

URANIUM MANAGEMENT PRESERVATION OF A NATIONAL ASSET

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ABSTRACT

The Uranium Management Group (UMG) was established at the Department of Energy's (DOE's) Oak Ridge Operations in 1999 as a mechanism to expedite the de-inventory of surplus uranium from the Fernald Environmental Management Project site. This successful initial venture has broadened into providing uranium material de-inventory and consolidation support to the Hanford site as well as retrieving uranium materials that the Department had previously provided to universities under the loan/lease program. As of December 31, 2001, ~ 4,300 metric tons of uranium (MTU) have been consolidated into a more cost effective interim storage location at the Portsmouth site near Piketon, OH.

The UMG continues to uphold its corporate support mission by promoting the Nuclear Materials Stewardship Initiative (NMSI) and the twenty-five (25) action items of the Integrated Nuclear Materials Management Plan (1). Before additional consolidation efforts may commence to remove excess inventory from Environmental Management closure sites and universities, a Programmatic Environmental Assessment (PEA) must be completed. Two (2) noteworthy efforts currently being pursued involve the investigation of re-use opportunities for surplus uranium materials and the recovery of usable uranium from the shutdown Portsmouth cascade. In summary, the UMG is available as a DOE complex-wide technical resource to promote the responsible management of surplus uranium.

INTRODUCTION

The Uranium Management Group (UMG) evolved from early activities at the Department of Energy's Oak Ridge Operations (DOE-ORO) that were aimed at integration of uranium management across the DOE complex. In the late 1990s, DOE-ORO assisted in the valuation of materials at DOE's Fernald and Hanford Sites and initiated consolidation of materials from Fernald to facilitate their site closure plans. In addition, DOE-ORO shared with other programs its expertise in uranium management, including packaging, handling, processing, storing, and shipping as well as assisted with the nuclear material integration efforts to draft a series of management plans for the various types of uranium. DOE's Office of Environmental Management (EM) supported this effort and formalized these activities in a Uranium Management Group, which EM chartered in July 1999. Such activities were designed to integrate expertise from throughout the DOE complex and enable DOE programs to increase efficiency, lower costs, and achieve disposition objectives.

This work at DOE-ORO reflects the changing mission of DOE. With the end of the Cold War, the Department's direction began shifting from making nuclear materials to stabilizing, storing, and disposing of nuclear inventories across the DOE complex. But as management activities at individual sites became entangled in DOE complex-wide issues – such as the role of these materials in national defense, physical security risks, and the high cost of management that will extend well into the future – it quickly became apparent that complex-wide representation and management would be beneficial.

In January 2000, DOE began its Nuclear Materials Stewardship Initiative (NMSI) to achieve integration of DOE activities and to reduce long-term costs associated with the management of nuclear materials. The Nuclear Materials Council, consisting of all Secretarial Officers and Operations Office Managers with responsibility for nuclear materials, was charged with carrying out the stewardship initiative, while the Stewardship Task Force, consisting of senior management-level appointees from each of the programs, organized working groups for carrying out the activities of the initiative.

In June 2000, the Department issued an Integrated Nuclear Materials Management Plan (1) that explored the option of establishing management groups for various nuclear materials. The Plan's Multi-Year Agenda for the Nuclear Materials Council included a task to "evaluate the costs and benefits of establishing nuclear material management groups and formally charter those that will serve corporate nuclear materials management needs." The groups envisioned by the plan would propose and plan integrated management solutions across programs for a given set of materials. As proposed, DOE's Stewardship Task Force conducted an evaluation of various material management groups. This effort showed significant merit for the material management groups. Based partially upon these findings, the Stewardship Task Force supported continued funding of the material management groups by EM. The Uranium Management Group has been recognized as a functioning entity within EM that is available as a technical resource for the DOE complex on an as-needed, for-hire basis.

