



# *Depleted Uranium Hexafluoride (DUF<sub>6</sub>) Storage, Conversion, and Management in the U.S.*

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# *Depleted Uranium (DU) Is a Legacy of Uranium Enrichment*





# Worldwide DU Inventory\*

Enricher	Inventory (MTU)	Storage form
United States	480,000	UF <sub>6</sub>
France (COGEMA and Eurodif)	190,000	U <sub>3</sub> O <sub>8</sub>
Urenco <sup>a</sup>	16,000	UF <sub>6</sub>
United Kingdom (BNFL)	30,000	UF <sub>6</sub>
Russia	460,000	UF <sub>6</sub>
Japan	10,000	UF <sub>6</sub>
Republic of Korea	200	UF <sub>6</sub>
China	2,000	UF <sub>6</sub>

<sup>a</sup>Urenco operates plants in Germany, the Netherlands, and the United Kingdom.

\*Source: *Management of Depleted Uranium*, OECD Nuclear Energy Agency and International Atomic Energy Agency, report number ISBN 92-64-19525-4, 2001.





# *Background*

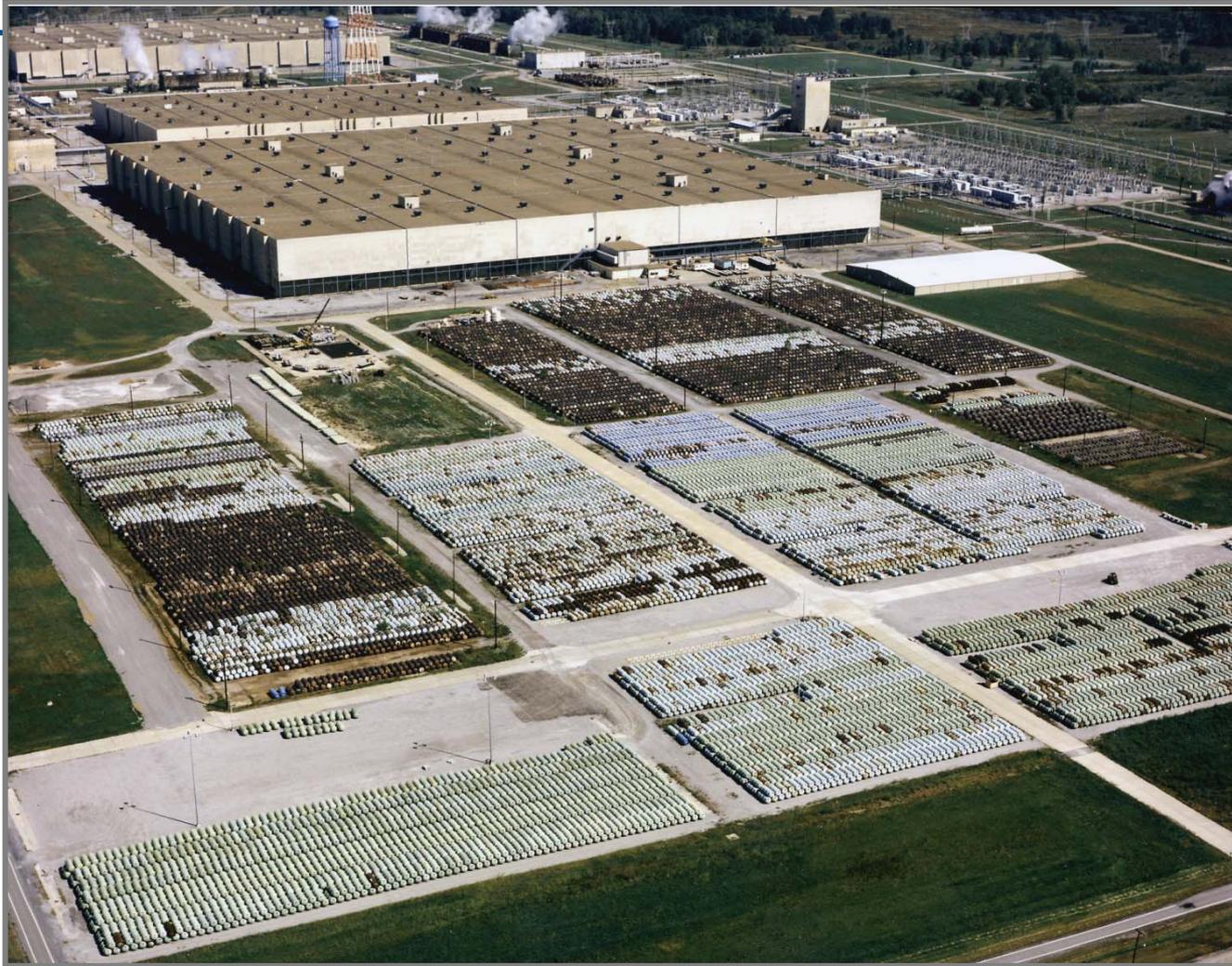
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- Large stocks of DU have arisen from uranium enrichment operations in the United States and Russia
- This surplus DU requires costly storage, monitoring, and eventual disposal
- Both countries share a common issue of how to dispose of their DU inventories in the most cost effective manner





