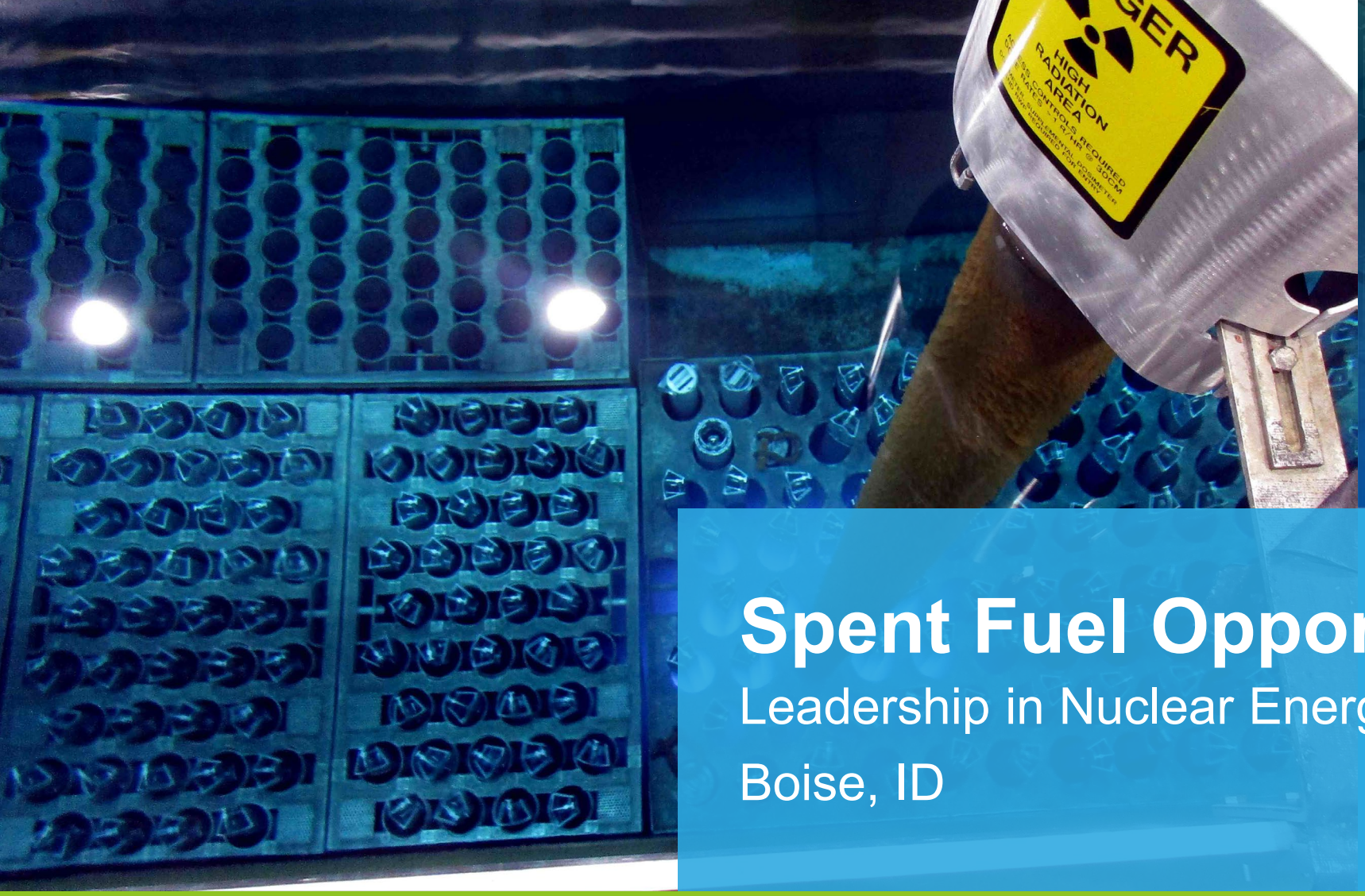


January 31, 2024

Josh Jarrell, Ph.D.
Senior Technical Advisor to DOE,
Advanced Nuclear Fuel Availability Program

