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Technical Considerations in Materials Management Policy Development*

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Introduction

Under the Materials-in-Inventory (MIN) initiative, the U.S. Department of Energy (DOE) intends to develop policies to ensure that materials are managed and used efficiently, cost-effectively, and safely throughout DOE.[1,2] The MIN initiative applies to any material in storage at facilities in the DOE complex that is not currently in routine use and will not be used for one year or longer, with the exception of materials that are already declared waste or set aside for national security purposes. The MIN initiative covers depleted uranium, scrap metals, chemicals, explosives, spent nuclear fuel, lead, alkali metals, and other materials such as equipment and hardware. By far the largest component of MIN is depleted uranium in the form of uranium hexafluoride (DUF_6).

This paper describes an approach for selecting strategies to manage individual materials in inventory. The approach integrates engineering feasibility, environmental impact, and cost considerations by first identifying feasible end states and uses for the material and then estimating the costs and environmental impacts associated with achieving the desired end state. The approach is currently being used to identify a long-term management strategy for DUF_6; however, it can be generalized for use with other materials covered by the MIN initiative. This paper first discusses applying the approach to DUF_6 management and then describes applying the generalized approach to other materials covered by MIN.

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DUF_6 Management Program Overview

When natural uranium is enriched in its U-235 isotope in gaseous diffusion plants, two UF_6 streams are produced. One stream is the enriched product; the other consists of depleted UF_6 tails. Depending on the level of enrichment and the depletion in the two streams, the percentage of UF_6 entering the diffusion plant that ends in the depleted stream can vary from about 80 to close to 100 (about 99.7%). Consequently, over the last 45 years, a large quantity of DUF_6 has accumulated at the three sites where gaseous diffusion plants were built and operated: Paducah, Kentucky; Portsmouth, Ohio; and Oak Ridge, Tennessee. The total quantity of DUF_6 produced by DOE before July 1, 1993 (the date on which the United States Enrichment Corporation took over uranium enrichment operations from DOE), is about 560,000 metric tons. This DUF_6 is stored in approximately 46,400 cylinders on outside yards. The cylinders are made of carbon steel and are of varying sizes, but most are about 1.2 m in diameter, 3.7 m in height, and contain approximately 14 metric tons of DUF_6.

Because of age and less-than-ideal storage conditions, many cylinders have lost their paint and appear rusty. In fact, some show signs of severe degradation from corrosion. Because of (1) the condition of the cylinders, (2) some questions raised by the Ohio Environmental Protection Agency, and (3) the changing missions of DOE, DOE began a program to evaluate long-term management strategies for the DUF_6 it owns.

The DUF_6 management program has four major components: (1) technology assessment, (2) engineering analysis, (3) cost analysis, and (4) the environmental impact statement (EIS). The technology assessment began when a notice was placed in the *Federal Register*[3] asking the industry and general public for recommendations on potential uses of DUF_6, technologies to convert the DUF_6 to another chemical form, and storage or disposal of depleted uranium in various chemical forms. The recommendations were reviewed by a panel of independent reviewers for technical feasibility. The panel's findings are documented in the technology assessment report.[4] The engineering analysis team grouped the reviewers' recommendations into functional modules.[5] The modules (and the options included in each) are as follows: conversion (to U_3O_8, UO_2, and metal); recycle/use (in radiation shielding or dense material applications); storage (above or below ground); disposal (above ground or in a shallow trench or deep mine); and transportation (by highway or rail). The modules are arranged into strategies. The environmental impacts (including the occupational and public health and safety risks) associated with the strategies are being assessed by the EIS team, and the associated costs are being assessed by the cost analysis team. A strategy for the long-term management of the DUF_6 will be selected on the basis of a comparison of the results of the EIS and the cost analysis.[6,7]

Generalized Approach to Materials Management Policy Development

The approach outlined above for selecting a DUF_6 management strategy can be generalized and applied to other materials covered by the MIN initiative. The steps involved are to:

1. Determine the inventory and characteristics of the material;
2. Identify potential end uses and disposition options;
3. Identify technologies and processes that can be used to convert the material from its current state to potential end states identified in the preceding step;
4. Evaluate the feasibility of the technologies and processes;

5. Develop management strategies on the basis of potential end states and feasible technologies and processes;
6. Assess the environmental impacts and estimate the costs of management strategies; and
7. Compare the alternative strategies on the basis of cost, environmental impacts, and other factors as appropriate, and select the strategy that provides the maximum benefit at minimum cost.

Conclusions

A technically defensible approach has been developed and is being used to select a long-term management strategy for DOE's DUF_6 inventory. The same approach can be adapted to management of other materials in inventory that have the potential to be reutilized.

References

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