Written Testimony of Kathryn D Huff

Professor and Department Chair
Nuclear Engineering and Engineering Physics
University of Wisconsin Madison

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Chair Capito, Ranking Member Whitehouse, and members of the Committee, thank you for the opportunity to testify about spent nuclear fuel management and nuclear fuel recycling.

I am appearing today in my individual capacity as a nuclear engineer and former federal official. I am a professor and chair of the Department of Nuclear Engineering and Engineering Physics at the University of Wisconsin-Madison. However, my testimony does not represent the official position of the University of Wisconsin. From 2021 through 2024, I led the Office of Nuclear Energy at the U.S. Department of Energy, first as Principal Deputy Assistant Secretary and Acting Assistant Secretary and then as the Senate-confirmed Assistant Secretary for Nuclear Energy. My research has addressed nuclear fuel cycles, advanced reactor systems, radioactive waste management, and nuclear nonproliferation.

A durable U.S. spent fuel management program will require federal leadership. Private companies are prepared to develop equipment, establish processes, and operate some of these complex facilities. Meanwhile, the federal government is equipped to provide reliable economic incentives, maintain responsibility for materials that require management over generations, and ensure independent regulatory oversight.

Permanent Disposal and the Nuclear Waste Fund

After several years of operation, the enriched uranium fuel rods that power nuclear reactors deplete and must be removed. The heat and radioactivity associated with spent nuclear fuel must be managed by reactor operators and stored safely. The existing U.S. reactor fleet generates about 2,000 metric tons of spent fuel each year. More than 90,000 metric tons are stored at more than 70 reactor and storage sites across the country [1]. Over the last 55 years, more than 2,500 cask shipments of spent fuel have been transported across the United States without any radiological releases to the environment or harm to the public [2].

The promise of new reactors can most responsibly be realized in conjunction with progress on the management of their spent nuclear fuel. The United States will need permanent disposal capacity under every plausible fuel cycle strategy. Permanent disposal will be required for fuel that is not recycled and for wastes produced during recycling.

Yucca Mountain is off the table. Nevadans have consistently opposed the repository, and their position is understandable. Nevada did not host commercial nuclear power reactors or receive the electricity and economic benefits associated with the fuel Congress directed there. DOE's investigation and development of alternatives acknowledges that. The most resilient approach will be through a consent-based process involving affected communities, states, and Tribal Nations.

Consolidated interim storage is needed to reduce taxpayer liabilities, remove fuel from shutdown reactor sites, reduce the number of storage locations, and establish transportation capability. In order for consolidated

interim storage to proceed with the confidence of a host community, the agreement must define the operating term, capacity, renewal conditions, benefits, monitoring requirements, and connection to permanent disposal. Additional congressional authorization would be required before DOE can construct and operate a federal consolidated interim storage facility and begin removing commercial spent fuel from reactor sites.

The latest DOE financial statement reports a Nuclear Waste Fund balance of over $51 billion [11]. But it is inaccessible. Congress should change the budgetary treatment of the Fund so that money collected for nuclear waste management can be used predictably for its original purpose.

A mission-focused federal corporation, similar to Canada's Nuclear Waste Management Organization, could be well suited to manage commercial spent fuel transportation, storage, and disposal. It would require reliable access to the Nuclear Waste Fund, authority to negotiate host agreements and long-term contracts, technical capacity, and governance that can continue across presidential administrations [12].

Elements of Sustainable Nuclear Spent Fuel Management

1. **A national recycling program.** A coherent program requires clear objectives, consistent measures for evaluating technologies, and federal cost sharing for first-of-a-kind projects.

2. **Federal responsibility.** A commercial scale recycling facility requires durable federal responsibility for spent fuel and residual waste. A government-owned, contractor-operated model would combine that responsibility with private-sector expertise.

3. **Statutory authority.** DOE acceptance of fuel at any site other than Yucca Mountain requires statutory clarity on activities, ownership, funding, liability, licensing, community participation, Tribal consultation, and long-term stewardship.

