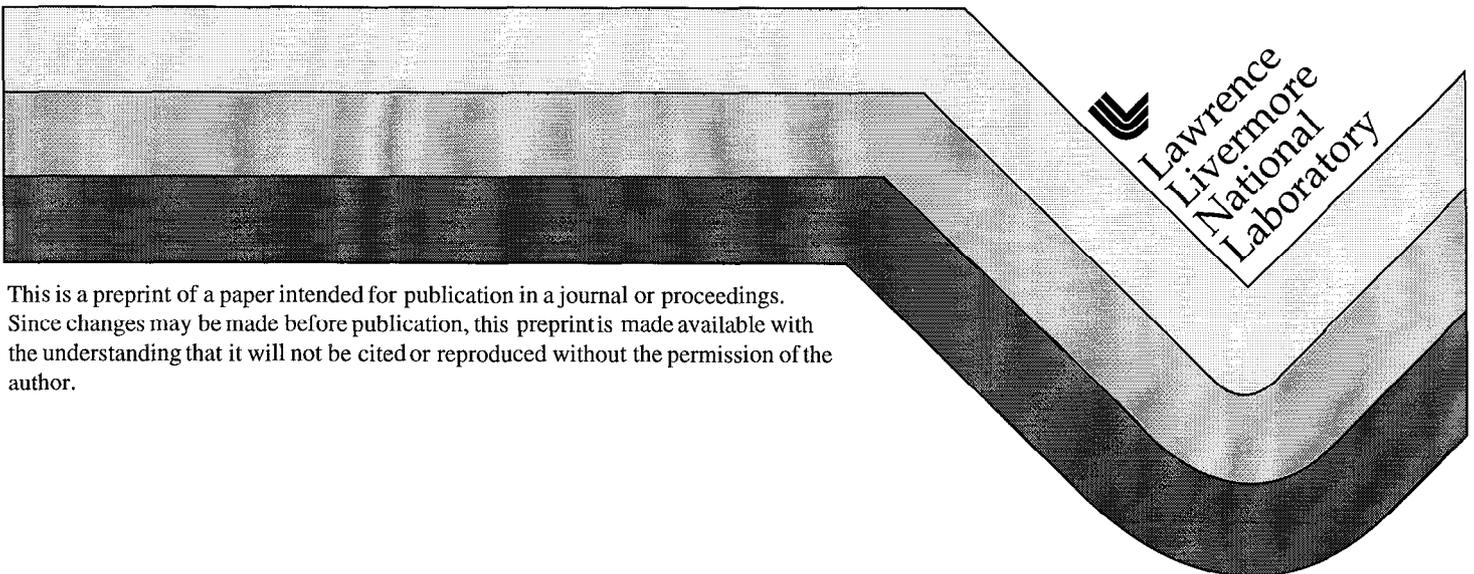


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U.S. TRANSPARENCY MONITORING UNDER THE U.S./RUSSIAN HEU PURCHASE AGREEMENT

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ABSTRACT

The conversion of Highly Enriched Uranium (HEU) metal to low enriched uranium (LEU) takes place at four Russian sites. HEU metal to oxide processing began in 1994 with shipments of HEU oxide from the Siberian Chemical Enterprise (SChE) to the Ural Electrochemical Integrated Plant (UEIP) fluorination and blending facility. U.S. transparency monitoring at these facilities began in February 1996. In 1996, fluorination and blending operations began at the Electrochemical Plant (ECP). In 1997, additional HEU metal to oxide was added at the Mayak Production Association (MPA), and additional fluorination and blending operations have been performed at SChE.

U.S. transparency monitoring at these facilities is intended to provide confidence that HEU weapons components are received, that the HEU metal is converted to HEU oxide, and that the HEU is blended to LEU prior to shipment to the U.S. Enrichment Corporation (USEC). The monitoring begins with observation of HEU weapon components in sealed containers, including confirmation of the ^{235}U enrichment using U.S. nondestructive assay (NDA) equipment. The feeding of HEU metal shavings to the oxidation process and the subsequent packaging of the HEU oxide for shipment to the fluorination and blending facilities are then monitored. At those facilities, monitors are allowed to witness the fluorination and blending of the HEU into LEU. Monitors are allowed to use the NDA instrumentation to confirm that HEU is being processed. A series of process and material accountancy documents are provided to U.S. monitors.

Introduction

HEU weapons components in sealed containers are shipped to two oxidation plants located at the MPA in Ozersk, and the SChE in Seversk. At the MPA and SChE sites, the HEU components are first destroyed by machining them to HEU metal shavings. The metal shavings are then burned to HEU oxide in furnaces, the burned HEU oxide is purified using a chemical purification process, and the purified HEU oxide is then packaged and shipped to the ECP in Zelenogorsk, and to other facilities at SChE. At these facilities, the purified HEU oxide is fluorinated to produce HEU hexafluoride. The HEU hexafluoride is blended with uranium hexafluoride at an enrichment of 1.5% ^{235}U to produce LEU hexafluoride product in the range of 3.6% to 4.95% ^{235}U . In addition to blending the HEU hexafluoride, SChE also sends the HEU hexafluoride to the UEIP in Novouralsk. UEIP blends the HEU hexafluoride with the 1.5% ^{235}U slightly enriched uranium hexafluoride to produce the LEU hexafluoride product. The total amount of the LEU product and the enrichments of the LEU is specified and purchased by USEC

Transparency measures are being implemented at all of the Russian facilities to provide confidence that the nonproliferation goals of the Agreement are being met. This paper presents an overview of the transparency implementation monitoring that has occurred at MPA, SChE, ECP and UEIP.

