities
- Developed in situ process monitoring tools
- Improved U-TRU co-deposition technology
- Accelerated electrorefining of EBR-II driver fuel for HALEU feedstock

Key Focus Areas

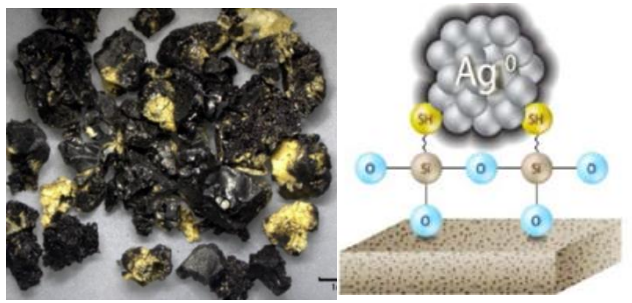
- Identify and develop new process chemistry for preparing and treating MSR fuel
- Improve our fundamental understanding of salt chemistry to simplify and optimize flowsheets
- Improving the overall economics with technology improvements and simplified flowsheets
- Develop integrated facility design requirements and design concepts
- Integrating safeguards by design in RD&D

Off-Gas and Waste Form Technologies

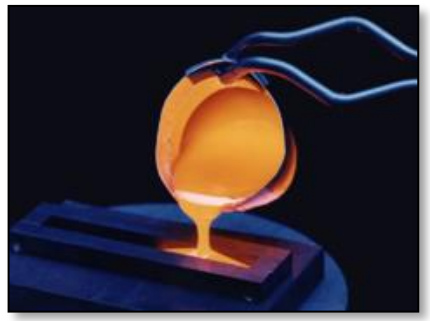
Any recycling application requires off-gas and waste form technologies

- Developing and demonstrating advanced forms for salt waste streams.
- Developing options for iodine capture and immobilization.
- Developing and optimizing sorbent material for traditional and advanced fuel cycles.

Studying long-term efficiency of an iodine sorbent



Silver-loaded aerogel, an iodine sorbent



Quench-cooled sampling of phosphate glasses

Thank you!

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