MISSION/GOALS/OBJECTIVES

Consistent with the recommendations of the Integrated Nuclear Materials Management Plan, the mission of the UMG is to safely and efficiently transfer, store, and reuse or disposition the Nation's excess uranium material by ensuring the availability of the necessary facilities and processes to achieve disposition. The UMG uses a DOE complex-wide task team and corporate strategy to identify synergistic opportunities and developing collaborative projects to enable DOE to:

- optimize use of uranium materials and facilities throughout the DOE complex,
- maximize reuse of excess materials to produce revenue, and
- minimize costs of processing and disposition.

The uranium materials within the scope of the UMG include:

- low enriched uranium (LEU);
- natural uranium (NU); and
- depleted uranium (DU).

These materials come in various forms, including metal, oxides and other compounds, research reactor fuel, residues, and radiation sources and standards. The UMG is also cognizant of and works with other DOE organizations responsible for highly enriched uranium (HEU), Uranium-233 (U-233), and depleted uranium hexafluoride (DUF₆).

Excluded from the scope of the UMG are uranium materials contained in spent fuel within the scope of the Spent Nuclear Fuel Program, strategic weapons material, and waste material.

As part of the Office of Nuclear Fuel Security and Uranium Technology, the UMG is managed for DOE by DOE-ORO in Oak Ridge, Tennessee. The UMG consists of a small group of experienced personnel that provide a broad range of services to facilitate management of excess uranium in various forms. The group works with other DOE program and site offices, site contractors, universities, commercial

concerns, and foreign countries to identify integration opportunities that cut across programs and offices and to develop integrated responses to DOE excess uranium management needs and issues.

The goal of the UMG is to serve as the focal point, catalyst, technical resource, project planner, and facilitator for uranium materials identified above. The UMG is reaching this goal by accomplishing the following objectives:

- **Inventory** – Establish and maintain a baseline inventory of uranium materials with sufficient detail to allow management decisions and related actions to be taken;
- **Planning** – Develop and maintain plans for the management and disposition of uranium materials;
- **Infrastructure** – Recommend adequate infrastructure and facilities for management of the Department's many diverse uranium materials;
- **Expertise** – Serve as a business and technical resource to program offices and sites for sales, processing, storing, handling, packaging, transporting, and dispositioning excess uranium materials;
- **Decision Support** – Provide the primary support for the Departmental decisions on uranium issues; and
- **Implementation** – Facilitate complex-wide activities related to the sales, processing, storing, handling, packaging, transporting, and dispositioning of uranium materials.

ESTABLISHING URANIUM FACILITIES

Consolidation of excess material under the leadership of one integrated management organization with a corporate focus can reduce the Department's cost in maintaining storage facilities and in supporting personnel involved in the disposition of uranium materials. Under the UMG's direction, excess uranium materials will be stored in either one centralized location or several locations for partial consolidation. Relocation of material will result in reduced cost, enhanced regulatory compliance, improved safety, as well as aid in nuclear nonproliferation.

One of the major accomplishments of the UMG is the establishment of an interim storage facility for consolidation of excess uranium at the Portsmouth Site. The UMG performed this work in cooperation with DOE's Offices of Nuclear Energy (NE) and Environmental Management (EM), with NE supplying the building and EM providing the funding for renovation. This 1950s-era, ~100,000 square foot structure was cleaned out and is being renovated and upgraded as needed; currently, the upgrades have cost ~ \$2.3 million. The Safety Analysis Report (SAR) and the Technical Safety Requirements (TSR) for the building were updated prior to receipt of any uranium material.

Of the sites considered as an interim storage location, the DOE Portsmouth site near Piketon, Ohio, was the preferred alternative. This site was the most likely location for a storage facility because a uranium management infrastructure is already in place, including:

- Trained and experienced personnel,
- available buildings with requisite floor space,
- a nuclear criticality safety alarm system, and
- an interim receipt and storage program already initiated.

RETAIN/DISCARD CRITERIA

While usable excess uranium will be retained and stored for future use, excess uranium that cannot be reused will not be considered for inclusion into the UMG and therefore, must be discarded in appropriate and environmentally safe ways. Distinguishing usable uranium from uranium that should be discarded is a significant task in the overall management of excess uranium.

