



DEPARTMENT OF ENERGY

National Nuclear Security Administration

Secretarial Determination of No Adverse Material Impact on the Domestic Uranium Mining, Conversion, and Enrichment Industries to Support Mo-99 Production

AGENCY: National Nuclear Security Administration (NNSA), Department of Energy (DOE).

ACTION: Notice.

SUMMARY: On November 22, 2023, the Secretary of Energy issued a Secretarial Determination (hereafter “determination”) covering the sale, lease, or transfer of up to 750 kilograms uranium (kgU) of high-assay low-enriched uranium (HALEU) (above 5, but less than 20 weight percent (wt.-%) uranium-235) per year during the two-year period following signature of the determination to support molybdenum-99 (Mo-99) production. For the reasons set forth in the Department's “Analysis of Potential Impacts of Certain Uranium Transactions on the Domestic Uranium Mining, Conversion, and Enrichment Industries,” which is incorporated into the determination, the Secretary determined that these transactions will not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industries.

FOR FURTHER INFORMATION CONTACT: Requests for additional information may be sent to Peter Rocco: officeofconversion@nnsa.doe.gov or (202) 287-1018.

SUPPLEMENTARY INFORMATION:

Authority and Background:

The Department of Energy (“the Department”) holds limited inventories of uranium in various forms and quantities that have been declared as excess and are not dedicated to U.S. national security missions. Within DOE, the National Nuclear Security Administration (NNSA) manages these inventories to carry out critical missions, including minimizing the use of highly

enriched uranium (HEU) in civilian applications. NNSA down-blends excess HEU from these inventories to high-assay, low-enriched uranium (HALEU) — a subset of low enriched uranium (LEU) enriched above the commercial level of 5 wt.-% and below 20 wt.-% of the isotope U-235 — to be used as fuel for research reactors and target material for the production of critical medical isotopes.

This notice involves the sale, lease, or transfer of HALEU to support molybdenum-99 (Mo-99) producers. Leases covered by this determination fulfill a directive in the American Medical Isotopes Production Act of 2012 (Pub. L. 112–239, Division C, Title XXXI, Subtitle F, 42 U.S.C. 2065) for the Department to establish a program to make HALEU available, through lease contracts, for the production of Mo-99 for medical uses. The sales, leases, or transfers covered by this determination also support U.S. nuclear nonproliferation initiatives by down-blending HEU and encouraging the use of HALEU in civilian applications in lieu of HEU.

These sales, leases, or transfers are conducted in accordance with the Atomic Energy Act of 1954 (42 U.S.C. 2011 *et seq.*, “AEA”), as amended, and other applicable laws. Specifically, title I, chapters 6 and 14 of the AEA authorize DOE to sell or transfer special nuclear material, including HALEU. The USEC Privatization Act (Pub. L. 104-134, 42 U.S.C. 2297h *et seq.*), however, places certain limitations on DOE’s authority to sell or transfer uranium from its excess uranium inventory. Specifically, under section 3112(d)(2) of the USEC Privatization Act (42 U.S.C. 2297h-10(d)(2)), DOE may make certain sales or transfers of natural uranium or LEU if the Secretary determines that the sales “will not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industry, taking into account the sales of uranium under the Russian HEU Agreement and the Suspension Agreement,”

On November 22, 2023, the Secretary of Energy issued a determination covering the sale, lease, or transfer of up to 750 kgU of HALEU per year during the two-year period following signing of the determination to support Mo-99 production. For the reasons set forth in the Department’s “Analysis of Potential Impacts of Certain Uranium Transactions on the Domestic

Uranium Mining, Conversion, and Enrichment Industries,” which is incorporated into the determination, the Secretary determined that these transactions will not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industries. In accordance with section 306(a) of Division D, Title III of the *Consolidated and Further Continuing Appropriations Act, 2015* (Pub. L. 113-235), this determination is valid for no more than two calendar years following the date of the determination.

Signing Authority

This document of the Department of Energy was signed on December 18, 2023, by Corey Hinderstein, Deputy Administrator for Defense Nuclear Nonproliferation, pursuant to delegated authority from the Secretary of Energy. The document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, DC, on December 21, 2023.

Treena V. Garrett,
Federal Register Liaison Officer,
U.S. Department of Energy.

Set forth below is the full text of the Secretarial Determination.