Spent Fuel Opportunities at INL

Leadership in Nuclear Energy (LINE) Commission

Boise, ID

INL/MIS-24-76331

Battelle Energy Alliance manages INL for the
U.S. Department of Energy's Office of Nuclear Energy

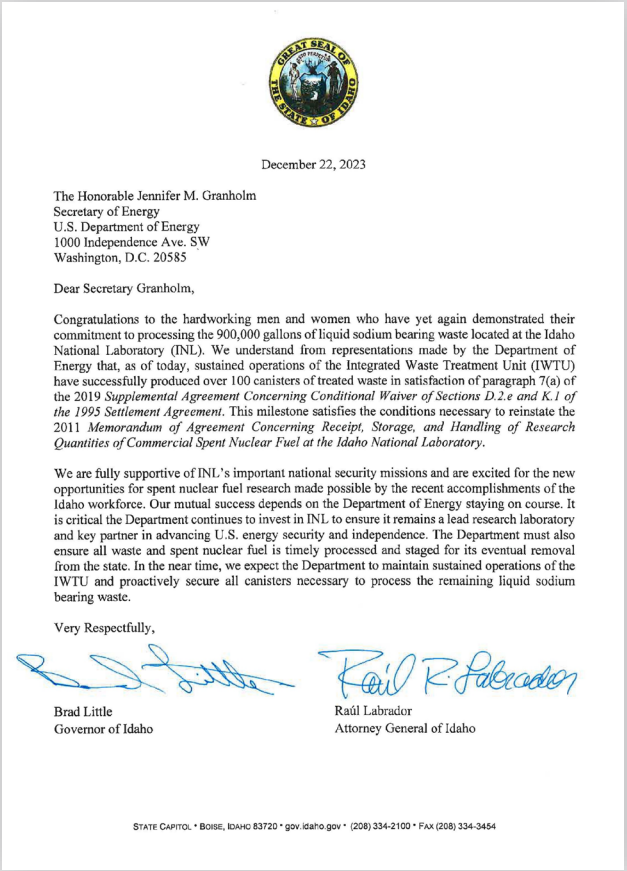
Idaho National Laboratory

Recent events have positioned INL for new spent fuel opportunities

- It's an exciting time at INL
  - IWTU successfully processed over 100 canisters
  - State of Idaho recognized SNF receipts could resume as covered under 2011 Memorandum of Agreement
  - Byron shipment was received at INL in December of 2023
- What's next?

The Byron shipment arriving at INL.

Idaho Environmental Coalition staff members and dignitaries signed the first canister before it was filled with treated sodium-bearing waste.



December 22, 2023

The Honorable Jennifer M. Granholm
Secretary of Energy
U.S. Department of Energy
1000 Independence Ave. SW
Washington, D.C. 20585

Dear Secretary Granholm,

Congratulations to the hardworking men and women who have yet again demonstrated their commitment to processing the 900,000 gallons of liquid sodium bearing waste located at the Idaho National Laboratory (INL). We understand from representations made by the Department of Energy that, as of today, sustained operations of the Integrated Waste Treatment Unit (IWTU) have successfully produced over 100 canisters of treated waste in satisfaction of paragraph 7(a) of the 2019 *Supplemental Agreement Concerning Conditional Waiver of Sections D.2.e and K.1 of the 1995 Settlement Agreement*. This milestone satisfies the conditions necessary to reinstate the 2011 *Memorandum of Agreement Concerning Receipt, Storage, and Handling of Research Quantities of Commercial Spent Nuclear Fuel at the Idaho National Laboratory*.

We are fully supportive of INL's important national security missions and are excited for the new opportunities for spent nuclear fuel research made possible by the recent accomplishments of the Idaho workforce. Our mutual success depends on the Department of Energy staying on course. It is critical the Department continues to invest in INL to ensure it remains a lead research laboratory and key partner in advancing U.S. energy security and independence. The Department must also ensure all waste and spent nuclear fuel is timely processed and staged for its eventual removal from the state. In the near time, we expect the Department to maintain sustained operations of the IWTU and proactively secure all canisters necessary to process the remaining liquid sodium bearing waste.

