



U.S. Department of Energy Office of Environmental Management Depleted Uranium Hexafluoride Management Program



Overview of Depleted Uranium Hexafluoride Management Program

Over the last four decades, large quantities of uranium were processed by gaseous diffusion to produce enriched uranium for U.S. national defense and civilian purposes. The gaseous diffusion process uses uranium in the form of uranium hexafluoride (UF_6), primarily because UF_6 can conveniently be used in the gas form for processing, in the liquid form for filling or emptying containers, and in the solid form for storage. “Depleted” UF_6 (DUF_6) is a product of the enrichment process and is stored at three uranium enrichment sites, located at Paducah, Kentucky; Portsmouth, Ohio; and the East Tennessee Technology Park (ETTP, formerly known as the K-25 Site) in Oak Ridge, Tennessee. Depleted uranium is uranium that, through the enrichment process, has been stripped of a portion of the uranium-235 isotope that it once contained so its uranium-235 proportion is lower than the 0.7 % (by weight) found in nature. The uranium in most of the U.S. Department of Energy’s (DOE) DUF_6 has between 0.2 to 0.4 % uranium-235 by weight.

DOE has management responsibility for approximately 700,000 metric tons (MT) of DUF_6 contained in about 57,700 steel cylinders at the Portsmouth, Paducah, and ETTP sites, where DOE has stored such material since the 1950s. The characteristics of UF_6 pose potential health and environmental risks. DUF_6 in cylinders emits low levels of gamma and neutron radiation. Also, when released to the atmosphere, DUF_6 reacts with water vapor in the air to form hydrogen fluoride (HF) and uranyl fluoride (UO_2F_2), both chemically toxic substances. In light of such characteristics, the mission of DOE’s DUF_6 Management Program is to safely and efficiently manage the Department’s inventory of DUF_6 in a way that protects the health and safety of workers and the public, and protects the environment until the depleted UF_6 is either used or disposed.

DOE’s DUF_6 Cylinder Inventory ^a		
Location	Number of Cylinders	DUF_6 (MT) ^b
Paducah, Kentucky	36,910	450,000
Portsmouth, Ohio	16,041	198,000
Oak Ridge (ETTP), Tennessee	4,683	56,000
Total	57,634	704,000

^a The DOE inventory includes DUF_6 generated by the government, as well as DUF_6 transferred from U.S. Enrichment Corporation pursuant to two memoranda of agreement.

^b A metric ton (MT) is equal to 1,000 kilograms, or 2,200 pounds.

The DUF_6 Management Program involves three primary activities: (1) cylinder surveillance and maintenance, (2) conversion of DUF_6 to a more stable chemical form for use or disposal, and (3) development of beneficial uses of depleted uranium.

Cylinder Surveillance and Maintenance

It will take decades to convert the DUF_6 in the inventory to a more stable chemical form. As a result, the Department intends to continue surveillance and maintenance of the DUF_6 cylinders currently in storage.

The day-to-day management of the DUF_6 cylinders includes actions designed to cost-effectively improve storage conditions, such as

- Performing regular inspections and general maintenance of cylinders and storage yards;
- Restacking and respacing the cylinders to improve drainage and to allow for more thorough inspections;
- Repainting ends of skirted cylinders and repainting cylinder bodies as needed to arrest corrosion; and
- Constructing new concrete cylinder storage yards and reconditioning existing yards from gravel to concrete to improve storage conditions.

Typical DUF_6 cylinders stacked two high in outdoor yards for storage. Cylinders generally contain about 12 metric tons (14 tons). DOE's DUF_6 Management Program is focused on (1) continued cylinder surveillance and maintenance, (2) conversion of the DUF_6 to a more stable chemical form for use or disposal, and (3) development of beneficial uses of depleted uranium.



Conversion

The eventual disposition of DUF_6 remains the subject of considerable interest to members of the U.S. Congress, concerned citizens, and other stakeholders. The Congress stated its intentions in Public Law 105-204, signed by the President in July 1998. Public Law 105-204 required DOE to develop a plan to build two DUF_6 conversion facilities, one each at Portsmouth, Ohio, and Paducah, Kentucky.

DOE submitted the required plan, *Final Plan for the Conversion of Depleted Uranium Hexafluoride*, to Congress in July 1999. This document discussed DOE's technical approach and schedule to implement this project. Although much of the information provided in this report is still valid, a few aspects of this plan have changed since its publication:

- Responsibility for the project was transferred from DOE's Office of Nuclear Energy, Science and Technology (NE) to the Office of Environmental Management (EM). The Energy and Water Development Appropriation for FY 2001, Public Law 106-377, transferred funding for uranium program activities to a new account, Uranium Facilities Maintenance and Remediation (UFM&R), which is managed by EM.
- Several details associated with the procurement of the two facilities have been revised as the procurement strategy and solicitation have evolved. In particular, the schedule milestones originally provided in the July 1999 plan have been revised to reflect a construction start date of January 31, 2004.