SECRETARIAL DETERMINATION FOR THE SALE, LEASE, OR TRANSFER OF CERTAIN HIGH-ASSAY, LOW-ENRICHED URANIUM FOR THE NEXT TWO YEARS

I determine that the sale, lease, or transfer of up to 750 kilograms uranium (kgU) of high-assay low-enriched uranium (above 5, but less than 20 weight percent uranium-235) per calendar year subsequent to signing this determination to support molybdenum-99 production will not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industries. I base my conclusions on the Department's *Analysis of Potential Impacts of Certain Uranium Transactions on the Domestic Uranium Mining, Conversion, and Enrichment Industries*, which is incorporated herein. I have considered, *inter alia*, the requirements of the *USEC Privatization Act of 1996* (42 U.S.C. §§ 2297h *et seq.*), the nature of uranium markets, and the current status of the domestic uranium industries. I have also taken into account the sales of uranium under the *Agreement Between the Government of the United States of America and the Government of the Russian Federation Concerning the Disposition of Highly Enriched Uranium Extracted from Nuclear Weapons* ("Russian HEU Agreement") and the *Agreement Suspending the Antidumping Investigation on Uranium From the Russian Federation* ("Suspension Agreement").

Jennifer Granholm

Date: November 22, 2023

Set forth below is the full text of the *Analysis of Potential Impacts of Certain Uranium Transactions on the Domestic Uranium Mining, Conversion, and Enrichment Industries*.

ANALYSIS OF POTENTIAL IMPACTS OF CERTAIN URANIUM TRANSACTIONS ON THE DOMESTIC URANIUM MINING, CONVERSION, AND ENRICHMENT INDUSTRIES

I. Introduction

A. Legal Authority

The Department of Energy (DOE) manages its excess uranium inventory in accordance with the *Atomic Energy Act of 1954* (42 U.S.C. 2011 *et seq.*, “AEA”), as amended, and other applicable laws. Specifically, Title I, Chapters 6 and 14 of the AEA authorize DOE to sell or transfer special nuclear material. Low-enriched uranium (LEU) is a type of special nuclear material.

The *USEC Privatization Act* (Pub. L. 104-134, 42 U.S.C. 2297h *et seq.*) places certain limitations on DOE’s authority to sell or transfer uranium from its excess uranium inventory. Specifically, under section 3112(d)(2)(B) of the *USEC Privatization Act* (42 U.S.C. 2297h 10(d)(2)(B)), DOE may make certain sales or transfers of natural uranium or LEU¹ if:

- (A) The President determines that the material is not necessary for national security needs;
- (B) The Secretary determines that the sale of the material will not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industry, taking into account the sales of uranium under the Russian HEU Agreement and the Suspension Agreement; and,
- (C) The price paid to the Secretary will not be less than the fair market value of the material.

Regarding condition A): for purposes of section 3112(d)(2)(A) of the *USEC Privatization Act*, DOE has historically treated material not included in the Nuclear Weapons Stockpile Memorandum (a memorandum signed by the President that identifies uranium necessary for defense needs) as being excess to national security needs. None of the material included in the proposed transactions was included in the most recent Nuclear Weapons Stockpile Memorandum.

This analysis focuses on condition B above.

¹ Section 3102 of the *USEC Privatization Act* defines “low-enriched uranium” as “uranium enriched to less than 20 percent of the uranium-235 isotope, including that which is derived from highly enriched uranium.” 42 U.S.C. 2297h(5). Section 3112A of the *USEC Privatization Act* also provides a definition of LEU: “a uranium product in any form, including uranium hexafluoride (UF₆) and uranium oxide (UO₂), in which the uranium contains less than 20 percent uranium-235, including natural uranium, without regard to whether the uranium is incorporated into fuel rods or complete fuel assemblies.” 42 U.S.C. 2297h-10a(a)(5). Both definitions encompass HALEU, which is U-235 enriched between 5%-20%. Thus, HALEU is a form of LEU and falls within the Secretarial Determination requirement.

Regarding condition C): the price paid to the Secretary will not be less than the fair market value of the LEU sold, transferred, or leased. Specifically, for HALEU leased under the ULTB Program, the lease contracts contain a pricing mechanism to ensure that the Department receives the prevailing market value for its material, as required by AMIPA. For other HALEU sales or transfers, the contracts will require cash payment for the fair market value of the HALEU sold. Accordingly, all sale or lease transactions will comply with section 3112(d)(2)(C), and the fair market value will be determined at the time of the transaction.

The validity of any determination under this section is limited to no more than two calendar years subsequent to the determination.² The *USEC Privatization Act* also permits sales or transfers of enriched uranium for governmental purposes under section 3112(e), which are not subject to the limitations imposed by section 3112(d).

