

Programmatic Value Determination Process for Accountable Nuclear Materials

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ABSTRACT

US DOE is responsible for lifecycle management of special and accountable nuclear materials used and held at sites throughout the complex. Disposition of such materials is often complex and must be preceded by a thorough process to identify that final disposition is the best option. The Programmatic Value Determination (PVD) process is a roadmap for disposition of accountable nuclear material as outlined by DOE Order 410.2, *Management of Nuclear Materials* [1], and DOE Order 474.2, *Nuclear Material Control and Accountability* [2]. As described in the Orders, the Nuclear Materials Integration Division (NMID) within the DOE Office of Safety, Infrastructure, and Operations is responsible for nuclear materials management policy, guidance, and integration of special and accountable nuclear material, including consolidation and/or disposition of nuclear materials. NMID works with site-level subject matter experts, such as the Y-12 National Security Complex Central Scrap Management Office (CSMO), to effectively manage US DOE's inventory of nuclear materials. US DOE sites that have identified nuclear material that is not actively being used by a US DOE program and is not being held for future programmatic use (i.e., "No Defined Use") are to evaluate viable disposition pathways and coordinate with their Program Office and NMID as needed. Available disposition pathways for nuclear materials fall into the following broad categories: use at another US DOE site or by a non-US DOE government agency; retention for future use; sale or other authorized transfer; or disposal as waste, perhaps at a different location. NMID coordinates this process via the PVD process. The PVD process allows US DOE to evaluate available materials in light of US DOE mission needs. NMID, Program Offices, and site subject matter experts, such as CSMO, often work together to determine whether the material may be used for other ongoing mission-related activities. The PVD process is designed to formalize coordination between NMID, the US DOE sites, and Program Offices to ensure nuclear materials of value are not prematurely dispositioned permanently as waste, ultimately capitalizing on cost savings and enhanced mission effectiveness for US DOE.

INTRODUCTION

Lifecycle management of nuclear materials involves planning and executing work processes appropriately to preserve the value, maximize the beneficial use, and manage the potential liabilities of nuclear material resources during each lifecycle phase. Secure storage and final disposition of nuclear materials have been leading concerns in the US DOE Enterprise since the end of the cold war. Prompted by the attacks on September 11, 2001, and ongoing security threats around the globe, focused lifecycle management of nuclear material continues to be a primary concern for US DOE. Nuclear materials are critical assets in national defense, energy production, and many other facets of modern life. They are also potential liabilities in the sense that they can be highly attractive theft and sabotage targets with radiological characteristics hazardous to human life and the environment.

For these reasons, nuclear materials must be dispositioned to appropriate locations or facilities in consideration of their current programmatic value.

Nuclear materials no longer needed for their current intended purpose are declared No Defined Use materials. This is initially a site-specific categorization in that the material is no longer needed at its current location. However, the material may be needed at another location, in another program, or it may be rare and valuable enough to warrant retaining as a National Asset. The formalized US DOE Programmatic Value Determination (PVD) process discussed in this paper standardizes and facilitates the process that US DOE officials and their field elements use to determine the optimal use and disposition path for a material and to assist the US DOE sites in moving No Defined Use nuclear materials to the next appropriate lifecycle phase. Broadly, movement into the next appropriate lifecycle phase considers immediate reapplication to other approved programs, retention for future use, and disposal as radioactive waste.

BACKGROUND

When nuclear materials are no longer needed to support their original programmatic purposes, they are often staged onsite while a disposition pathway is determined and/or devised. Ideally, the temporary staged phase will be as short as possible; however, in many cases, complex disposition plans can take years to execute. Over time, this creates a backlog of No Defined Use materials staged and requiring large footprints in facilities that are needed for current mission activities. In addition, the unique characteristics of some nuclear materials bring unique disposition challenges that must be resolved before a disposition plan can be executed. Receiving site acceptance criteria and DOT-compliant packaging are two frequently recurring challenges with long lead-time resolutions. These and many other elements are factored into NNSA Nuclear Materials Integration Division (NMID) decisions on final disposition pathways. Determination of disposition options for more complicated instances results in an exploratory and iterative process.

