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IN FOCUS

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# Uranium Reserve Program Proposal: Policy Implications

## DOE Budget Proposal

The President's FY2021 budget request for the Department of Energy's (DOE's) Office of Nuclear Energy includes $150 million for the purchase and development of a Uranium Reserve (UR) program. For the UR program, DOE would purchase uranium from domestic uranium producers to develop a stockpile of uranium that would be available for nuclear power operators in the event of a civilian nuclear fuel market disruption. According to DOE, the UR program would also support U.S. strategic fuel cycle capabilities for defense purposes. The UR program refers to DOE's proposal to procure uranium and not the development of a physical facility to store uranium.

DOE's proposal to purchase domestic uranium for a UR program would be a new initiative included in the FY2021 budget request. This In Focus describes the background and current context for the proposal, as well as uranium requirements for commercial power production and defense-related applications, and analyzes the policy implications of appropriating funds for the establishment of the UR program.

## Background

During the 1950s and 1960s, the United States procured uranium by funding domestic uranium mining and milling operations and purchasing foreign-produced uranium concentrate largely in support of the production of U.S. nuclear weapons and other defense applications. Over time, U.S. uranium needs changed from weapons production to commercial nuclear power production, supplied almost exclusively by domestically produced uranium during the 1970s. According to the Energy Information Administration (EIA), U.S. nuclear utilities and reactor operators have purchased increasingly more foreign-origin uranium for reactor fuel than domestically produced uranium since the late 1980s. In 1987, about half of uranium used in domestic nuclear reactors was foreign origin. By 2018, 93% of uranium used in U.S. nuclear reactors was foreign origin.

On January 16, 2018, two U.S. domestic uranium mining companies petitioned the U.S. Department of Commerce to investigate whether uranium imports from foreign state-owned enterprises—such as those in Russia, China, and Kazakhstan—pose a threat to national security. The companies were asking Commerce to investigate foreign uranium imports under Section 232 of the Trade Expansion Act of 1962 (19 U.S.C. §1862), which provides the President with the ability to impose restrictions on certain imports. Those decisions are subject to an affirmative determination by Commerce that the product under investigation "is being imported into the United States in such quantities or under such circumstances as to threaten to impair the national security." The domestic uranium companies' petition called on the President to enact a quota, pursuant to Section 232, on uranium imports such that "25% of the average historical consumption will be reserved for newly produced U.S. uranium."

On July 18, 2018, Commerce began a Section 232 investigation into uranium imports. In May 2019, Commerce submitted a report to the President finding that uranium imports posed a threat to national security and recommended the President take action under Section 232. According to a presidential memorandum released by the Trump Administration on July 12, 2019, the President did not concur with Commerce findings. Nonetheless, the Trump Administration expressed significant concerns regarding national security and responded by establishing a Nuclear Fuel Working Group (NFWG), which included representatives from various executive branch agencies. The working group was tasked with examining domestic nuclear fuel production and options to revive the entire nuclear fuel supply chain. The NFWG was to provide a report to the President within 90 days of the memorandum. To date, neither Commerce's report to the President based on its Section 232 investigation nor the recommendations of the NFWG to the President have been made public.

## Commercial Fuel for Nuclear Reactors

The front end of the nuclear fuel cycle includes multiple stages of processing uranium materials before it is capable of producing electricity in a commercial nuclear power reactor. These stages include uranium mining and milling, uranium conversion, uranium enrichment, and nuclear fuel fabrication. At each stage, uranium is processed chemically or isotopically into different products. Generally, each of those uranium products or services may be bought, sold, traded, or stockpiled throughout a global uranium market involving a host of international organizations. The global uranium market operates with multiple industries exchanging uranium products and services through separate, non-direct, and interrelated markets. Nuclear utilities and reactor operators generally diversify fuel sources and may acquire and stockpile uranium from multiple domestic and foreign suppliers and servicers. These transactions may involve multiple federal agencies and international agreements.