In addition, DOE has prepared a Programmatic Environmental Impact Statement to evaluate the long-term management and use of the DUF₆. The Record of Decision was issued in August 1999 and specifies that DOE would “take necessary steps to promptly convert the depleted UF₆ inventory.”

On October 31, 2000, DOE issued a request for proposals (RFP) to procure a contractor to design, construct, and operate DUF₆ conversion facilities. The objective of the DUF₆ conversion project is to chemically process the Department’s inventory of DUF₆ (now located at the Paducah Gaseous Diffusion Plant, the Portsmouth Gaseous Diffusion Plant, and the ETTP) to some other stable chemical form acceptable for transportation, beneficial use/reuse, and/or disposal. Conversion facilities will be constructed at Paducah and Portsmouth. In addition, the selected contractor will also assume cylinder surveillance and maintenance of the DOE inventory of DUF₆, low-enrichment uranium (LEU), UF₆ and empty and heel cylinders. These surveillance and maintenance activities will include the transfer of cylinders located at the ETTP to the Portsmouth site for conversion. Finally, the selected contractor will also be responsible for transportation and disposition of conversion by-products, all waste forms, and empty and heel cylinders. It is currently estimated that it will take up to 25 years of conversion plant operations to convert all of DOE’s DUF₆ inventory.

As part of the selection process, DOE will prepare an environmental critique and synopsis for each proposal. The environmental critique will evaluate the environmental data and information submitted by each offeror and will be subject to the confidentiality requirements of the procurement process. A publicly available environmental synopsis, based on the environmental critique, will be prepared to document the consideration given to environmental factors in the contractor selection process and the determination of reasonable alternatives. The environmental synopsis will be filed with the U.S. Environmental Protection Agency and will be incorporated into the site-specific Environmental Impact Statement (EIS) analysis.

The site-specific EIS analysis will be conducted to evaluate conversion project alternatives, pursuant to the National Environmental Policy Act (NEPA). This EIS will represent the second level of a tiered environmental assessment process being used to evaluate and implement the DUF₆ Management Program. The EIS will assess the potential environmental impacts of constructing, operating, maintaining, and decontaminating and decommissioning DUF₆ conversion facilities at the Portsmouth and Paducah sites, as well as other reasonable alternatives. The NEPA process will be completed in advance of a go/no-go decision, specifically, before beginning detailed design of the conversion facilities.

Beneficial Use of the Depleted Uranium

DOE is committed to exploring the safe, beneficial use of depleted uranium and other materials resulting from conversion of DUF₆ (e.g., fluorine and empty carbon steel cylinders) for the purposes of resource conservation and cost savings compared with disposal. Accordingly, DOE has initiated the Depleted Uranium Uses Research and Development Program. This program will explore the risks and benefits of several uses of depleted uranium including its use as a radiation shielding material, a catalyst, or semi conductor material in electronic devices.

The Department is also committed to assuring that direct disposal of these materials is possible in the event that beneficial uses do not materialize.

For More Information

Please direct comments or questions concerning the DOE DUF₆ Management Program to: Kevin Shaw, U.S. Department of Energy, Office of Environmental Management, Office of Site Closure Oak Ridge Office (EM-32), 19901 Germantown Road, Germantown, MD 2087; (301) 903-4232; fax (301) 903-3479.

Environmental and project-related materials are available for public review in the following reading rooms:

DOE Headquarters, Freedom of Information Reading Room, 1000 Independence Avenue, S.W., Room 1 E-190, Washington, DC 20585. Telephone: (202) 586-3142.

Oak Ridge/DOE, Public Reading Room, 230 Warehouse Road, Suite 300, Oak Ridge, Tennessee 37831. Telephone: (865) 241-4780 or 1-800-382-6938, option 6.

Paducah/DOE, Environmental Information Center, 115 Memorial Drive, Paducah, Kentucky 42001. Telephone: (270) 554-6967.

Portsmouth/DOE, Environmental Information Center, 3930 U.S. Route 23, Perimeter Road, Piketon, Ohio 45661. Telephone: (740) 289-3317.

Additional information is also available through the project web site at: <http://web.ead.anl.gov/uranium>, or at <http://www.tis.eh.doe.gov/nepa>.