US DOE/NNSA facilities have been working for years to reduce their inventories of unneeded nuclear materials, often following processes and procedures developed internally as needed to meet the respective sites' needs. While the sites are successfully reducing their holdings, obtaining NMID concurrence prior to 2017 lacked formality and standardization within the US DOE Enterprise. The lack of standardization across all the sites that manage nuclear materials led to process inefficiencies and long lead-times for disposition. NMID is actively implementing a robust program to enable the national laboratories, plants, and other sites to manage their nuclear material inventories in an integrated manner.

DESCRIPTION

The disposition process is initiated when a specific site determines that a nuclear material item or nuclear material group is no longer needed at that site. Examples include completion of a project or phase of a project, completion or termination of a nuclear research program, or reduction of nuclear material items or groups that are in excess of programmatic demand. The objective of the disposition processes is to support US DOE projects with transferring No Defined Use materials from these sites to other locations where the materials can be used productively, protect the material items adequately if they are to be retained for future use, or dispose as waste. The flow diagram in

Figure 1 depicts the chronological steps of the PVD process from its initiation at a US DOE/NNSA site and the following coordination with NMID or other organizations as needed. Responsibilities in Figure 1 are color-coded: US DOE/NNSA site responsibilities are blue, NMID responsibilities are gold, and site or Lead Materials Management Organization subject matter expert responsibilities are green.

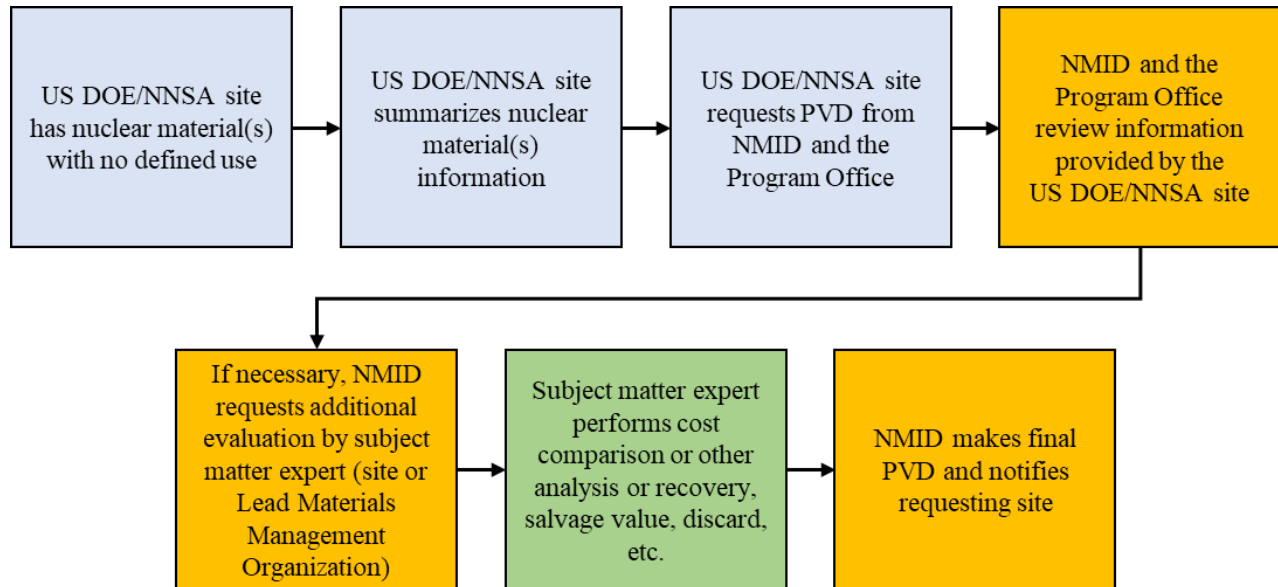


Figure 1. Programmatic Value Determination Process Overview.