4. **Independent regulation.** Commercial demonstrations require NRC involvement from design through operation and all applicable NRC licenses. Ultimately, storage and disposition will require NRC licensing as directed under the NWPA.

5. **A waste management organization.** Effective transportation, storage, and disposal require a dedicated mission-focused federal corporation with predictable access to the Nuclear Waste Fund and authority to develop consent-based alternatives to Yucca Mountain.

Spent Nuclear Fuel and Recycling

We should recycle spent nuclear fuel for the same reasons we recycle aluminum, paper, and other valuable materials. Recycling uses resources efficiently and preserves resources for future generations. Certainly, the technical and institutional demands of recycling used nuclear fuel are much greater than those associated with household materials. However, responsibility to use valuable material conscientiously is the same.

Most of the material in spent light-water-reactor fuel is uranium. The remainder includes plutonium, other actinides, and fission products. Recycling can recover uranium and transuranic elements for additional energy production and can recover selected isotopes for medical, industrial, research, or space applications. Depending on the process and the reactors using the recovered material, recycling can also simplify the heat load, radionuclide inventory, physical form, and volume of material requiring permanent disposal.

Those outcomes depend on the technology. Aqueous and electrochemical processes produce different recovered materials and different waste streams. Light-water-reactor oxide fuel, metallic fast-reactor fuel, TRISO fuel, sodium-bonded fuel, and irradiated fuel salts also require different approaches to handling, processing, transportation, and disposal. A credible demonstration must identify the intended use of each recovered product and the management and disposition route for each residual waste stream.

Every fuel cycle strategy requires permanent disposal. Some spent fuel will be technically or economically unsuitable for recycling, and every recycling process produces wastes. Recycling can improve repository performance or capacity by changing the heat load and composition of those wastes. Demonstrating those benefits requires calculations based on a defined fuel cycle and repository design.

First-of-a-kind recycling facilities will require substantial capital investment, licensing work, fuel qualification, specialized supply chains, and trained workers. The market price of recovered fuel will not compensate a private developer for every national benefit. Improved energy security, reduced dependence on foreign fuel cycle services, domestic technical capacity, and the preservation of resources for future generations benefit the public. Federal cost sharing is appropriate when a project can demonstrate those benefits and meet defined technical, cost, schedule, safeguards, and waste-management milestones.

Institutional Responsibility for Reprocessing

Commercial-scale civilian reprocessing has not developed anywhere as a purely private, market-financed enterprise. France's La Hague facility is operated by Orano. The French government owns approximately 90 percent of Orano, and reprocessing is part of a national nuclear fuel cycle policy [3]. Japan's Rokkasho Reprocessing Plant is owned by Japan Nuclear Fuel Limited, whose shareholders include the ten domestic electric power companies and 74 other domestic companies [4]. Rokkasho operates within a national policy and statutory system for reprocessing, financing, regulation, safeguards, and the management of recovered plutonium and radioactive waste [5].

I have visited both La Hague and Rokkasho. These are serious industrial facilities which require extensive infrastructure and government integration. They rely on heavily shielded process buildings, remote operations and maintenance, nuclear material accountancy, physical security, waste treatment and vitrification, transportation systems, financial consistency, and a workforce capable of sustaining these functions for decades. The operator must also manage recovered nuclear material and multiple radioactive waste streams whose disposition extends beyond the commercial life of the plant.

The institutional model for a first commercial-scale recycling facility warrants careful evaluation. A government-owned, contractor-operated structure could preserve federal responsibility while drawing on private expertise. The cost and schedule failures of DOE’s MOX Fuel Fabrication Facility at Savannah River demonstrated that this model offers no guarantee of success. Under any ownership model, responsibility for the facility, nuclear materials, and residual waste would need to be clear.

Nuclear Lifecycle Innovation Campuses

In July 2026, DOE announced memoranda of understanding with Utah, Tennessee, Oklahoma, Louisiana, and Idaho to explore Nuclear Lifecycle Innovation Campuses [6]. DOE has described possible campus activities that include conversion, enrichment, deconversion, fuel fabrication, recycling, storage, and disposition, potentially alongside reactors and industrial users.