Very Respectfully,

Brad Little
Governor of Idaho

Raúl Labrador
Attorney General of Idaho

STATE CAPITOL • BOISE, IDAHO 83720 • gov.idaho.gov • (208) 334-2100 • FAX (208) 334-3454

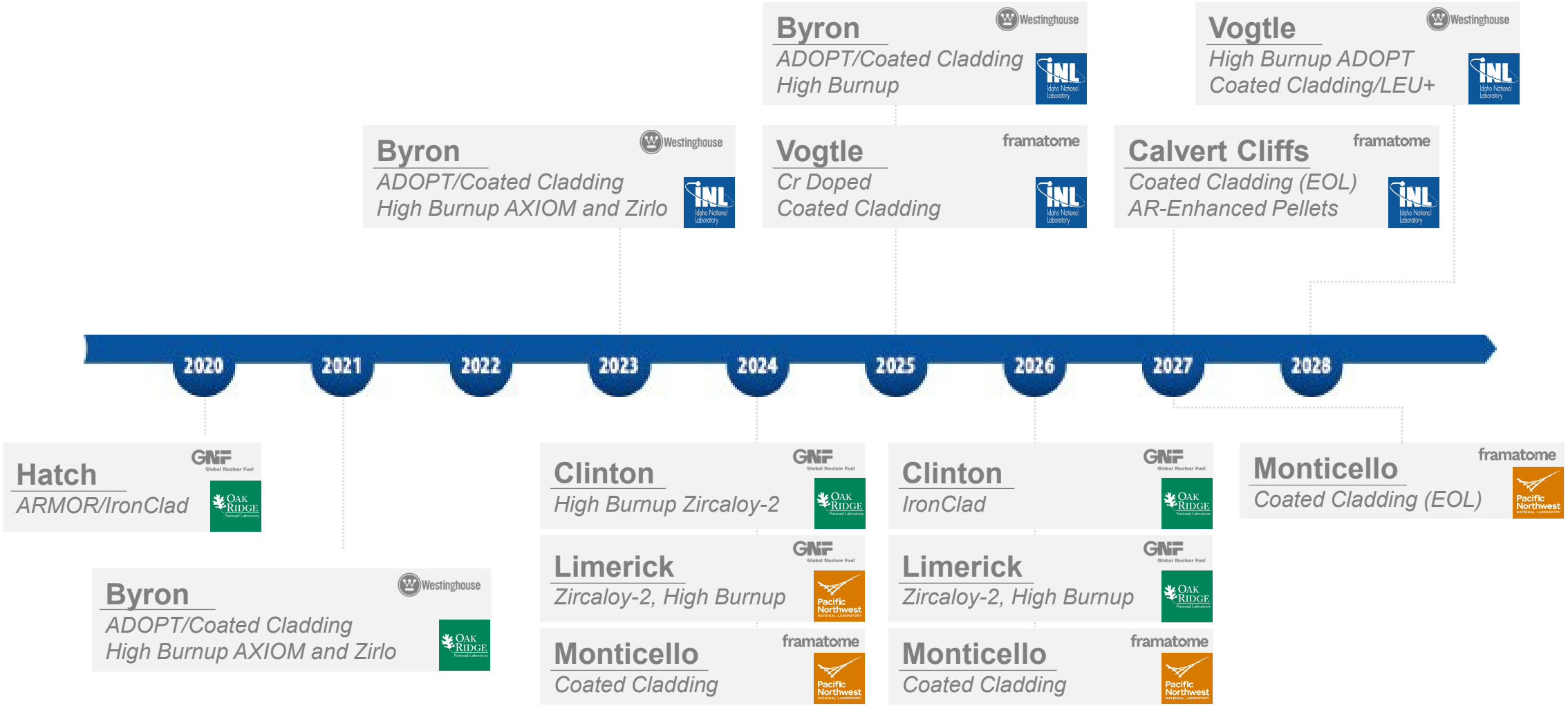
Idaho's Governor and Attorney General sent a letter to the U.S. Secretary of Energy commemorating the continued operation of INL's Integrated Waste Treatment Unit at the INL Site