# Paducah Gaseous Diffusion Plant



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# *The U.S. $DUF_6$ Management Program Involves Three Primary Activities*



- 1. Cylinder storage, surveillance, and maintenance**
- 2. Conversion of  $DUF_6$  to a more stable chemical form for use or disposal**
- 3. Development of beneficial uses of DU**





# 1. Cylinder Storage, Surveillance, and Maintenance

## Cylinder Management

The cylinder management program is responsible for safely storing DOE's  $\text{DUF}_6$  inventory at Paducah, Portsmouth, and East Tennessee Technology Park sites until the  $\text{DUF}_6$  is used or disposed of

57,634  
cylinders  
704,000 MT  
of  $\text{DUF}_6$

- Inspect cylinders for degradation
- Restack cylinders to improve drainage and to allow thorough inspections
- Repaint cylinders to arrest corrosion
- Build new cylinder yards





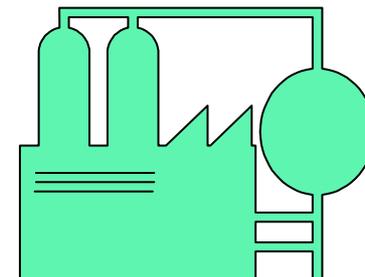
## 2. $DUF_6$ Conversion

Full cylinders go to conversion plants at  
Portsmouth and Paducah

Government-owned and contractor-operated facilities will convert DOE's  $DUF_6$  inventory located at the storage sites to some other stable chemical form acceptable for transportation, beneficial use/reuse, and/or disposal

DU product,  
aqueous HF,  
empty  
cylinders

- $DUF_6$  cylinder receipt, inspection, and processing
- Cylinder preparation for  $DUF_6$  vaporization
- Conversion to uranium oxide using Framatome's dry conversion process
- Product storage limited to less than 6 months
- Transportation and disposal of uranium oxide
- Marketing of HF





### 3. *Development of Beneficial Uses of DU*

#### Depleted Uranium Uses Research and Development Program

**Develop beneficial uses of  $\text{DUF}_6$  conversion plant products**

**DU is a potentially valuable energy resource**

**Goal: Reduce costs by avoiding transportation and disposal costs**

**Marketable Products**

- **Fundamental research**
- **Prototype fabrication and demonstration of near-commercial technology**
- **Focus on DOE system-wide uses and cost reductions**
- **Industry/university cooperation**
- **International collaboration**
- **Reduction of regulatory and institutional barriers**





