

# Programmatic Review of Depleted Uranium Uses Research and Development Program

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# This Talk Organization

- Program justification
- Program definition
- How it is working
- How it is set-up for the future
- Issues

# Depleted Uranium (DU) Uses R&D Program

## Background

- The U.S. Government has more than 700,000 metric tons of surplus depleted uranium hexafluoride ( $\text{DUF}_6$ ), resulting from uranium enrichment operations, stored at sites across the country.
- The costs to convert this material to a stable form and dispose of it is estimated to be several billions of dollars.



OAK RIDGE NATIONAL LABORATORY  
U. S. DEPARTMENT OF ENERGY

Paducah Gaseous Diffusion Plant, CTD WS 1150  
(ORO 88-899)



# Justification for DU Uses R&D Program

## 1. Legislation

- Public Law 105-204 [PL 1998] states
  - “The Secretary of Energy shall prepare . . . a plan and proposed legislation . . . to treat and recycle depleted uranium hexafluoride . . .”. This requires that DOE undertake a good-faith effort to consider the recycle (i.e., beneficial use) of the DU, and the fluorine and cylinders associated with it.
- As required by this public law prepared, “*Final Plan for the Conversion of Depleted Uranium Hexafluoride as Required by Public Law 105-204*” [DOE 1999b].
  - This plan includes commitments to a DOE program to explore beneficial use of the products from  $\text{DUF}_6$  conversion to reduce the cost of DU hexafluoride disposition while maintaining the option to dispose of conversion products that cannot be used.

# Justification for DU Uses R&D Program (continued)

## 2. Compliance Agreements

- In 1998, DOE and the Ohio Environmental Protection Agency reached a settlement in the form of an agreed order [OEPA 1998] regarding management of the  $\text{DUF}_6$  at the Portsmouth Enrichment Plant.
- The order exempts DOE for a specified time from the requirement to evaluate whether  $\text{DUF}_6$  stored at Portsmouth is a **hazardous waste**.
- The exemption is contingent on DOE making “**good-faith efforts** to evaluate potential use or reuse of the  $\text{DUF}_6$ ”.

# Justification for DU Uses R&D Program (continued)

## 3. DU Programmatic EIS Record of Decision (ROD) [DOE 1999a].

- ROD states as preferred alternative:
  - “DOE plans to continue its support for the development of Government applications for depleted uranium products and to continue the safe management of its depleted uranium inventory as long as such inventory remains in storage prior to total conversion.”
- The decision statement in the ROD states that DOE decided to promptly convert the  $\text{DUF}_6$  inventory to DU oxide, DU metal, or a combination of both. It further states that
  - “The DU oxide will be used as much as possible (emphasis added) and the remaining DU oxide will be stored for potential future uses or disposal, as necessary.”.

# Roadmap

- Required by Public Law 105-204, “DUF<sub>6</sub> Materials Use Road Map” [DOE 2000c]. Describes R&D program to investigate potential beneficial uses of DU, fluorine, and steel cylinders . . .
- Defines where to commit future R&D investments.
- Issued for public comment, September 2000.
- ~19 sets of comments received by October 20, 2000 deadline
- Revised draft, for formal approval, will be ready in March 2001.

# DU Uses R&D Program

- Flowing from the Roadmap a full scope program was formulated
  - 110 Repository applications
  - 120 Heavy concrete
  - 210 Dose calculation
  - 220 Regulatory support
  - 230 Cylinder reuse
  - 310 Long-term storage
  - 320 DU disposal
  - 410 UO<sub>2</sub> alteration
  - 420 High-value fluorine
  - 430 Basic research
  - 440 International collaboration
  - 510 Systems analysis
  - 520 Management

# DU Uses R&D Program Strategy

- The program is emphasizing two main use scenarios
  - Large volume, low value uses, e.g., shielding, package fill
  - Low volume, high value uses, e.g., catalysis
  - High value uses would create market and potentially revenue that could increase demand for DU, through CRADAs, licensing of IP, etc.
- A key strategy is to partner with other programs to leverage existing funds and allow alternate sources of funds to be applied
  - Partnership with SC on catalysis
  - Exploring partnership with NE and DARPA on thermoelectrics