Byron Shipment Receipt

- In early December, INL received the shipment of 25 fuel rods
- INL coordinated closely with state and tribal leaders regarding the shipment
- The news release was issued on January 25
  - https://inl.gov/nuclear-energy/commercial-advanced-nuclear-fuel-arrives-in-idaho-for-testing/
- The shipment received coverage in several local and state publications, with national coverage likely to follow this week

The Byron shipment arriving at INL's Hot Fuel Examination Facility

Industry ATF Test Sample Shipment Plans

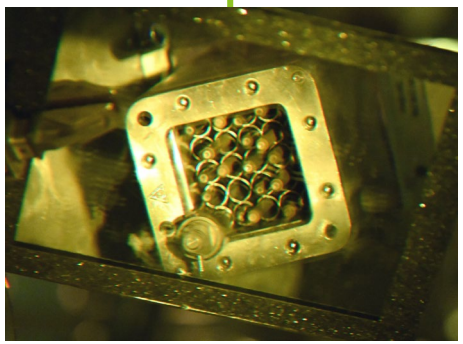


Spent fuel comes in a range of shapes and sizes

- Different fuels can have significantly different masses, volumes, and densities
- 2011 Memorandum of Agreement limits the annual receipt to 400 kgU in a calendar year
  - 400 kgU can be dramatically different depending on the type of spent fuel

Spent fuel size and mass comparison – Commercial spent fuel is VERY dense

~37.4 kgU or 0.9 gallons



25 commercial rods from Byron

All the heavy metal in the Byron shipment would fit in an empty gallon jug

~400 kgU or 1.3 ft^3

Standard commercial fuel assembly

All the heavy metal in the assembly shipment would fit in this 1.3 ft^3 microwave

~15,000 kgU

A single storage cask can hold 15 metric ton of uranium (MTU) of commercial spent fuel

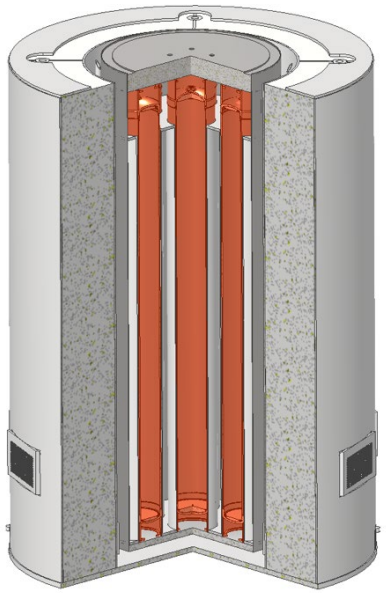
Spent fuel size and mass comparison – Non-commercial spent fuel is much less dense

~0.2 kgU per TRIGA Element

~400 kgU is about 2000 TRIGA elements (or 56 ft^3)