A major achievement of the UMG has been the development of retain/discard criteria for excess LEU, NU, and DU. These criteria can be used by DOE sites to determine if material should be retained or discarded. These screening criteria were developed as part of the Trade Study on Consolidation and Management of LEU/NU/DU, in which the UMG participated.

The criteria for determining whether to retain or discard excess uranium identified different pathways that result in ten distinct alternatives for disposition. These pathway alternatives are:

- Ship to the UMG consolidation site(s) for storage pending known DOE or other government use;
- Ship to an alternative site for storage pending known DOE or other government use;
- Directly dispose of material from the site of origin (onsite processing may be necessary);
- Ship offsite for treatment and disposal;
- Sell to the commercial market directly from the site of origin;
- Continue storage at the site of origin pending use (no action);
- Repackage and consolidate storage pending use;
- Process onsite with continued storage pending use;
- Process onsite with consolidated storage pending use; and
- Ship offsite for processing and interim storage pending use.

In evaluating whether a specific material meets the criteria for either retain or discard, DOE sites and the UMG must consider a number of factors. These factors are:

- Physical condition,
- Form,
- Purity,
- Enrichment,
- Quantity,
- Site,
- Packaging and shipping,
- Availability of disposal options,
- Economics of disposal,
- Availability of storage,
- Economics of storage, and
- Unique applications.

Other factors must be evaluated from a complex-wide view by the UMG and/or DOE program offices. Some of these additional factors are material ownership, market conditions, availability of HEU material for down-blending, and availability of facilities for purification/blending and the economics.

To use these criteria, the UMG has developed logic diagrams to simplify the decision making process. The logical processes have been incorporated into an Excel spreadsheet and are implemented through check boxes, pull-down menus, and information about the physical state of the uranium.

CONSOLIDATING EXCESS URANIUM

To support commitments made to the State of Ohio for the cleanup of the DOE Fernald Site following decommissioning, the Department is moving excess uranium that has been determined to have value from the Fernald site to the UMG interim storage facility at the Portsmouth site. Prior to decommissioning, Fernald prepared an Environmental Assessment (EA) that addressed the packaging of their material. The UMG then conducted an EA for the transportation of the Fernald material to the Portsmouth site and interim storage there. The EA concluded with a finding of no significant impact. Shipments began in June 1999. Through December 2001, UMG has accepted from Fernald ~ 3,400 MT out of a projected 3,800 MTU to be transferred. Completion of this effort is expected in FY 2002.

The UMG has also accepted excess uranium materials from the DOE Hanford Site in support of a DOE agreement and consent order with the State of Washington. Hanford prepared an EA with the assistance of UMG that concluded with a finding of no significant impact. Approximately 900 MT of LEU was subsequently transferred from the Hanford Site.

The transfer and consolidation of excess LEU, NU, and DU from Fernald and Hanford to the Portsmouth site will save the Department a considerable amount of money. Several million dollars were saved at Hanford by avoiding the cost of burying the excess material onsite. Fernald estimates that the UMG alternative saved them ~ \$23 million over the site removal and burial option. Fernald also estimates that if the UMG option had not been available, the costs due to schedule delays may have exceeded \$75 million. The goal of the UMG in the future is that the consolidated surplus uranium from these two sites will be processed and sold to generate revenue, rather than being discarded.

UMG also supports the Department's national security, nonproliferation, safety, and environmental missions by accepting for storage small amounts of excess uranium returned from universities, commercial operations, and foreign countries. Some DOE-owned material has been loaned or leased for research and development programs. In addition, UMG will accept material from DOE sites possessing relatively minor quantities and will assist with packaging and shipping at those sites that lack the necessary expertise.

The uranium materials retrieved from five (5) universities by the Department has been accepted by UMG for interim storage at the Portsmouth site. These universities and related quantities are:

- Seattle University – 2.2 MT of LEU metal
- University of Nebraska – 2.5 MT of NU metal
- Cornell University – 2.0 MT of LEU as UO₂
- University of Florida – 3.0 MT of LEU as UO₂
- California State at Northridge – 2.0 MT of NU metal

UMG has performed scoping visits to four (4) other universities to identify materials for possible future transfer and consolidation: Purdue University, Pennsylvania State University, Massachusetts Institute of Technology, and the University of Idaho.

