



# **Termination of Safeguards Controls Best Business Practices**

Energy Facility Contractors Group  
Safeguards & Security Working Group  
Material Controls & Accountability  
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# Termination of Safeguards Controls Best Business Practices

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## 1 Introduction/Background

In August 2010, the Material Control and Accountability (MC&A) subgroup of the Energy Facility Contractors Group's (EFCOG) Safeguards & Security Working Group (SSWG) determined the creation of a document on the Termination of Safeguards (ToS) Controls would benefit the MC&A communities within the Department of Energy/National Nuclear Security Administration (DOE/NNSA). A team of DOE/NNSA MC&A representatives was formed to develop this document. Guidance provided herein for terminating safeguards on special nuclear material (SNM) is based on requirements contained in DOE Order 474.2, *Nuclear Material Control and Accountability*.

## 2 Purpose/Scope

Current DOE directives do not dictate methodologies, but provide each site the latitude to determine the best approach for implementing ToS policies at their facility while meeting requirements.

This document provides a practical application of the termination process, including examples. The document is intended to provide guidance to Safeguards/MC&A practitioners on requirements, considerations, and processes in regards to ToS controls. Although this document can be used as a reference, sites should obtain approval from their cognizant security authority before implementing their chosen methodologies.

## 3 Termination of Safeguards Requirements

ToS is the process required for transferring accountable NM to a waste or decontamination and decommissioning (D&D) facility after a no programmatic determination is made by the Office of Nuclear Materials Integrations (ONMI). ONMI will work with the appropriate Program Office DOE Line Management (DP, EM, etc.) when making the no programmatic determination.

Terminating safeguards on nuclear materials meeting the criteria for attractiveness level E is approved by the DOE/NNSA line management (local federal security management), either through inclusion in the MC&A Plan or by letter.

When ToS for attractiveness level D or higher is requested, approval from the departmental element (i.e. Office of Science), with a consultation from the Office of Health, Safety, and Security (HSS) is required for DOE facilities. For NNSA facilities, approval is received from the Associated Administrator for Defense Nuclear Security, with a consultation from HSS.

When requesting ToS, contact the approving office for specific criteria, additional requirements, and formatting they would like to see on the request. Often the following information is contained in a request:

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## Overview

- What is being proposed for the item or campaign
- Information pertaining to 'no programmatic value' determination

## Material Description

- Material composition (chemical and physical form, specification, etc.)
- Category & Attractiveness level (individual items/shipping containers) and totals
- Measured values; how obtained and/or justified

## Material Disposition

- Proposed disposition plan/options including schedule, resources, participants, etc.
- Explanation of how material meets Waste Acceptance Criteria (WAC) for proposed receiving facility
- Detailed information about how material will be handled, processed, stored, packaged and protected until removed from inventory
- Identification of point at which ToS controls will occur; also information about how material will be adequately protected at the disposal facility, if appropriate.

## Security Analysis

- Discussion of radiological sabotage risks and what, if any, mitigating measures are being implemented
- Results of analysis for theft or diversion

The flow chart in Figure 3-2 provides an example of the steps taken in the termination process for waste materials. In the example, waste materials are sent to a holding account (H-RIS) controlled by the Waste Management group prior to being shipped to a final waste disposal site.

## 3.1 Characterization of Material

Proper identification or characterization of materials is imperative when determining whether materials are eligible for ToS. To determine eligibility, material must be measured and properly characterized to determine attractiveness level and category.

### Attractiveness Level

Materials are ranked or assigned attractiveness levels, based on their usefulness in constructing a weapon and/or an improvised nuclear device. In general, the attractiveness level for a particular material form is determined by two attributes; the relative effort required to convert that material into a form that can be used to produce a weapon and/or an improvised nuclear device, and self-protection characteristics, such as radioactivity, that make the material more difficult to

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handle. This attractiveness level ranking ranges from Attractiveness level A materials which are directly usable as a weapon and/or an improvised nuclear device to Attractiveness level E materials which require difficult and complex processing before they can be used to construct a weapon and/or improvised nuclear device.

Special nuclear materials or materials protected as SNM defined in Tables A and B in DOE O 474.2, Attachment 2, include:

- Enriched Uranium
- Uranium-233
- Plutonium-242 (Pu)
- Plutonium-239-241
- Plutonium-238
- Uranium in Cascades
- Separated Americium-241 (Am)
- Separated Americium-243
- Separated Neptunium-237 (Np)

Attractiveness level determination for SNM can be made using the decision tree in Figure 3-1.

