

EXECUTIVE SUMMARY

BACKGROUND

In February 1996, the Department of Energy (DOE) commissioned a comprehensive effort to document and declassify the United States inventory and other information needed to present a complete picture of the production, acquisition, and utilization of highly enriched uranium (HEU). *Highly Enriched Uranium: Striking A Balance* presents the results of that study. The effort was commissioned to facilitate discussions of HEU storage, safety, and security with stakeholders, to encourage other nations to declassify and release similar data, and to support the national policy on transparency of nuclear materials. This information will also be available for formulating policies involving the identification and disposition of surplus nuclear materials.

Highly Enriched Uranium: Striking A Balance contains details of the U.S. HEU inventory as of September 30, 1996, and provides a historical material balance that summarizes over 50 years of U.S. activities that produced, acquired, and utilized HEU. This report focuses on the facilities and activities that have produced and used HEU during the 50-year history of the nuclear weapons complex. The report contains important newly declassified HEU information regarding the total U.S. inventory, including the quantities required to support ongoing Departmental programs. Other newly declassified information includes details about the HEU produced in the U.S. uranium enrichment facilities and the total quantity of HEU transferred to the United Kingdom under a Mutual Defense Agreement.

This report also updates the quantities of HEU declared surplus to the Department's needs at the DOE February 6, 1996, Openness Press Conference. It also revises the quantity for the total U.S. production of HEU released at the June 27, 1994, Openness Press Conference.

Recognizing that openness is essential to public accountability and trust, the DOE is continuing to take aggressive steps to declassify and inform the public about the Department's past and present activities where it does not jeopardize U.S. national security or aid worldwide nuclear proliferation. In this way, this report "strikes a balance" between openness and the necessity to protect information that needs to remain classified for nonproliferation and national security reasons.

By constructing a historical material balance, this report also attempts to "strike a balance" between the September 30, 1996 HEU inventory and the processes that produced, acquired, and used HEU. While other DOE reports have provided much of this information separately, this report

Highly Enriched Uranium

- ✓ Definition: HEU is uranium that has been enriched to a uranium-235 isotopic content of 20 percent or more.
- ✓ Uses: For over 50 years, HEU has been used in nuclear weapons, naval reactors, and research reactors.

combines previously released data along with newly declassified information that has allowed DOE to issue, for the first time, a comprehensive report on HEU.

Section 1 introduces the reader to the predecessor organizations to the DOE, the nuclear material control and accountability system, and the Department's "Openness Initiative." Section 2 provides some perspective on the production and uses of HEU, including the Department's nuclear weapons complex. The two most important sections of this report are Sections 3 and 4 where details of the U.S. HEU inventory and the historical material

balance are presented. Sections 5 and 6 contain the details for the historical material balance and much of the newly declassified HEU information. Annual quantities are presented by fiscal year. The appendices provide information on HEU facilities, U.S. HEU spent nuclear fuel inventory, the Navy Nuclear Propulsion and Army Nuclear Power Programs, and Agreements for Cooperation with foreign countries.

This report was prepared using official Department historical information including facility material control and accountability (MC&A) records, historical MC&A summary reports, and individual site inventory and transaction data as reported in the Nuclear Materials Management and Safeguards System (NMMSS). When site MC&A records or NMMSS data were not available, historical reports and memoranda were used to augment these data. This report is based on the evaluation of those records and represents the Department's best interpretation. The information in this report may be updated or revised in the future should additional or more detailed data become available.

U.S. HEU INVENTORY

As of September 30, 1996, the total U.S. inventory of HEU was **740.7 MTU**¹ containing **620.3 MTU-235**². Of the total 740.7 MTU, **562.9 MTU** are required to support ongoing and future programs, and **177.8 MTU** are surplus to the Department's needs.

The 177.8 MTU of surplus HEU represents a 3.5 MTU increase over the quantities previously released by the Department in February 1996. This increase is a result of ongoing site material

Scope of This Report

- ✓ Overall: A historical report on U.S. HEU production, acquisition, and utilization activities.
- ✓ Timeframe: 1945 through September 30, 1996.
- ✓ Relationship to Other Countries: This report provides quantities of HEU sent to foreign countries. This report also provides quantities of HEU received from foreign countries. This report does not account for retransfers of U.S.-origin HEU between foreign countries. Transactions between foreign countries are the responsibility of the IAEA.

¹ MTU is defined as metric tons of elemental uranium and includes all isotopes of uranium.

² MTU-235 is defined as metric tons of uranium-235.

stabilization activities, material disposition actions, and Defense Programs' stockpile management and stewardship activities.

MATERIAL BALANCE

The primary objective of a material balance is to provide assurance that all material quantities are present in the correct amount. In terms of uranium-235, the weapons-usable isotope of interest in this report, the Department was able to achieve a material balance equaling the actual inventory of 620.3 MTU-235. A material balance in terms of total uranium was not possible due to data limitations, which are discussed in Section 4.