Through December 2001, the UMG has accepted for interim storage ~ 4,300 MTU of uranium materials. The origin locations for this material are depicted in Figure 1. The assay and form of these materials are depicted in Figure 2.

Before additional uranium materials can be consolidated into the UMG, a Programmatic Environmental Assessment (PEA) must be completed. This action will allow public involvement in its overall planning

process and specifically to examine the alternatives and study the consequences for the consolidation of these types of excess material. Public meetings will be held in proximity to sites being considered for the consolidation locations to solicit oral and written comments. The PEA is scheduled to be completed in CY 2002.

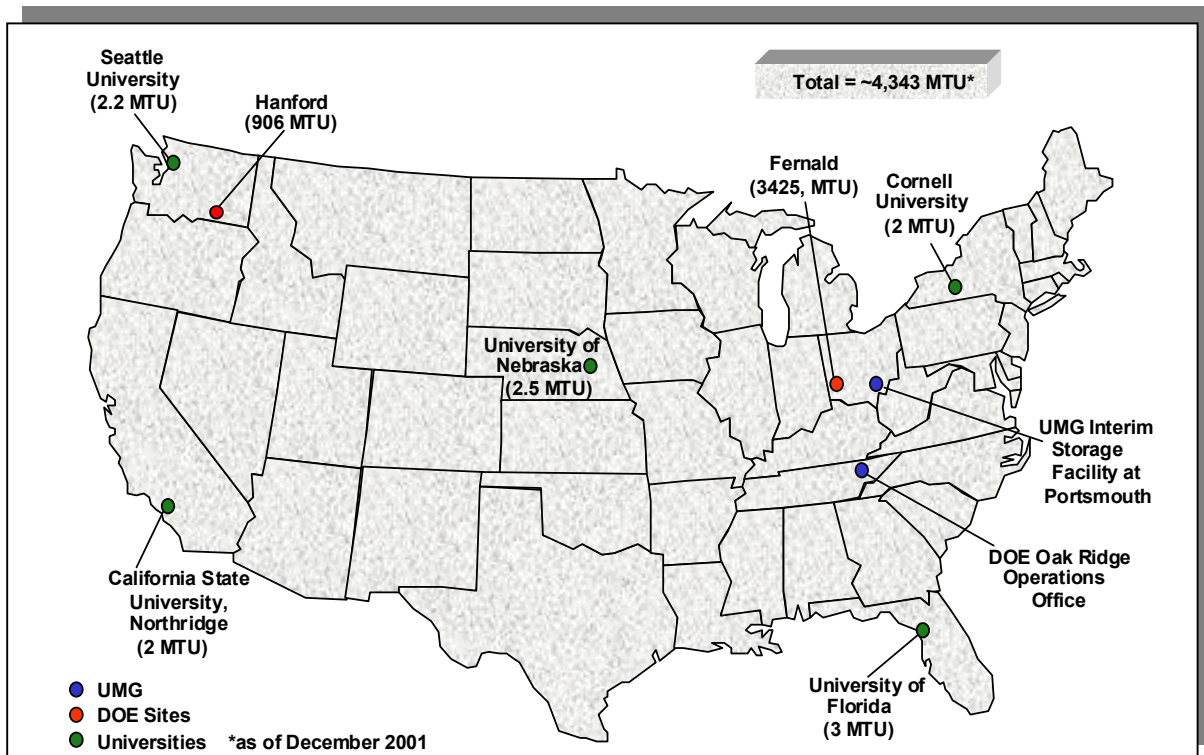


Fig. 1 – DOE and university sites where uranium materials have been retrieved and consolidated at the Portsmouth site.