# FY 2000 Work

- **Work commenced on tasks**
  - 110 Repository applications
  - 120 Heavy concrete
  - 230 Cylinder reuse
  - 430 Basic research
  
- **Budget**

– R&D program expense	\$231K
– Roadmap activity	<u>\$248K</u>
<b>TOTAL</b>	<b>\$479K</b>

# Planned FY 2001 Work Scope

- In FY 2001, goal is to consolidate initial work and initiate a few new actions, and build support for increased activity in FY 2002
- **Tasks**
  - 110 Repository applications (including workshop with RW)
  - 120 Heavy concrete
  - 420 High-value fluorine
  - 430 Basic research
  - 440 International collaboration
- **Funding**
  - \$877K (includes \$320K for Russian work)

# Achievements

- Comprehensive program plan that implements roadmap
- Experiments
  - Catalysts
  - Semiconductor
  - DU fill in waste package (WP) in FY 01
  - DUCRETE in FY 01
- 5 open literature publications
- Special session during Waste Management 2001 Symposium, February–March 2001, “Advances in DU Technology”
- News media
  - Nuclear Fuel newsletter review of program paper at Winter 2000 ANS conference
  - Nuclear News journal review of November Spectrum Conference papers on DUCRETE and DU fill in WP
- On-going negotiation with RW to arrange a workshop on DU uses in repository

# Interfacing Organizations (by end of FY 01)

- 3 national laboratories (ANL, BNL, pending supplemental funds)
- 2 universities (University of Tennessee, Prof. Meek; University of Kentucky–Paducah, Prof. Dunbar)
- Russian Academy of Science
- Offices within DOE
  - SC
  - EM
  - NE
  - RW
  - Maybe FE, EE

# FY 2001 Funding Supplement

- Seeking additional funds to permit initiation and expansion of activities
- What it allows program to do
  - Makes up for shortfall created by greater than expected impact of international collaboration
    - Allows program manager to work full-time on program
    - Allows initiation of important tasks
      - Task 220 Regulatory support (Argonne National Laboratory)
      - Task 230 Cylinder reuse (begin demonstration)
      - Task 410 UO<sub>2</sub> alteration (at University of Missouri)
      - Task 510 Systems analysis (economics of DUCRETE compared to reference process)

# Proposed FY 2002 Budget

- Increase spending on initiated tasks to allow completion on schedule
- Conduct experiments initiated in late FY 01 on DU fill material in WP, and DUCRETE
- Initiate new basic research on DU semiconductor properties
  - Solar-cells, thermoelectric generation (UT's Prof. Meek sabbatical funding)
- Expand basic research on DU catalysts
  - De-sulfurization proof-of-principle examinations
- Support commercialization for DU catalysts for destruction of VOC's

## DU Uses R&D Funding (\$K)

Task no.	Task	Spent prior FY <sup>+</sup>	Committed funding FY 01	FY 01 funding plus supplement	Proposed FY 02
110	Repository applications (cermet, fill)	67	160	230	375
120	Heavy concrete (DUCRETE)	48	160	210	375
210	Dose calculation	0			
220	Reg. support	0		50	50
230	Cyl. reuse	19		50	150
310	Long-term storage	0			
320	DU disposal	0			
410	UO <sub>2</sub> alteration	0	0	30	50
420	High value fluorine	0	30	30	150
430	Basic research (DU catalysts, semiconductors)	87	100	100	250
440	International collaboration (Russia Workshop)	0	170*	170*	50
510	Systems analysis	0		40	50
520	Management	10	107	217	250
	TOTAL	231	727	1,127	1,750

\*Authorized funding in FY 00 was \$340K for DU R&D plus \$225K for roadmap.

\*An additional \$150K was held back by DOE for Russian Academy of Science work.

# Issues

- **Funding**
  - Funding levels for FY 2000, 2001 not adequate to cover all work scope or level of activities planned
  - FY 2000 funding was about ~20–30% of postulated and planned budget
  - FY 2001 funding request was only ~75% of planned
  - Limited funding has limited activities, half-time manager
  - More promising activities have emerged that cannot be initiated
  - A little extra funds would go a long way
- **Leadership**
  - A federal program manager in EM should be appointed
- **Russian Academy of Sciences**