B. Transactions Considered in This Analysis

Two types of potential transactions are considered in this analysis: (1) the lease of LEU for the production of molybdenum-99 (Mo-99) pursuant to the *American Medical Isotopes Production Act of 2012* (AMIPA)³; and (2) the sale or transfer of LEU to producers for use in medical isotope development and production, which would enable the material to be used for Mo-99 production outside of AMIPA requirements. The exact uses of LEU under these transactions and designs of facilities in which the LEU would be utilized vary by producer, but fission-based production usually involves fabrication or preparation of uranium for irradiation, followed by chemical processing to extract the Mo-99 for packaging into a generator and delivery to a radiopharmacy.

The first type of transaction would be under AMIPA. These transfers would support the Uranium Lease and Take Back (ULTB) program, was established under AMIPA and enables DOE to lease LEU to produce Mo-99 in the United States without the use of highly enriched uranium (HEU).

The second type of transaction considered in this analysis is a sale or transfer of LEU to producers for use in medical isotope development and production processes, including Mo-99, that are not under the ULTB program and do not meet the criteria of section 3112(e)(3) of the *USEC Privatization Act* for governmental purposes.

Both types of transactions require a Secretarial Determination under section 3112(d)(2)(B) of the *USEC Privatization Act* as well as meeting the other criteria of section 3112(d)(2).

The materials considered in this analysis would be sold, leased, or transferred during the two-year period following the signing of the Secretarial Determination and would consist of no more than 750 kgU of HALEU in any year. Based on semi-annual HALEU demand surveys conducted to determine producers' material needs, DOE's National Nuclear Security Administration (DOE/NNSA) assessed 750 kgU of HALEU for each year covered by this determination.

² see section 306(a) of Division D, Title III of the *Consolidated and Further Continuing Appropriations Act, 2015* (Pub. L. 113-235)

³ Pub. L. 112-239, Division C, Title XXXI, Subtitle F, 42 U.S.C. 2065

Assuming a tails assay of 0.20 wt.-% U-235, this quantity would be equivalent to approximately 28,700 kgU of natural uranium hexafluoride and approximately 33,850 separative work units (“SWU”) to produce 750 kgU of HALEU at 19.75 weight-% U-235.⁴

II. Analytical Approach

The analytical approach relied on for previous Secretarial Determinations covering the sale, transfer, or lease of excess uranium for Mo-99 development and production (80 FR 65728, Oct. 27, 2015), the ULTB program (81 FR 1409, Jan. 12, 2016), and the Secretarial Determinations for the Sale, Lease or Transfer of Uranium (signed and dated Nov. 26, 2019 and Nov. 23, 2021, respectively) is repeated here and updated to the extent necessary.

This analysis evaluates the state of the domestic uranium industries and the relevant impacts if DOE goes forward with these potential transactions. DOE has developed a set of factors that this analysis considers in assessing whether DOE’s uranium sales and transfers will have an “adverse material impact” on the domestic uranium mining, conversion, or enrichment industry:

1. Prices
2. Production at existing facilities
3. Employment levels in the industry
4. Changes in capital improvement plans and development of future facilities
5. Long-term viability and health of the industry
6. *Russian HEU Agreement and Russian Suspension Agreement*

While no single factor is dispositive of the issue, DOE believes that these factors are representative of the types of impacts that the proposed sale, lease, or transfer may have on the domestic uranium industries. Not every factor will necessarily be relevant on a given occasion or to a particular industry; DOE intends this list of factors only as a guide to its analysis.

III. Assessment of Potential Impacts

1. Prices

There is currently no domestic commercial supplier for HALEU. Therefore, there is no established market price for HALEU. DOE sets a price for HALEU based on a combination of commercial market price components for LEU, plus a charge for the separative work above the 5% LEU limit reflecting the historical cost to DOE to produce this material. Through the end of 2022, the market value of 4.95% enriched LEU rose 200% from its low point in October 2017. The market price rose 90% from December 2020 through December 2022. Industry analysts forecast a continued increase in the market value of LEU.⁵ The relatively small quantities of HALEU provided by DOE have not impacted the price increases in this market, and DOE does not expect that they would impact price in the future.

Further, with no domestic commercial provider for HALEU, the DOE sales and leases of HALEU would not displace production or affect prices among the commercial domestic uranium

⁴ The calculation is based on the Y-12 Standard Specification for LEU Metal Supply for Mo-99 Isotope Production, which assumes deliveries of quantities of 19.75 wt.-% LEU. If any sale, lease, or transfer includes material at an assay other than 19.75 wt.-%, the amount will be converted so that the total amount in any year covered by this Determination is equivalent to no more than 750 kgU at 19.75 wt.-%.