Examples of Attractiveness level E materials include:

- Materials that contain less than or equal to 0.1 weight percent SNM
- Highly irradiated SNM. Highly irradiated SNM is material sufficiently radioactive to ensure a high probability of failure of task(s) by an adversary. The determination of high probability of failure of task(s) must be coordinated with the site's risk assessment and/or other assessments performed by the site.
- Solutions containing less than 1 gram SNM per liter of solution.
- Uranium-bearing materials with a uranium enrichment of less than 20 percent U-235 or less than 10 percent U-233.
- Other Accountable Nuclear Material (i.e., non-SNM) defined in DOE O 474.2, Attachment 2, Table B, to include:
  - Depleted Uranium (U)
  - Normal Uranium
  - Berkelium (Bk)
  - Californium-252 (Cf)
  - Curium (Cm)
  - Deuterium (D)
  - Enriched Lithium (Li)
  - Thorium (Th)
  - Tritium (H-3)

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Table 3-1, below from DOE-STD-1194-2011, *Additional Attractiveness level E Criteria for SNM*, contains additional and more descriptive information on lower-grade forms of SNM that may be classified as attractiveness level E for purposes of terminating safeguards.

**Table 3-1. Additional Attractiveness Level E Criteria for SNM**

<i>Description/Form</i>	<i>Maximum SNM concentration* (wt%) for MC&amp;A and physical protection termination</i>	<i>Maximum SNM concentration* (wt%) for only physical protection equivalent to Category IV</i>
<b>SNM solutions and oxides:</b> <i>nitrate, caustic or chloride solutions; contaminated/impure oxides, metal fines and turnings, glove box sweepings</i>	0.1	N/A
<b>SNM amenable to dissolution and subsequent separation:</b> <i>pyro chemical salts; chloride melt; hydroxide cake; floor sweepings; alumina; condensates; reduction residues; sand, slag, and crucible; magnesium oxide crucibles spent fuel and spent fuel residues</i>	0.1	0.2
<b>SNM in organic matrixes or requiring mechanical separation disassembly and subsequent multiple recovery operations:</b> <i>HEPA filters, organic solutions, oils and sludges, graphite or carbon scrap, surface contaminated plastics, metal components, combustible rubber</i>	0.2	1.0
<b>SNM bound in matrix of solid, sintered, or agglomerated refractory materials:</b> <i>SNM embedded in glass or plastic, high-fired incinerator ash, spent resins, salt sludges, raffinates, and sulfides</i>	0.5	2.0
<b>SNM microencapsulated in refractory compounds or in solid-dilution:</b> <i>vitrified, bituminized, cemented, or polymer-encapsulated materials; SNM alloyed with refractory elements (tungsten, platinum, chromium, stainless steel); ceramic/glass salvage</i>	1.0	5.0

\*SNM weight percent is based on element weight for plutonium and isotope weight for U-235 and U-233

The decision tree in Figure 3-1 supports the table above for determining attractiveness levels based on weight percent SNM and assists in identifying termination criteria. Individual sites must make the determination which materials in their inventory correspond to the descriptions of the five groups in the table.

### Category

SNM category (I, II, III, and IV) is a designation of the significance of NM based on the material types, the material forms, and the amount of material.

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### Terminating Safeguards on Attractiveness Level D or higher Materials

There are methods to raise discard limits if site inventory reveals a need. The current inventory quantities should be evaluated to determine if low equity materials are stagnant because of unavailable or inefficient recovery options. A cost benefit analysis will reveal the value of recovering the material, transferring to another facility for recovery, or raising the discard limit to allow ToS. The cost/benefit analysis to raise a discard limit should accompany a ToS request.

The following examples may be considered, but still require DOE/NNSA approval before they may be implemented.

#### **Example 1**

*Materials proposed for ToS could be “conditioned” to be non-recoverable. The intent would be to make it as difficult to recover the SNM from the attractiveness level D and higher material as it is from attractiveness level E materials. This type of conditioning could be based on a physical or chemical change of the material based on an experiment which effectively changes the attractiveness level of the material or immobilizing materials in compounds or encapsulating the materials that reduce the ease of recovery.*

#### **Example 2**

*The following criteria were used for requesting approval for termination of waste materials resulting from repackaging plutonium-bearing residue of attractiveness level D materials in preparation for disposal at the Waste Isolation Pilot Plant (WIPP):*

*Safeguards may be terminated on materials that meet one of the following criteria:*

- *They are packaged in drums with pipe overpack components to a maximum of 200 fissile grams equivalent (FGE) and contain less than 10 weight percent plutonium.*
- *They are packaged in drums without pipe overpack components to a maximum of 200 FGE and contain less than 10 weight percent plutonium.*
- *They are packaged in standard waste boxes to a maximum of 325 FGE and contain less than 10 weight percent plutonium.*
- *They are packaged in another configuration that meets WIPP requirements and do not exceed the FGE and weight percent criteria above.*