## *Conversion of $DUF_6$ to a More Stable Form*

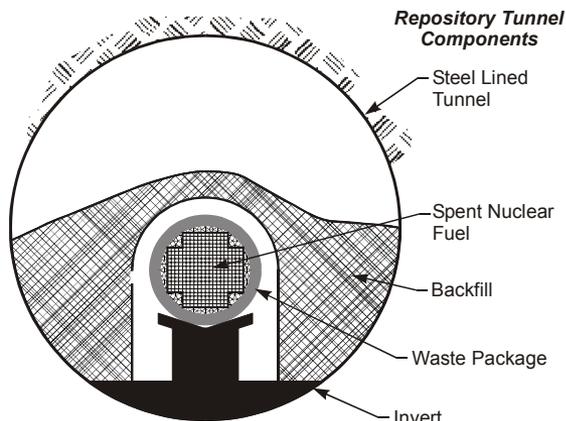
*DOE has recently awarded a \$558M contract to convert and dispose of 704,000 metric tons of  $DUF_6$*

- **Contract awarded August 29, 2002, to Uranium Disposition Services, LLC**
  - **Framatome ANP**
  - **Duratek Federal Services**
  - **Burns and Roe**
- **Contract is for**
  - **Design, construction, and 5-year operation of two facilities located at the gaseous diffusion plants at Portsmouth, OH, and Paducah, KY**
  - **Surveillance and maintenance of cylinder inventory**
  - **Shipment of  $UF_6$  cylinders from Oak Ridge, TN, to Portsmouth, OH**
- **DU product ( $DU_3O_8$ ) sent for disposal, if no reuse is found**
- **Construction to start by July 31, 2004**
- **Contract provides incentives for reuse of DU**





# *Beneficial DU Uses That Consume the Inventory, But Have Low Market Value, \$/t DU*

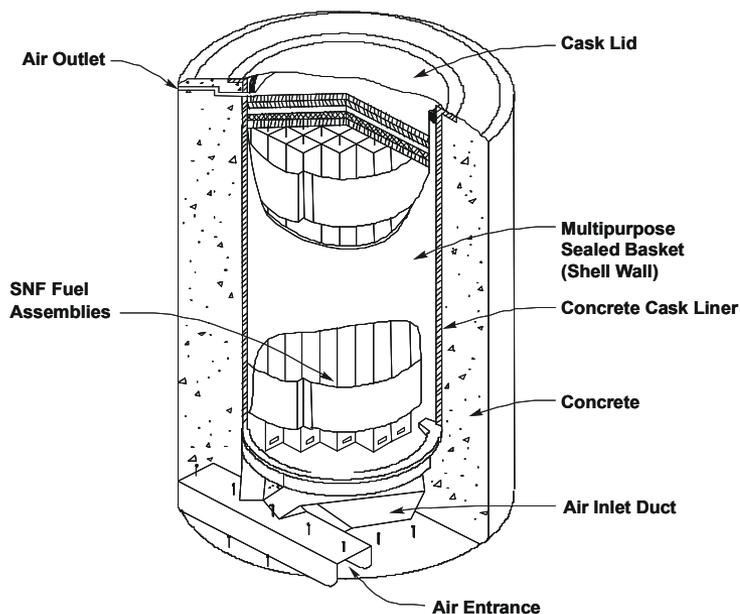


- **Geologic repository**

**DU surrounding the waste package provides a chemical barrier to spent nuclear fuel (SNF)**

- **SNF and high-level-waste casks**

**New DU concrete and steel cermet materials enable smaller, lighter-weight casks**





# *Beneficial, Innovative Material Uses That Have High Intrinsic Value, \$/t DU*

*(Royalties from licensing these materials will lower overall DU disposition costs)*

- **Catalysts**
- **Semiconductors**
- **Electrodes for hydrogen production**
- **Batteries**
- **Fuel cells**
- **Others**



**Solar Panel Installed at ORNL Roof Test Facility**