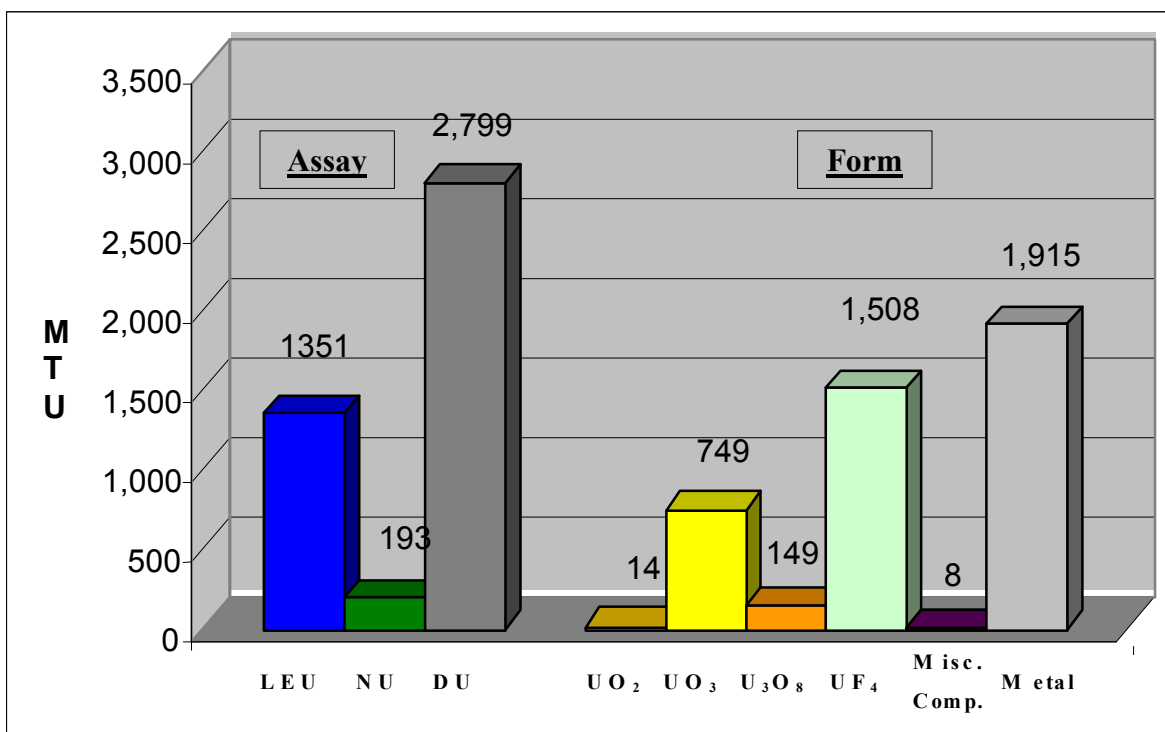


Fig. 2 – Uranium materials consolidated by assay and form.

INVENTORY INFORMATION

As the transfer of excess uranium progresses from facilities being closed to UMG storage site(s), it is important to maintain accurate records to readily identify, characterize, and retrieve this material. Information on the uranium will be essential for analysis and for decisions concerning its packaging, transportation, marketability, processing requirements, and the ultimate reuse or disposal of the material. If material is to be sold, information on a material's characteristics may be essential for meeting criteria specified by the end-user.

To meet this information requirement, UMG is establishing a database as an information management tool to document and track materials accepted by the UMG. This will ensure that DOE has access to all available information on an item-by-item basis, including the number and location of containers, the contents, and the characteristics of the material. The database has been designed to facilitate the use of existing data from sources such as the Nuclear Materials Management and Safeguards System (NMMSS), Nuclear Materials Control and Accountability (NMC&A), the Nuclear Materials Inventory Assessment (NMIA), site-level systems, various analytical laboratory systems, container characterization systems, and hardcopy reports. As specific information is found not to be available from these sources, the site of origin is contacted for the data.

For the database to be effective in assessing disposition alternatives, certain basic material characteristics are required while others are desired. In some cases, actual material analyses may not be available, and so for materials that appear to have the same manufacturing specifications as materials for which analyses

are available, the characteristics may be inferred. All such inferred characteristics will be clearly identified in the database.

Work on the UMG database is progressing in parallel with materials consolidation. Information about a majority of items in inventory has been entered, and input for all inventoried items will soon be completed. Additional information will be added as other excess materials are consolidated by UMG. This database can be accessed electronically to provide data at the item level in a consistent format that is easily stored and retrieved.