#### **Example 3**

*Dilute or mix the material with non-SNM or non-nuclear materials to reduce the assay to less than or equal to 0.1 weight percent. If processing or downblending is approved, the resultant materials would meet the criteria for attractiveness level E.*

#### **Example 4**

*Pu-bearing sources (attractiveness level C) totaling a Category III amount are sent to WIPP. No*

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*processing of the material to a lower attractiveness level is required. Safeguards are terminated upon the shipment leaving the site. Transportation security is consistent with protection requirements for a Category III amount of SNM. The receiving facility protection is appropriate for inclusion of these materials which is documented in a VA or risk assessment.*

### 3.2 Programmatic Value

Programmatic value is determined by the ONMI. Project codes may be used for items to identify materials which are “excess” and materials which still have “programmatic” value. Programmatic codes are assigned to nuclear materials for use in current programmatic activities.

An initial phase document called “Nuclear Material Process Disposition Guidance” was issued by the ONMI September 30, 2013. As required by DOE Order 410,2, Nuclear Materials Management, the guidance was developed and issued by ONMI to assist with this process. Production sites generally have established discard limits for material forms because process waste streams are routinely generated from the production and processing of nuclear materials including (e.g., receipt, storage, dismantlement/disassembly, chemical recovery, stabilization, down-blending etc.) and require prompt disposal. Programmatic reuse and value as compared to disposal options should be considered prior to designating a disposal path. Cost to maintain or store the material, ship to another facility, cost to recover and process for reuse, and environmental, safety and health, and security requirements, are factors considered in determining no programmatic value and designating disposal paths.

### 3.3 Risk Analysis

Based on the category and attractiveness level of the material and a risk assessment, additional security measures may be required to be implemented at the waste facility receiving the material. Risk assessments must clarify any radiological sabotage (RADSAB) threat, identify the security measures required at the waste disposal facility, and identify cost effective countermeasures, if needed, to prevent or minimize the threat. Any additional protection requirements should be included in the termination request.

### 3.4 Waste Management Control

When safeguards termination occurs, terminated material must be transferred to the control of a waste management organization (either off-site or on-site) and must not be co-located with accountable nuclear materials.

If the material is held on site, the waste management area must be physically or geographically separated from accountable materials. The purpose of segregation is to eliminate a diversion path of more attractive materials. Separating materials does not necessarily require expensive or complicated mechanisms. An area cordoned off with ropes may be adequate to prevent mingling



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with accountable materials, while a separate building remotely located from buildings containing accountable materials may be more desirable. When space for storage or holding areas is limited, there may be no choice but to place terminated and accountable materials relatively near each other. However, the facility must demonstrate and document the controls that will prevent collation. These controls must clearly identify locations for terminated materials and the materials must be clearly segregated from accountable nuclear materials to prevent any confusion. A description of the waste management area and controls should be included in the termination request.

The Waste Management organization must be involved in the process to ensure they can accommodate the transfers. Even non-accountable items have to meet retained waste, Resource Conservation and Recovery Act (RCRA), or other environmental laws.

### 3.5 Writing Material off the Books

Materials approved for safeguards termination are removed from MC&A inventory through a transaction reported to the Nuclear Materials Management and Safeguard System (NMMSS) on a DOE/NRC Form 741 *Nuclear Material Transaction Report* and/or the electronic version, DP-740 data set. Transactions reported to NMMSS move the material from the site's reporting identification symbol (RIS), or primary RIS, to either a RIS designated for waste holding (H-RIS), or for final disposal or burial (V-RIS).

If a facility has its own burial site, a transaction may be made directly to the V-RIS. For a facility that does not have a burial site, the transfer may be made to a holding account (H-RIS) until the material is shipped from the site for burial or sent to another waste facility. The location at a site designated for the holding account is typically under the control of the Waste Management organization.

If material is terminated and for some reason must return to accountability utilize the site's accounting process for returning nuclear materials to inventory.

### 3.6 Point of Termination

Once approval is received, the point at which safeguards are actually terminated depends on several factors. For waste materials, the material may be shipped directly to burial (either on-site or off-site) or the material may be held, or stored, pending shipping arrangements. For routine discards, the termination point should be described in the site MC&A Plan. Unusual situations should be documented in the TOS request.

Physical protection based on risk analysis may still be required based on the result of the risk analysis performed early in the process.

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The following examples from various facilities demonstrate when safeguards termination may occur.