The site nuclear material management (NMM) organizations maintain comprehensive knowledge of their material inventories and are therefore relied upon to have knowledge of the available disposition options given the material characteristics. NMM organizations are encouraged to recommend disposition options to NMID based on their knowledge of the material. If NMID and the US DOE Program Office concur, then the PVD process serves as approval to proceed with the recommended disposition path. If the site has no recommendations for disposition, then the PVD process allows NMID to evaluate the material from a broader, US DOE-wide perspective and provide guidance to the site on how to proceed. In the easiest cases, there is a pre-identified need for the material at another site and the two sites and respective Program Offices work together to transfer the material in accordance with Nuclear Material Control and Accountability (MC&A) requirements [2] to ship the materials in compliance with DOT regulations.

If there is no obvious pre-identified need for the No Defined Use material, the holding site notifies the appropriate Program Office and NMID via the PVD request form for assistance in determining the appropriate disposition path. The request form provides a standardized process for all US DOE sites requesting disposition assistance from NMID. The completed PVD request form provides enough basic material characterization information to assist NMID and the Program Office in determining whether the material has a use at another US DOE site; has use outside of the US DOE Enterprise; should be retained as a National Asset due to its rarity, value, and potential future need; or has no programmatic value.

In the event that NMID determines that a material has no programmatic value, then disposing the material via the US DOE radioactive waste management system is the approved disposition pathway. In such instances, the PVD process serves a critical function for the DOE MC&A Termination of Safeguards process (DOE Order 474.2, *Nuclear Material Control and Accountability* [2]). The completed and approved PVD request form is attached to respective requests to terminate safeguards on materials that will be disposed of as waste. The NMID-approved PVD form provides assurance to US DOE MC&A officials that NMID has evaluated the material in question, concurs that it has no programmatic value, and determined that disposal as waste is the appropriate disposition path. Requests for termination of safeguards must be accompanied by the completed PVD form.

US DOE and NNSA also oversee disposition programs for legacy materials that have been removed from certain uses, e.g., weapons-usable fissile materials. The PVD process allows US DOE to evaluate the potential use of the inventory within policy restrictions and ensures that inventories are not permanently degraded before such use has been evaluated.

REQUESTING PROGRAMMATIC VALUE DETERMINATION

Proper material characterization is paramount for selecting the appropriate disposition path. The characterization information is used by NMID to analyze the US DOE need for the material. The site NMM organization should evaluate the material and provide a recommendation, if known, on the PVD request form. The site recommendation provides a beginning point for NMID. The characterization of the material should be detailed enough to convey the following:

- Material form and quantity
- MC&A Category and Attractiveness Level (per DOE Order 474.2 [2])
- Material composition (physical and chemical form, constituents, impurities, and assay)
- Security classification
- Potential programmatic uses
- National Asset candidacy
- Previous decisions, including announcements under National Environmental Policy Act, policy mandates, or legal or international commitments
- Any other information that the site considers relevant to the disposition determination

Additional material characterization may be required to support disposition planning, depending on the requirements of the proposed receiving site. The characterization of the material also provides information needed to ensure compliance with relevant packaging and transportation requirements and to establish handling operations required to prepare the material for shipment (such as radioactivity, fissile content, physical and chemical forms, isotopic constituents and other material associated quantities, and other health, safety and security requirements).

DETERMINING PROGRAMMATIC VALUE

Once NMID has analyzed US DOE needs and advertised the material to other US DOE/NNSA sites, if necessary, NMID will develop a PVD for the material.