⁵ Energy Resources International, Inc. (ERI), *Nuclear Fuel Cycle Supply and Price Report*, ERI-2006-2202/December 2022.

mining, conversion, or enrichment industries. Even if it did, the amount would be so small that the effects would be minimal.

2. Production at Existing Facilities

An analysis of the impact of the proposed sales and leases based on an assessment of production at existing facilities is straightforward. There is currently no domestic commercial supplier of HALEU in the United States. Due to the lack of a sufficient near-term market, owners and operators of enrichment facilities have not developed HALEU enrichment capability to produce uranium enriched to 19.75 wt.-% U-235. With the closing of the Paducah Gaseous Diffusion Plant in 2013, the only uranium enrichment facility in the United States operating at commercial scale is the URENCO USA facility operated by Louisiana Energy Services, LLC (LES), in Eunice, New Mexico, which is currently licensed by the Nuclear Regulatory Commission (NRC) to possess uranium only up to 5.5 wt. % U 235.⁶

Further, it is not feasible for commercial Mo-99 producers to use commercially available assays of LEU (i.e., LEU enriched to 5.5 wt.-% U-235 or less) instead of HALEU. Given the specialized uses, designs, and regulatory requirements of these isotope producers, the use of commercial-assay LEU would prevent the facility or target from achieving the same performance or efficiency and thus from being used for their intended purposes.

Although the DOE sales and leases of HALEU would not displace production among the commercial domestic uranium mining, conversion, or enrichment industries, even if it did, the amount would be so small that the effects would be minimal. With respect to these industries, to produce the amount of HALEU in the proposed sales and leases from primary production would require approximately 75,000 pounds of uranium concentrates (U₃O₈), 28,700 kgU of conversion services, and 33,800 SWU of enrichment services. By comparison, the entire domestic fleet of nuclear reactors in 2020 required approximately 43 million pounds of U₃O₈, 16.2 million kgU of conversion services, and about 14.8 million SWU.⁷ Therefore, the feed, conversion, and SWU content of the DOE material represents 0.17%, 0.17%, and 0.22% of annual domestic requirements, respectively.

The domestic conversion industry consists of only one facility that historically produced between 10 million kgU and 12 million kgU per year and reduced its capability to 7 million kgU in 2017. Honeywell, the owner of that facility, suspended operation in 2018, but resumed operation in July 2023 at 7 million kgU per year. Thus, although there has been no conversion occurring in the United States for several years, there are signs of the market improving given Honeywell's recent restart. As mentioned above, there is only one currently operating commercial enrichment facility, URENCO USA's subsidiary, LES, in the United States. The total capacity of that facility is 4.9 million SWU.

In October 2023, American Centrifuge Operating, LLC (ACO), a subsidiary of the U.S. company, Centrus Energy Corp. (Centrus), began enrichment operations on a demonstration basis at DOE's facility in Piketon, Ohio.⁸ The initial production goal is 20 kgU 19.75% HALEU. ACO/Centrus is discussed at length in Section 4 below.

3. Employment Levels in the Industry

⁶ U.S. Nuclear Regulatory Commission, *Materials License*. License Number SNM-2010, Amendment 57, Docket Number 70-3103.

⁷ The global requirements information comes from an analysis prepared by Energy Resources International, Inc. (ERI), *Nuclear Fuel Cycle Supply and Price Report*, ERI-2006-2101/June 2021.

⁸ HALEU Demonstration Project Starts Enrichment Operations in Ohio | Department of Energy

As stated above, DOE sales and leases of HALEU would not displace production among the commercial domestic uranium mining, conversion, or enrichment industries, and therefore will not affect employment levels in these industries.