### **Example 1:**

Termination occurs when the material is shipped to a burial facility. Termination occurs as the material is physically removed from the facility and the shipment is recorded in the accounting system and reported to NMMSS.

### **Example 2:**

Termination occurs when the nuclear material items are received in waste storage areas managed and controlled by the Waste Management organization. The material may be held in the storage area until shipped to final disposition, but is removed from accountability when it is received by the Waste Management organization.

### **Example 3:**

Based on an approved equivalency/exemption, termination of transuranic (TRU) waste or attractiveness level D materials occurs when materials are loaded and secured into TRUPACT II vessels in preparation for shipment to the Waste Isolation Pilot Plant (WIPP). Once the vessels are locked and secured, materials may be removed from inventory and safeguards may be terminated.

## 3.7 Approvals

Termination methodologies or processes should be thoroughly documented in plans and procedures, including the MC&A Plan, and must receive appropriate approvals from the DOE/NNSA site office or Headquarters.

Each individual occurrence or request for termination may be submitted to DOE/NNSA for review and approval. Alternatively, termination criteria may be predetermined and blanket approval received for specified materials. This is to be documented in the MC&A Plan with approval of the Plan by the DOE/NNSA cognizant security serving as the approval mechanism. Some facilities make an annual request to DOE/NNSA for a specified quantity of material based on projected activities or processing. The approved quantity is tracked throughout the year, and when that amount has been terminated and written off the books, a new request is submitted.

## 4 Directives

Excerpts from directives addressing ToS requirements are included in this section. The full text of these directives is available at [www.directives.doe.gov](http://www.directives.doe.gov) or [www.nsa.energy.gov/aboutus/ouroperations/managementandbudget/policysystem](http://www.nsa.energy.gov/aboutus/ouroperations/managementandbudget/policysystem)

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### 4.1 DOE O 474.2, Nuclear Material Control and Accountability

#### REQUIREMENTS.

*g. Termination of Safeguards.*

*Sites/facilities requests to terminate regulatory control of nuclear materials must be reviewed by their Program Office DOE line management and the Office of Nuclear Materials Integration who will approve or disapprove the request. Safeguards can be terminated on nuclear materials provided the following conditions are met.*

- (1) Determine that the nuclear material is of no programmatic value to DOE.*
- (2) Require that designated facilities and nuclear materials for safeguards termination are assigned the proper categorization and attractiveness levels according to Attachment 2 Table C, Graded Safeguards Table and Attachment 2, page 4, using the Graded Safeguards Table.*
- (3) Meet the criteria for attractiveness level E. When ToS for attractiveness level D or higher SNM is requested, approval is received from the departmental element after consultation with the Office of Health, Safety and Security (HSS). For NNSA facilities, approval is received from the Associate Administrator for Defense Nuclear Security after consultation with HSS.*
- (4) Require that when disposal of a Category II or greater quantity of SNM is being considered, DOE line management for both the shipping and receiving facilities must concur in a security analysis for theft or diversion of the material performed jointly by the shipping and receiving site/facility operators.*
- (5) Ensure that the nuclear material being written off the accounting record system will be written off as a transfer to decontamination and decommissioning (D&D) or a waste management reporting identification symbol (RIS).*
- (6) Ensure that the nuclear material for which safeguards have been terminated is not collocated with other nuclear materials.*
- (7) Ensure the requirements associated with the level of security specified by DOE line management as a condition of ToS are implemented effectively.*
- (8) When the site/facility operator requests ToS for a nuclear material facility, the following must be done:*

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- (a) *DOE line management conducts a termination survey to ensure that no accountable nuclear material remains.*
- (b) *Ensure that the only remaining material is waste or residual holdup that meets the definition of attractiveness level E.*
- (c) *Ensure that nuclear material has been written off the accounting record system as a transfer to a waste management RIS or D&D organization RIS.*

### MATERIAL CONTROL METRICS.

- k. *The mechanism for ToS is documented and implemented.*
- n. *Until the DOE line management has approved ToS for a facility, the MC&A program is maintained at level commensurate with the category and attractiveness of the material deemed to have been present.*

### MATERIAL ACCOUNTING METRICS.

- c. *Each site has established a set of MBAs. All accountable quantities of nuclear material at the site is assigned to an MBA unless safeguards have been terminated in accordance with safeguards termination requirements.*

## 4.2 DOE Standard, Nuclear Materials Control and Accountability, DOE-STD-1194-2011

### 6.2.6 Termination of Safeguards

*ToS exempts nuclear materials from MC&A requirements and thereby removes the safeguards basis for applying physical protection requirements for theft and diversion of nuclear material. Materials for which safeguards are terminated may still need to be protected and controlled pursuant to other DOE security directives or site policy based on the specific details of the material and/or location. ToS implies that a waste management organization will continue to control and account for the material in accordance with waste management regulations.*