The PVD is the process by which NMID determines whether the material has value to US DOE mission needs and activities. The PVD includes determining the appropriate disposition path (e.g., potential use, to be retained as a National Asset, or categorized as waste). All nuclear materials must be determined to have no programmatic value prior to disposal to waste-management systems. Following are factors NMID considers in the process to determine programmatic value and designate disposal paths:

- Market and/or strategic value (replacement)
- Cost to maintain or store the material
- Cost to ship to another facility
- Population (number of items) of current and future inventory
- Cost to recover and process for reuse (e.g., if a capability exists or if new equipment/capability will be required)
- Waste facility availability and WAC
- Cost to dispose
- Environmental, safety, and health concerns
- Benefits of disposal (e.g., eliminations of risks and recapture of storage space)
- MC&A/security requirements
- Other applicable factors

The process of requesting programmatic value determination as it is initiated by the US DOE/NNSA sites through the determination decision made by NMID is depicted in a flow process in Figure 2.

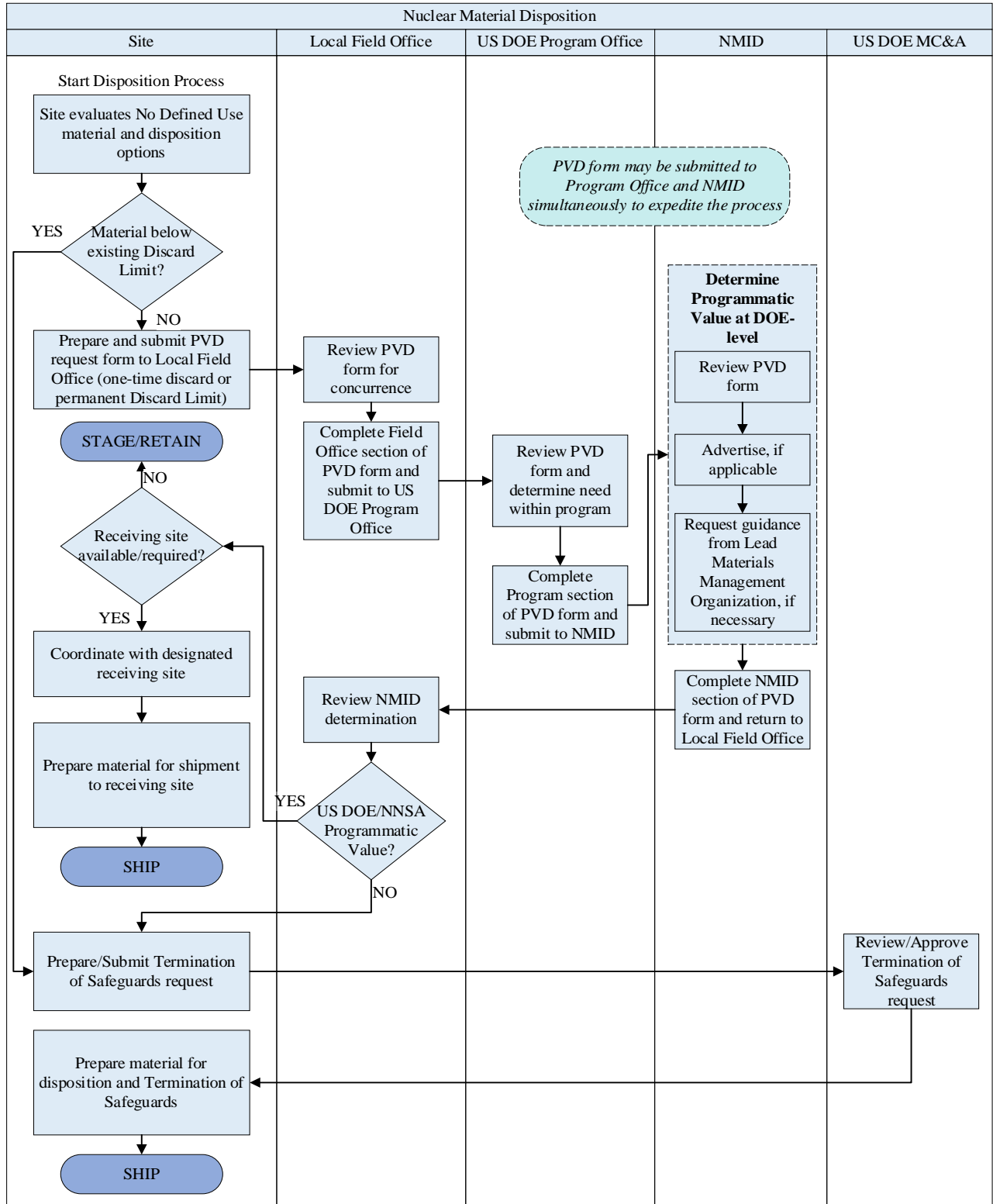


Figure 2. Disposition Process Flow.

The PVD process is a formalized, coordinated effort that takes place between NMID, the US DOE sites, and Program Offices to ensure nuclear materials of value are not prematurely dispositioned permanently as waste. Once the disposition path forward determination is made, US DOE/NNSA sites follow the termination of safeguards process [2] or are shipped to another US DOE/NNSA site for continuing programmatic use.

DISCARD LIMITS

Material Discard Limit is another concept that has been developed to streamline the disposition process at US DOE sites. A Discard Limit is a threshold quantity of nuclear material at or below which the material is pre-approved to be discarded to waste-management systems. A Discard Limit may be established at the site or complex-wide level. When a Discard Limit has been set for a material, it is typically based on the concentration of the isotope or element of interest in the material. While the Discard Limit for a specific nuclear material is often based on a comparison of the cost of storage and recovery to the cost of disposal, it may also be a function of the material quantity, form, concentration, location, and other factors including process capabilities at the site and elsewhere within the US DOE Enterprise. Therefore, despite the