Transparency Monitoring at the Russian Plants

The United States has the right to conduct six, 5-day monitoring visits each year to MPA, SChE, ECP, and UEIP. In addition, at UEIP, the Department of Energy has established a Permanent Presence Office at the plant, which is staffed with 3 to 4 U.S. monitors.

At MPA, five monitoring visits were conducted in 1998 and three monitoring visits have been conducted to date in 1999. At SChE, three monitoring visits were conducted in 1996, six were conducted in both 1997 and 1998, and three monitoring visits have been conducted to date in 1999. At ECP, four monitoring visits were conducted in 1997, six were conducted in 1998, and three have been conducted to date in 1999.

At UEIP, before the Permanent Presence Office was established in August 1996, a monitoring visit was conducted in February 1996. The Permanent Presence Office is staffed nearly continuously throughout the year, except for closing down over the Christmas holidays and recently for an occasional week at other times during the year.

Transparency Monitoring Activities

U.S. monitors conduct the following activities at the Russian sites involved in the HEU Purchase Agreement.

At MPA and at the Chemical and Metallurgical Plant at SChE where HEU weapon components are converted to purified HEU oxide:

- At the area where HEU weapon components in Weapon Component Transport Containers are received, inventory the containers by recording the serial numbers of the containers and perform NDA measurements to confirm that HEU is in the containers.
- Perform an NDA measurement on an in-house shop container to confirm that it is empty. Then after technicians transfer the weapon component from the transport containers to the shop container, perform an NDA measurement on the transport container to confirm that it is empty and on the shop container that it now contains HEU.
- After HEU metal shavings have been produced from the weapon component, perform an NDA measurement on the tray containing the metal shavings to confirm that HEU is in the tray.
- Witness the placement of the HEU metal shavings in a glovebox and the ignition of the metal shavings. The glovebox is sealed with a U.S. seal while the U.S. monitors are conducting other activities and the metal shavings are being burned to HEU oxide.
- Witness the removal of the HEU oxide from the glovebox and perform an NDA measurement on the oxide in the tray to confirm that HEU is in the tray.

- Witness the introduction of the HEU oxide into wet chemical purification process to purify the HEU and produce a purified HEU oxide.
- Witness the removal of the purified HEU oxide from the purification process and the packaging of the purified HEU oxide into shipping containers. Inventory the containers by recording the serial numbers of the containers, the production lot number assigned to the purified HEU oxide in the container, and the total gross weight of the containers (all of this information is stamped on a tag attached to the container). Perform an NDA measurement on the shipping container to confirm that HEU is in the container.

At ECP and at the Conversion Plant at SChE where the purified HEU oxide is received and converted to HEU hexafluoride:

- Witness the receipt of the containers of purified HEU oxide and inventory the containers in storage by recording the serial numbers of the containers, the production lot number assigned to the purified HEU oxide in the container, and the total gross weight of the containers. Perform an NDA measurement on the shipping container to confirm that HEU is in the container.
- Witness the loading of the purified HEU oxide into fluorinators, where the HEU oxide is reacted with fluorine to produce HEU hexafluoride (HEU UF₆). The HEU hexafluoride is then desublimed to a solid in 6-liter cylinders.
- Inventory the 6-liter cylinders by recording the serial numbers of the cylinders, the production lot number assigned to the HEU hexafluoride in the cylinders, and the total gross weight of the cylinders (all of this information is stamped on a tag attached to the cylinder). Perform an NDA measurement on the cylinders to confirm that HEU is in the cylinder.

At ECP, at the Enrichment Plant at SChE, and at UEIP where the HEU hexafluoride is received and blended with the slightly enriched uranium hexafluoride at an enrichment of 1.5% ²³⁵U to produce the LEU hexafluoride product:

- Inventory the 6-liter cylinders by recording the serial numbers of the cylinders, the production lot number assigned to the HEU hexafluoride in the cylinders, and the total gross weight of the cylinders. Perform an NDA measurement on the cylinders to confirm that HEU is in the cylinders.
- At the blendpoint, record the pressure of the HEU hexafluoride gas and the slightly enriched uranium hexafluoride gas before and after critical-flow orifice plates so that the flow rates of the gases can be determined.
- Before the orifice plates are installed into the piping at the blendpoint, U.S. monitors inspect the plates to determine the size of the orifice in the plates. U.S. seals are attached to the bolts holding the orifice plates in place. The integrity of the U.S. seals are confirmed during each monitoring visit.
- At LEU hexafluoride product transfer facilities, witness the transfer of the LEU hexafluoride product from in-plant cylinders to 30B cylinders and to 1S sample cylinders provided by USEC.
- Witness the weighing of the 30B cylinders and the 1S sample cylinders.

At certain steps where material is transferred from site to site, or from facility to facility at a given site, U.S. seals are applied to randomly selected containers and cylinders before the transfer and inspected by U.S. monitors both before and after the transfer.

At the facilities, process and material accountancy documents are provided to U.S. monitors. These documents are reviewed and the information on the documents is copied. The information is returned to the United States where it is analyzed and compared to the observations taken during on-site monitoring activities.

Summary

U.S. monitors conduct inventory and process-monitoring activities at the four Russian plants involved in the HEU Purchase Agreement. Information is also obtained from process and material accountancy documents while the monitors are at the Russian plants. The analysis of the monitoring activities and the information obtained from the documents contribute to the overall confidence that the Russian plants are processing HEU as declared.

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