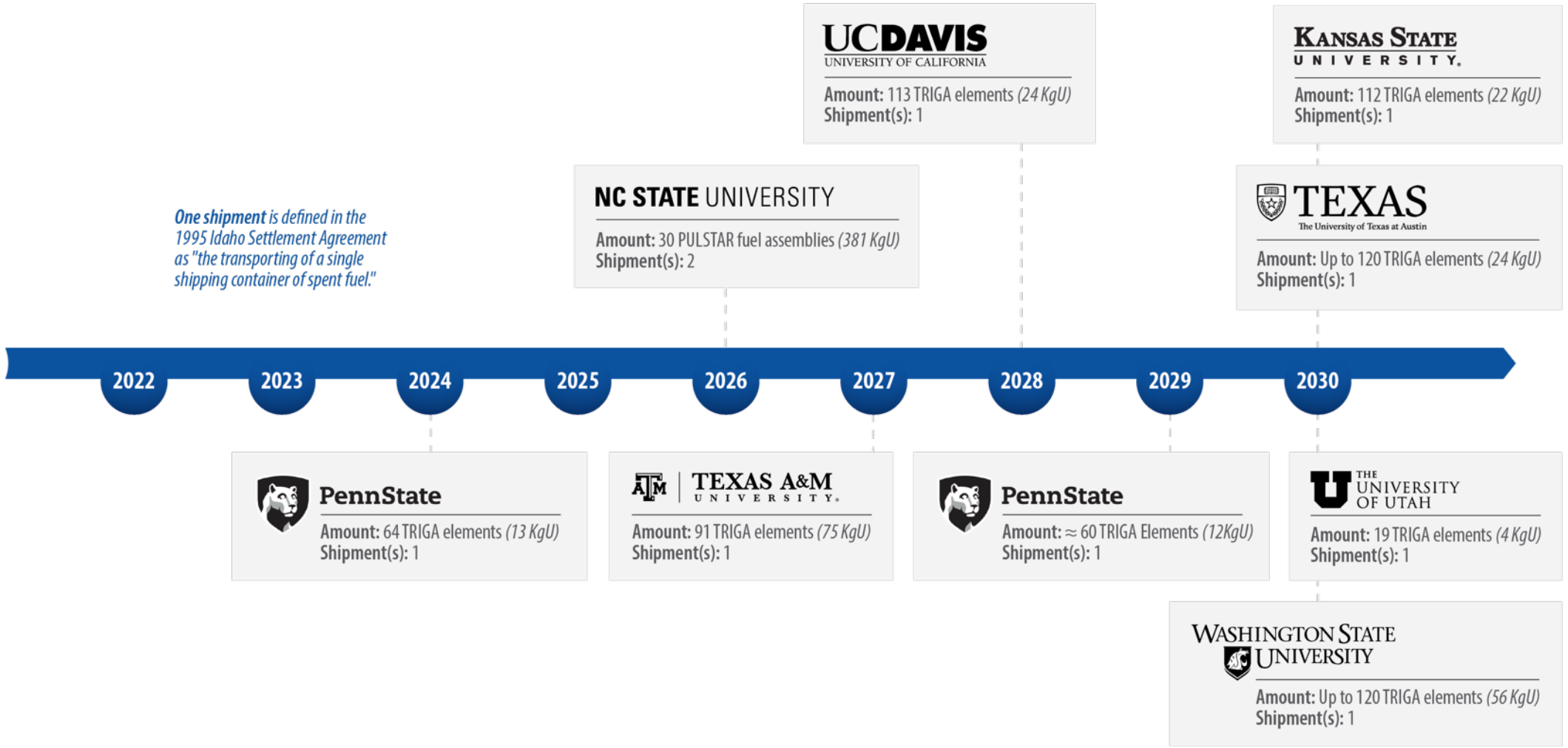
400 kgU of TRIGA elements represents about 2 fridges of volume

~130 kgU (or 100x less mass than commercial spent fuel)



A single storage cask can hold 651 elements. Each storage system holds 7 inner canisters with 93 TRIGA elements per canister

Potential Shipments of Spent Nuclear Fuel from Universities



21 Operating Nuclear Plants Need High-Burnup Demonstration Cask Data

- Cask is loaded with spent fuel at North Anna in Virginia
- Data (and thus shipment) is needed by 2027
- INL has only properly-sized facilities in the U.S. to do the work
  - Large hot cell (CPP-603) for fuel transfer
  - PIE facilities at Hot Fuel Examination Facility
- Two plants (Prairie Island, MN & Calvert Cliffs, MD) will be in default of their NRC spent fuel storage license in 2028 unless data is collected.
  - 19 more plants could be in non-compliance starting in 2029
- Several additional R&D projects are of interest to DOE and the industry if cask is received at INL
  - Aging management, instrumentation, safeguards and security applications

Recap / Questions

- Spent fuel receipts are now planned consistent with the 2011 ISA Memorandum of Agreement
  - The State has provided a significant opportunity for additional R&D with commercial SNF
- Opportunities for exciting and impactful research is on the horizon
- Any questions?

Idaho National Laboratory

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy. INL is the nation's center for nuclear energy research and development, and also performs research in each of DOE's strategic goal areas: energy, national security, science and the environment.