cost evaluation, there may be certain nuclear material items or lots of nuclear material items that should be discarded if they are small quantities and there is no justification for running a recovery process. Certain items can be discarded even at higher quantities or at higher safeguards attractiveness levels if there is no practical process available to convert inventories into a usable form. Those considerations should be described in the PVD request form.

Because process waste streams containing nuclear materials are routinely generated from the production and processing of nuclear materials (e.g., receipt, storage, dismantlement, disassembly, chemical recovery, stabilization, and down-blending), Discard Limits enable prompt disposal of those wastes. Discard Limits are also useful during site cleanup to allow disposal of legacy materials with no programmatic value and of materials which are expended in place during tests or experiments. Due to differences in processing capabilities and other site-specific factors, a Discard Limit approved for one site does not necessarily constitute approval of the same Discard Limit at another site.

Once approved, Discard Limits provide a streamlined process for disposing of specific materials as waste without further review and approval from NMID. It must be noted that a Discard Limit does not override DOT, WAC, or Nuclear Criticality Safety requirements related to discard of the material. Discard Limits are currently in place for specific material types and quantities at specific sites. If revised or additional Discard Limits are needed, they can be requested using the PVD request process.

CONCLUSION

The PVD process is a critical element in the US DOE effort to streamline and facilitate effective nuclear materials management at all US DOE sites and facilities. The PVD process provides a standardized methodology for determining appropriate disposition pathways for nuclear materials that are no longer needed for their original programmatic use. The PVD process also enables US

DOE to manage its nuclear materials with a global supply and demand perspective supported by a depth of localized knowledge from the NMM organizations at the individual sites.

REFERENCES

1. [US DOE] US Department of Energy, [NNSA] National Nuclear Security Administration, Office of Nuclear Materials Integration. 10 April 2014. DOE Order 410.2, Admin Change 1, Management of Nuclear Materials. Washington (DC): DOE.
2. US DOE. 13 September 2016. DOE Order 474.2, Change 4, Nuclear Material Control and Accountability. Washington (DC): DOE.