## Domestic Production Capacity

For calendar year 2019, EIA reported production of 173,875 pounds of domestic uranium concentrate ($U_3O_8$), the lowest annual production amount since before 1949. As of the fourth quarter of 2019, EIA reported three domestic in-situ recovery (ISR) plants operating and three domestic conventional uranium mills on standby. Uranium

concentrate purchased for the UR program may be produced by operators of conventional uranium mining and milling operations or ISR facility operations. Currently, the three operational ISR facilities (solution mining operations in which a solvent is pumped through underground ore bodies to recover uranium) are located in Wyoming. Three conventional uranium mills and 12 other ISR facilities on standby or partially licensed are located in Nebraska, New Mexico, South Dakota, Texas, Utah, and Wyoming. After mining and milling, the next stage for developing uranium into nuclear fuel is uranium conversion. During uranium conversion, $U_3O_8$ is used to generate uranium hexafluoride ($UF_6$), which is needed for the subsequent stage in the fuel cycle: uranium enrichment. There is currently one domestic uranium conversion facility, the Honeywell plant in Metropolis, IL, which has been on standby since 2017 due to poor market conditions. According to Converdyn—the executive sales agent at the Honeywell conversion facility—the plant, when operational, has the capacity to deliver approximately 40% of domestic conversion requirements. On standby, the Honeywell facility in Metropolis currently operates as a warehouse, and the company serves as an international trading platform for $UF_6$ and uranium concentrate. According to the FY2021 proposal for the UR program, the DOE Office of Nuclear Energy would be responsible for procuring $U_3O_8$ through contracts with domestic uranium producers, contracting services for uranium conversion, and providing oversight over the UR program. According to DOE, this funding would support at least two domestic uranium mines and the reestablishment of domestic uranium conversion. DOE indicates that funding for uranium mines would be granted on a competitive basis. The budget request does not indicate the contract purchase price, which would be a major factor in determining the amount of $U_3O_8$ that could be procured from domestic producers.

## Defense Uranium Requirements

Uranium is used for naval nuclear reactor propulsion fuel, nuclear warheads, and the production of tritium for nuclear warheads. The amount of uranium required for these defense applications is lower than annual commercial nuclear power plant requirements. DOE's budget proposal did not identify an immediate national security need for uranium for defense-related nuclear applications.

The United States does not currently use enriched uranium produced through the civilian nuclear fuel cycle for defense-related applications. The U.S. Navy relies exclusively on federal defense stockpiles of highly enriched uranium (HEU) for nuclear-powered naval propulsion for all U.S. aircraft carriers and submarines. DOE's National Nuclear Security Administration estimated this supply to be sufficient until 2060. The federal defense stockpiles of HEU were developed largely after World War II. The United States discontinued production of HEU for nuclear weapons by 1964 due to the buildup of sufficient defense stockpiles and ended all production of HEU by 1992. Additionally, DOE requires a domestic source of low-enriched uranium (LEU) for the production of tritium. Tritium, an isotope of hydrogen used in nuclear weapons, decays at a rate of 5% per year and must be periodically replaced in existing nuclear weapons. According to DOE, LEU inventories are sufficient to sustain tritium production through 2041.

DOE does not currently enrich uranium to produce LEU for the production of tritium or to produce HEU fuel for naval propulsion. For uranium purchased for the UR program to be suitable for these defense-related applications, the federal government would need to establish domestic enrichment capability or continue to supply this material from surplus stocks as it does now. In addition to uranium processing, the federal government would be required to manage some resulting wastes, including depleted uranium produced during enrichment and high-level wastes generated after use from either defense-related application.

## Policy Implications

According to the FY2021 President's budget request, one policy objective of the UR program is to provide assurance of the availability of uranium for nuclear fuel supplies in the event of a market disruption or for defense purposes. DOE does not identify what would constitute a market disruption, criteria for providing uranium material to commercial utilities, or the price at which the uranium from the stockpile would be sold. For the requested $150 million, DOE could purchase approximately 6 million pounds of $U_3O_8$ from domestic producers (using the March 20, 2020, uranium spot price of $24.90). According to EIA, between 2009 and 2018, the annual $U_3O_8$ equivalents loaded into all domestic nuclear power plants averaged 47.2 million pounds. The amount of $U_3O_8$ would be lower than 6 million pounds annually if DOE contracts at a higher contract price with domestic producers, allocates a portion of that funding toward conversion, or apportions funding for storage and administrative costs. DOE's budget request does not consider additional costs of uranium enrichment, fuel fabrication, and waste disposal.

DOE and domestic uranium producers would need to negotiate the contract price, the quantity of $U_3O_8$, and contract duration, among other information. The margin between the contract price and the cost to produce uranium would affect the cost-effectiveness to produce uranium for domestic producers. Given this assumption, DOE would need to purchase less uranium at a higher contract price than currently available in the spot market and would likely have to continue the purchases for longer than one year. If DOE purchases less $U_3O_8$, than it could at the spot price, total conversion and management costs would be reduced proportionally. However given that scenario, the total amount of uranium available for nuclear utilities or DOE to limit a potential market disruption or for defense-related applications would be relatively less.

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