



NUCLEAR PROLIFERATION  
PREVENTION PROJECT

 The University of Texas at Austin

## Navy LEU Fuel R&D

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### Navy HEU Fuel Raises Proliferation Risks

U.S. Navy reactors, which propel submarines and aircraft carriers, annually use more than two tons of nuclear weapons-grade, highly enriched uranium (HEU) fuel, which raises four proliferation risks:

1. The HEU fuel is produced at a civilian facility, where if terrorists stole even 1% of the annual throughput, they would have enough for a nuclear weapon. Such a **theft of HEU from a civilian Navy fuel plant occurred in the 1960s**, according to a former U.S. NRC Commissioner.
2. U.S. Navy reliance on HEU fuel provides other countries an excuse to acquire HEU too, ostensibly for naval fuel but actually for nuclear weapons. In **Dec 2016, Iran's president ordered the development of naval propulsion reactors**, which his country says would require HEU fuel.
3. The U.S. Navy is exhausting its supply of HEU, so unless it switches to low-enriched uranium (LEU), which is unsuitable for nuclear weapons, **the U.S. would need to resume production of HEU for the first time since 1992**. That could undercut U.S. nonproliferation efforts to persuade other countries not to produce HEU.
4. Under the 2021 AUKUS pact, the United States plans to export technology for nuclear-propelled attack submarines including reactors and fuel. If the U.S. does not first develop LEU-fueled naval reactors, each attack submarine would require export of about half a ton of HEU, sufficient for at least 20 nuclear weapons, **raising new security risks and setting a dangerous precedent**.

France has converted its naval reactors from HEU to LEU fuel, and China's nuclear navy also uses LEU fuel. The U.S. has converted most of its nuclear research reactors from HEU to LEU fuel, and encourages all other countries to do so, to reduce risks of nuclear proliferation and terrorism.



France has switched to LEU fuel for its entire nuclear navy, including this ballistic-missile submarine. (Photo: Wikimedia)

### 2016: NNSA, POTUS Support LEU Fuel R&D

In a **July 2016 Report to Congress**, the Office of Naval Reactors (NR) said that successful development of an “advanced fuel system could allow use of LEU fuel with minimized impact on reactor lifetime, size, and ship costs.” It also said Navy LEU fuel R&D “would demonstrate United States leadership toward reducing HEU and achieving nuclear non-proliferation goals,” which it said “could have positive implications from a national security standpoint.”

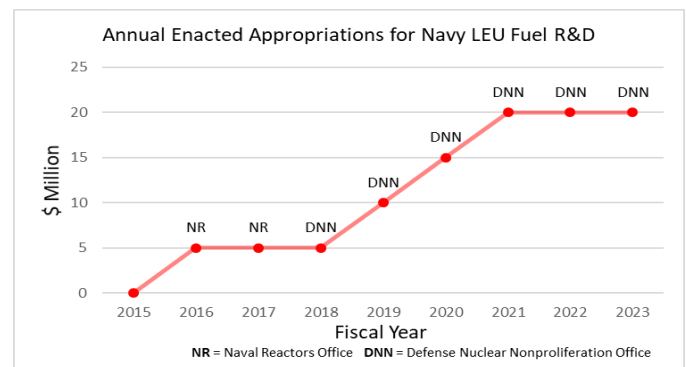
In March 2016, the **White House stated**: “Consistent with its national security requirements and in recognition of the nonproliferation benefits to minimizing the use of highly enriched uranium globally, the United States values investigations into the viability of using low-enriched uranium in its naval reactors.”



Less than 50 pounds of HEU is enough for an atomic bomb; The Navy uses 5,000 pounds annually for ships. (Photo: DOE)

### FY2016-2023: Congress Approves Funding

On a bipartisan basis, for eight years, Congress has appropriated funding for Navy LEU fuel R&D. For two years it went to NR, and for the next six to the Office of Defense Nuclear Nonproliferation (DNN). In March 2018, the Secretaries of Navy and Energy declined to determine that the program should continue. Despite this, Congress has gradually increased funding for the R&D program to assess the feasibility and cost of potential conversion to LEU fuel.



### Timeline

NR's 2016 report outlined a 15-year R&D effort, which “might enable an aircraft carrier reactor fueled with LEU in the 2040's.” Submarines have less available space, and HEU has higher energy density, so conversion to LEU fuel would await next-generation ships that could accommodate a larger reactor or easier refueling – starting with the SSN(X) in the 2040s. For this timeline, Congress would need to boost funding, as NR's plan envisioned a ramp-up from \$35M in FY18 to \$85M in FY20, and ultimately \$990M over 15 years.