SUPPORTING THE NUCLEAR MATERIALS COUNCIL

In FY 2001, the UMG supported the DOE Nuclear Materials Council relative to the Nuclear Materials Stewardship Initiative and the Integrated Nuclear Materials Management Plan (1). As a consequence of UMG's work and in conjunction with it, UMG assisted and continues to assist with several tasks included in the Council's Multi-Year Agenda.

In support of Task 6, to "evaluate the costs and benefits of establishing nuclear material management groups . . .," UMG conducted a cost-benefit analysis of the long-term, low-temperature (LTLT) chemical treatment of gaseous diffusion enrichment cascade equipment at the Portsmouth site to recover commercially viable uranium and to reduce decommissioning and decontamination costs. The LTLT project cost benefit analysis resulted in a higher NPV (\$104 million) than the baseline and, therefore, represents a significant cost savings potential to DOE and the taxpayers.

In support of Task 21, to "complete integrated assessment of uranium missions and facilities . . .," the UMG held a Task 21 kickoff meeting in October 2000 that helped define activities for gathering information and addressing integration opportunities; UMG subsequently developed a template to be used in gathering information from sites and programs for identification of issues and development of integration opportunities. The group compiled a list of suggested integration opportunities that directly apply to Task 21 and an additional list of suggested opportunities that apply to other tasks. One suggestion was an integrated HEU storage facility that was being considered for the Y-12 National Security Complex; a conceptual design report has been completed, and a budget line item is targeted toward beginning construction in FY 2002. Task 21 was subsequently reassigned to the National Nuclear Security Administration (NNSA) at Y-12, with UMG continuing to provide support to the effort.

As part of Task 22, to "complete analysis of non-HEU opportunities and recommend improvements," UMG played a major role in working with EM to complete the Trade Study on Consolidation and Management of LEU/NU/DU. The study concluded that LEU and NU in the form of UF₆ have commercial value through blending with HEU for commercial and research reactor fuel or as feed to enrichment plants, and LEU metal and oxide have value through blending for fuel. The study also concluded that DU, while not appearing to have economic value when directly used for blending to produce commercial fuel, has other potential opportunities for unique uses that should be considered.

REUSING EXCESS URANIUM

An initial objective of UMG is to manage consolidation of excess uranium to expedite DOE facility cleanup and closure while creating significant savings in surveillance, maintenance, and other activities. An equally important, second objective is to maximize the benefit from this national asset to U.S. taxpayers and to DOE programs. To take this second step, the UMG will survey the marketplace for potential opportunities to reuse or sell this valuable national asset.

LEU and NU have value for commercial reactor fuel or as feed to uranium enrichment plants; one method of capturing this value is through blending with HEU. Because LEU is enriched above the level of NU, it has an inherent SWU (separative work unit) value. DU is less suitable for blending or as enrichment feed, but it has potential for other applications, such as in shielding for high-level waste or spent fuel, in penetrators for conventional weapons, for counterweights, in fuel-cycle applications, and as a catalyst for such purposes as fluid cracking and promoting oxidation.

Some quantities of excess uranium will require processing before they can be sold. Processing alternatives include contracting with commercial companies for services or establishing/upgrading processing facilities at one or more DOE sites.

Certain restrictions will affect sales of DOE excess uranium in the commercial marketplace. Under requirements of the United States Enrichment Corporation (USEC) Privatization Act, sales of uranium for commercial power generation would first require a determination by the Secretary of Energy that the transactions would not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industries. The same law also stipulates that DOE cannot make sales at prices lower than fair market value. UMG sales practices will fully comply with all applicable laws, regulations, and DOE policies.

CONCLUSION

The UMG grew out of early activities by DOE-ORO and EM to integrate uranium management across the DOE complex. The EM-chartered UMG has responsibility for managing the nation's excess uranium by proposing and planning management solutions.