4. Changes in Capital Improvement Plans and Development of Future Facilities

Although there is currently no domestic uranium enrichment capability to produce HALEU, there have been recent noteworthy developments. In 2019, the Department entered into a cost-shared contract for a HALEU Demonstration Program with ACO to deploy a 16-machine cascade of AC-100 M centrifuges in Piketon, Ohio to produce 19.75 wt.-% U-235 with U.S.-origin enrichment technology that will result in a small quantity of HALEU. In June 2021, the NRC approved ACO's license amendment request to produce HALEU with an enrichment assay of up to 20 wt.-% U-235 at the Piketon facility. In November 2022, DOE announced another cost-shared award with ACO, equating to approximately \$150 million and including a \$30 million cost share during the first year to start up and operate the 16 centrifuges at the Piketon facility. In June 2023, ACO received NRC approval to introduce uranium hexafluoride into its cascade following completion of an operational readiness review.⁹ As part of the 2022 award, ACO must produce 20 kilograms of 19.75% enriched HALEU by December 31, 2023. Following completion of the demonstration, the contract calls for production at an annual rate of 900 kg of HALEU in 2024 with additional options to produce more material under the contract in future years, all subject to appropriations.¹⁰

Additionally, URENCO USA provided a notice to the NRC in April 2021 of its intent to amend the URENCO USA license to increase the enrichment level up to 10 wt.-% U-235.¹¹ URENCO USA expects to have capability to deliver HALEU up to 10 wt.-% U-235 in 2024. URENCO USA also has longer term plans to produce up to 19.75 wt.-% U-235.

However, the relatively small amounts of material covered by this Determination have no impact on capital improvement plans and development of future facilities including mines, conversion facilities, and enrichment plants.

5. Long-term Viability and Health of the Industry

There is currently no commercial supplier of HALEU in the United States. Therefore, there is no long-term industry impact to assess. During the period covered by this Determination, Centrus/ACO may begin producing up to 900 kgU annually in both 2024 and 2025. However, DOE providing a maximum of 750 kgU annually over the same time period to a specific subset of end users – Mo-99 producers – would not displace production by Centrus/ACO, given DOE's own estimate of extant HALEU demand (up to 40 metric tons by 2029-30).¹²

6. *Russian HEU Agreement and Russian Suspension Agreement*

⁹ "Centrus gets NRC's okay to introduce uranium in HALEU demonstration cascade." <https://www.ans.org/news/article-5092/centrus-gets-nrcs-okay-to-introduce-uranium-in-haleu-demonstration-cascade/>

¹⁰ American Centrifuge Plant and HALEU, from an analysis prepared by Energy Resources International, Inc. (ERI), *Nuclear Fuel Cycle Supply and Price Report*, ERI-2006-2202/December 2022.

¹¹ Louisiana Energy Services, LLC, dba Urenco USA, Submittal of License Amendment Request for Revision for MCNP6 Validation Report (LAR 21-03) (nrc.gov)

¹² U.S. Department of Energy to Acquire High-Assay Low-Enriched Uranium Material | Department of Energy

The Russian HEU Agreement ended in December 2013. The *Suspension Agreement* was extended on October 5, 2020 (85 FR 64112) and remains in force through 2040 with annual export limits on Russian enriched uranium product sold to U.S. utilities at commercially available assays (e.g., 5 wt.-% U-235).¹³ The *Suspension Agreement* allows for the sale of up to the following amounts of U-235 per year in 2023, 2024, and 2025 respectively: 25,471 kg, 20,968 kg, and 20,697 kg. The relatively small amount of material covered by this Determination is minimal compared to domestic needs for LEU and imports from the Russian Federation.

IV. Conclusion

With respect to the six factors listed above to assess market impacts:

1. The relatively small amounts of material covered by this Determination have no impact on the price of HALEU, for which there is currently no domestic commercial market price.
2. There are new developments in the industry, but production timelines will not be impacted in the timeframe for this Determination.
3. The relatively small amounts of material covered by this Determination have no impact on employment levels in the mining, conversion, or enrichment industries.
4. New market developments will not mature during this Determination period to a point where the market could be impacted by DOE sales, leases, or transfers.
5. The relatively small amounts of material covered by this Determination have no impact on the long-term viability and health of the mining, conversion, and enrichment industries.
6. The *Russian HEU Agreement* and *Suspension Agreement* are not factors because there is no HALEU currently being imported from Russia to the United States. Thus, DOE concludes that the sale, lease, or transfer of up to 750 kgU of HALEU per year to support the development and production of Mo-99 will not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industry, taking into account the ended Russian HEU Agreement and extended Russian Suspension Agreement.

[FR Doc. 2023-28501 Filed: 12/26/2023 8:45 am; Publication Date: 12/27/2023]

¹³ 2020 Amendment to the Agreement Suspending the Antidumping Investigation on Uranium From the Russian Federation, Federal Register / Vol. 85, No. 197 / Friday, October 9, 2020 / Notices <https://www.federalregister.gov/documents/2020/10/09/2020-22431/2020-amendment-to-the-agreementsuspending-the-antidumping-investigation-on-uranium-from-the-russian>.