Such a campus would involve several facilities with different purposes and different licensing requirements. Interim storage, repackaging, recycling, fuel fabrication, low-level waste disposal, greater-than-Class-C waste disposal, deep boreholes, and a geologic repository each present distinct technical and regulatory questions. Under 10 CFR 61.55, greater-than-Class-C waste is not generally acceptable for near-surface disposal unless the Commission approves a proposal for such disposal [7]. Deep boreholes may be appropriate for some small-volume conditioned waste forms. However, most intact commercial fuel assemblies and loaded storage systems would require handling, disassembly, conditioning, and repackaging before borehole disposal could be considered.

Establishing an Innovation Campus that accepts commercial spent fuel will require statutory authority and appropriated funding. To allow states and communities to evaluate the proposal, the statutory framework would need to clarify ownership, costs, and long-term responsibilities. It would also need to preserve accountability if a contractor withdraws or fails.

The memoranda with five governors are a useful beginning. A credible host state agreement must also identify the affected communities and Tribal Nations, provide resources for independent technical advice, establish the decisions requiring their agreement, and define withdrawal rights before major commitments are made. The hazards, benefits, ownership, and long-term responsibilities must be described before a community can evaluate whether it wishes to host them.

DOE Authorization and NRC Licensing

Congress separated nuclear promotion from independent nuclear regulation in the Energy Reorganization Act of 1974 [8]. In this framework, DOE has authority to conduct nuclear research and development and to build and operate facilities for authorized federal missions. Meanwhile, NRC retains exclusive authority to license commercial nuclear facilities.

And, although DOE Authorization may promise speed, stretching its applicability is likely to be counterproductive and weaken the independence of the licensing process. A project authorized by DOE with the expectation of later NRC licensing may not withstand a change in administration and could undermine public trust. Once the government has selected, funded, and allowed construction of a facility, sunk costs could place practical and political pressure on NRC review, undermining the very independence that is necessary to ensure nuclear safety and avoid conflicts of interest. For that review to remain credibly independent, NRC involvement must begin before those commitments are made.

Public opinion research supports independent NRC oversight. In a 2023 survey of 1,000 U.S. adults, NRC ranked slightly higher than DOE as a credible source of nuclear energy information, while university professors and national laboratory scientists ranked higher than both [9]. In a 2026 survey of 1,000 registered voters, 72 percent favored maintaining strict safety regulations even if they slow new projects [10]. Involvement by NRC, university researchers, and national laboratory scientists from the beginning can accordingly provide essential rigor and public credibility.

Any facility intended for commercial deployment should engage NRC from the beginning. Its design, quality assurance, safety analysis, material accountancy, waste forms, and operating records should support eventual NRC licensing. Early engagement allows technical issues to be resolved before the design is fixed and gives prospective host communities a clear view of the regulatory process.

Conclusion

The United States has safely stored and transported spent nuclear fuel for decades. However, it has not yet established a durable system for recycling valuable used nuclear fuel, removing spent fuel from reactor sites, or disposing of the material that remains. Congress now has an opportunity to establish that system with clear federal responsibility, independent regulation, meaningful participation by prospective host communities, and access to the funds collected for this purpose.

Thank you for the opportunity to appear before the Committee today. I look forward to your questions.

References

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[6] U.S. Department of Energy, Nuclear Lifecycle Innovation Campuses Contenders Announced, July 28, 2026; Theodore J. Garrish, written testimony before the House Committee on Energy and Commerce, Subcommittee on Energy, September 15, 2026.

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[8] Energy Reorganization Act of 1974, Pub. L. No. 93-438, 88 Stat. 1233.

[9] Bisconti Research, Inc., Who Does the Public Trust on Nuclear Energy, May 31, 2023. The survey included 1,000 nationally representative U.S. adults selected from the Quest Mindshare Panel.

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[11] U.S. Department of Energy, Nuclear Waste Fund Annual Financial Report Summary, FY2025 and Cumulative.

[12] Blue Ribbon Commission on America's Nuclear Future, Report to the Secretary of Energy, January 2012.