In the future, the UMG will complete the PEA and move to consolidate excess LEU, DU, and NU under its management at one or more locations. This material could come from several DOE sites (see Figure 3) and U.S. universities; farther in the future, implementation of the Strategic Arms Reduction Treaties (START II and/or START III) could result in large inventories of excess uranium that would likely be declared surplus and may be consolidated at UMG storage facilities. UMG will continue information management to preserve such data on the consolidated materials as form, level of enrichment, production history, and site of origin. The LTLT cost/benefit study will be completed and, if the process is implemented, will lead to potential recovery of usable material and reduction in decommissioning and decontamination costs.

Using the retain/discard criteria and alternative deposition pathways the UMG has developed, DOE sites and the UMG will proceed with determining whether excess uranium materials should be retained or discarded. Materials to be discarded will be disposed of in an environmentally responsible manner either onsite or at alternative locations. Materials to be retained will either be stored onsite or transferred to the UMG consolidation site(s) pending future DOE or other government use or processed for sale. UMG will continue to look for opportunities to be good stewards, by searching for end uses and responsible methods of material disposition

The future sale of most excess uranium will potentially produce revenues. Furthermore, there are savings inherent in consolidated management. But regardless of the economic benefit, recycling excess uranium is the environmentally responsible option for this material. In this way, excess uranium will be transformed from being a burden at a multitude of locations around the country, where it must be managed, to a consolidated resource that has potential to benefit the nation. Figure 3 shows likely candidate sites where excess uranium could be consolidated in to the UMG.

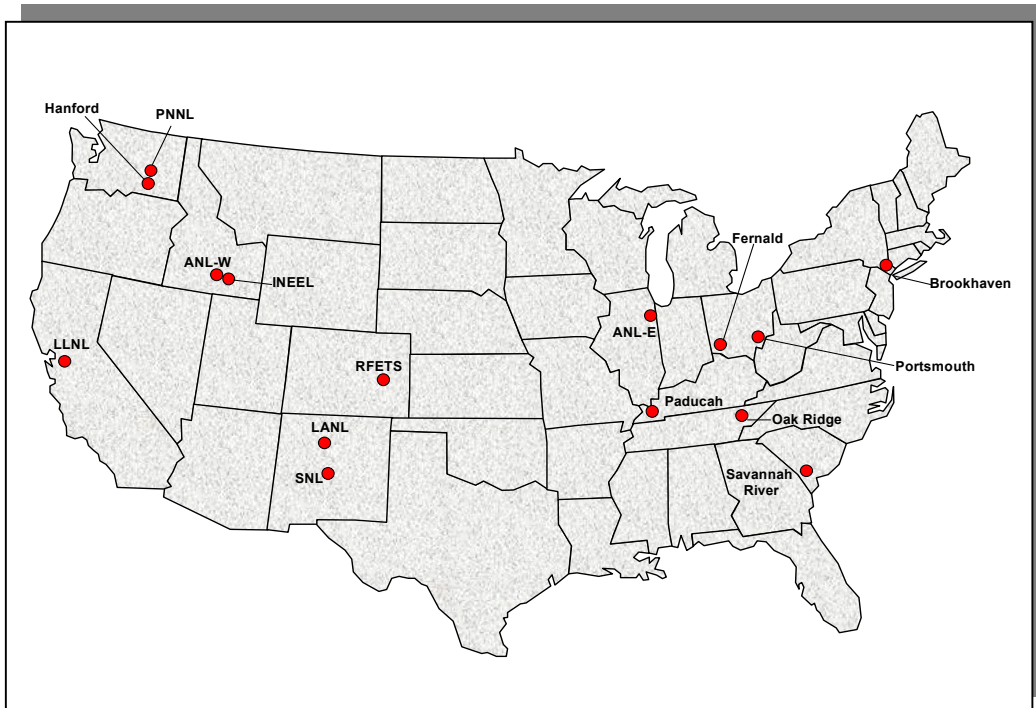


Fig. 3 – DOE sites with excess uranium assets for possible inclusion into the UMG

REFERENCES

- (1) *A Strategic Approach to Integrating the Long-Term Management of Nuclear Materials*, The Department of Energy's Integrated Nuclear Materials Management Plan, A Report to Congress, June 2000