NEWLY DECLASSIFIED INFORMATION

A summary of newly declassified information in this report is provided in the text box. Details are provided in Sections 3 through 6.

Summary of Newly Declassified Information

- ✓ Historical HEU production by assay.
- ✓ Historical HEU refeed by assay at all gaseous diffusion plants.
- ✓ The total quantity of HEU transferred to the United Kingdom under a Mutual Defense Agreement <deleted>.

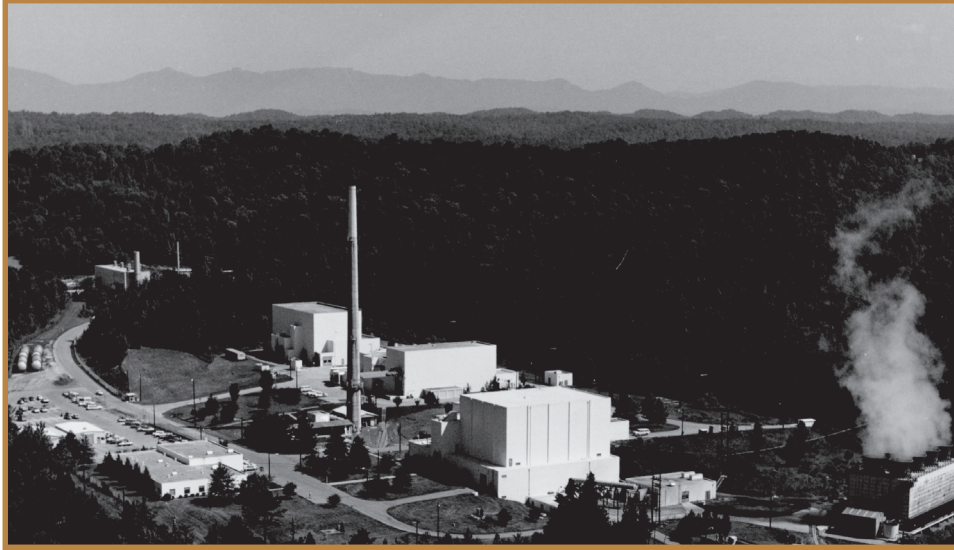
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CORRECTIONS TO PREVIOUSLY RELEASED DATA

The following are corrections made in this report to previously released data:

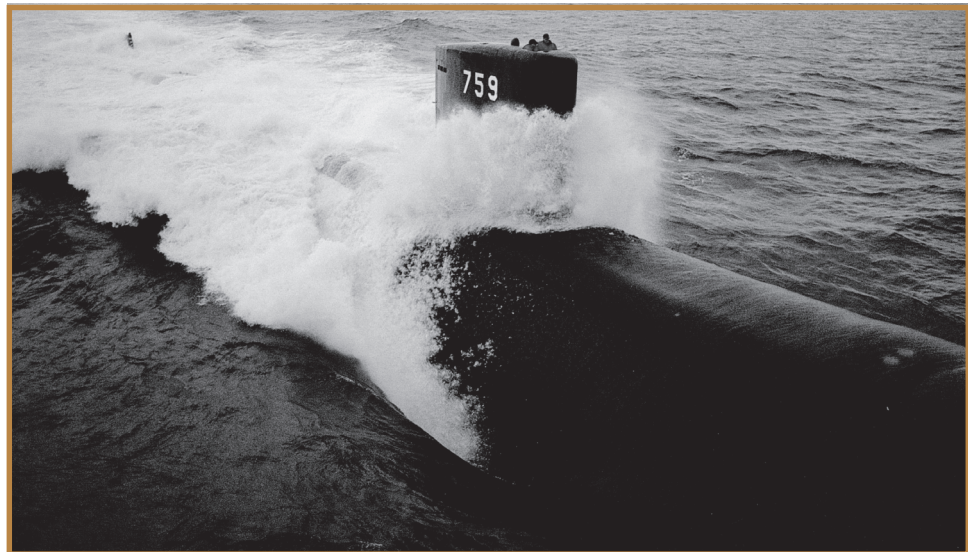
- U.S. HEU production quantity has been revised from 994 MTU to 1,045.4 MTU. Details are provided in Section 5.
- The cumulative inventory difference for the K-25 Site has been revised from -43 kilograms of uranium-235 to +113 kilograms of uranium-235. This represents a change of 156 kilograms from the book inventory. The -43 kilograms was the annual quantity reported for 1987 only and is not the cumulative quantity.

HIGHLY ENRICHED URANIUM: STRIKING A BALANCE



HEU is required as a fuel in many research and test reactors, including the High Flux Isotope Reactor (shown to the left) at the Oak Ridge National Laboratory.

All U.S. nuclear-powered warships currently use reactors fueled by HEU. Pictured is the U.S.S. Jefferson City (SSN 759), a Los Angeles-Class Attack Submarine.



HEU is required for nuclear weapons. Pictured is a Pantex Plant worker preparing to disassemble nuclear weapons.