#### 6.2.6.1 Safeguards can be terminated on nuclear materials provided the following conditions are met:

- a. *If the material is SNM or protected as SNM, it shall be attractiveness level "E" and have a measured value.*
- b. *The material has been determined by DOE line management to be of no programmatic value to DOE.*

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- c. The radiological sabotage risks associated with the materials have been evaluated and additional measures beyond waste management regulations put in place to ensure that protection requirements, if applicable, will be met after safeguards termination. Only nuclear materials that are of radiological sabotage concern need to be evaluated against this requirement.*
  - d. The material is transferred to the control of a waste management or D&D organization where the material is accounted for and protected in accordance with waste management regulations. The material shall not be collocated with other accountable nuclear materials.*
  - e. When considering safeguards termination of SNM other than attractiveness level "E", the DOE/NNSA Departmental Element shall approve the termination request after consultation with the HSS Office of Security Policy.*
  - f. If SNM Category II or greater is being considered for termination, a security analysis for theft or diversion must be performed, and approval received from the responsible DOE/NNSA Departmental Element.*
- 6.2.6.2** *Terminating safeguards on SNM holdup can occur only after the holdup has been measured and properly credited to the accountability books. Unless demonstrated to be otherwise, the attractiveness level and/or category of SNM in process holdup shall be considered to be the highest attractiveness level and/or category of the total SNM put into the process during its lifetime. Hold up can be designated recoverable or unrecoverable.*
- a. "Recoverable holdup" is the material that can be recovered during D&D operations. This material may have been affixed to system components and materials, but during D&D the material will loosen or become retrievable. Within the accounting system this type of material is also referred to as "process holdup".*
  - b. "Unrecoverable holdup" is material that is inaccessible in the facility even during the D&D process. This material is embedded in and affixed to system components (equipment holdup) and material (glass, plastics, metals, concrete slab, etc.). This holdup is considered beyond economical and technical recovery.*
- 6.2.6.3** *Management of Terminated Materials - The MC&A organization shall coordinate with the Security organization to provide accountability information (Attractiveness and Category) for terminated materials. This includes materials exhumed from waste trenches, removed from inactive facilities, etc. This information will permit the*

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*determination of the proper physical security protection measures as specified in DOE M 470.4-2, Physical Protection.*

### 5 Glossary

#### **ATTRACTIVENESS LEVEL (ATL):**

A grouping of special nuclear material types and compositions that reflects the relative ease of processing and handling required to convert that material to a nuclear explosive device.

(<https://pir.labworks.org/glossary>)

#### **MATERIAL CONTROL AND ACCOUNTABILITY (MC&A):**

The parts of the safeguards program that provide information on, control of, and assurance of the presence of nuclear materials including systems necessary to establish and track nuclear material inventories, control access to and detect loss or diversion of nuclear material, and ensure the integrity of those systems and measures. (Nuclear Material Control & Accountability)

(<https://pir.labworks.org/glossary>)

#### **MEASURED VALUE:**

The result of a measurement and its associated uncertainty. (<https://pir.labworks.org/glossary>)

#### **NUCLEAR MATERIALS (NM):**

All materials so designated by the Secretary of Energy. At present, these materials are depleted uranium, enriched uranium, americium-241, americium-243, curium, berkelium, californium-252, plutonium-238, plutonium-239-241, plutonium-242, lithium-6, uranium-233, normal uranium, neptunium-237, deuterium, tritium, and thorium. (<https://pir.labworks.org/glossary>)

#### **NUCLEAR MATERIALS MANAGEMENT AND SAFEGUARDS SYSTEM (NMMSS):**

The national database and information system for nuclear materials controlled by the government and created to support national safeguards and management objectives in the domestic and foreign use of nuclear resources. (<https://pir.labworks.org/glossary>)

#### **SPECIAL NUCLEAR MATERIAL (SNM):**

Plutonium, uranium-233, uranium enriched in the isotope 235, and any other material that, pursuant to 42 U.S.C. 2071 (Section 51, as amended, of the Atomic Energy Act of 1954), has been determined to be special nuclear material, but does not include source material; it also includes any material artificially enriched by any of the foregoing, not including source material. (DOE O 474.2) (<https://pir.labworks.org/glossary>)

#### **TERMINATION OF SAFEGUARDS:**

Exempts NM from the safeguards basis for applying physical protection requirements for theft and diversion of NM, providing termination requirements are met. After safeguards termination

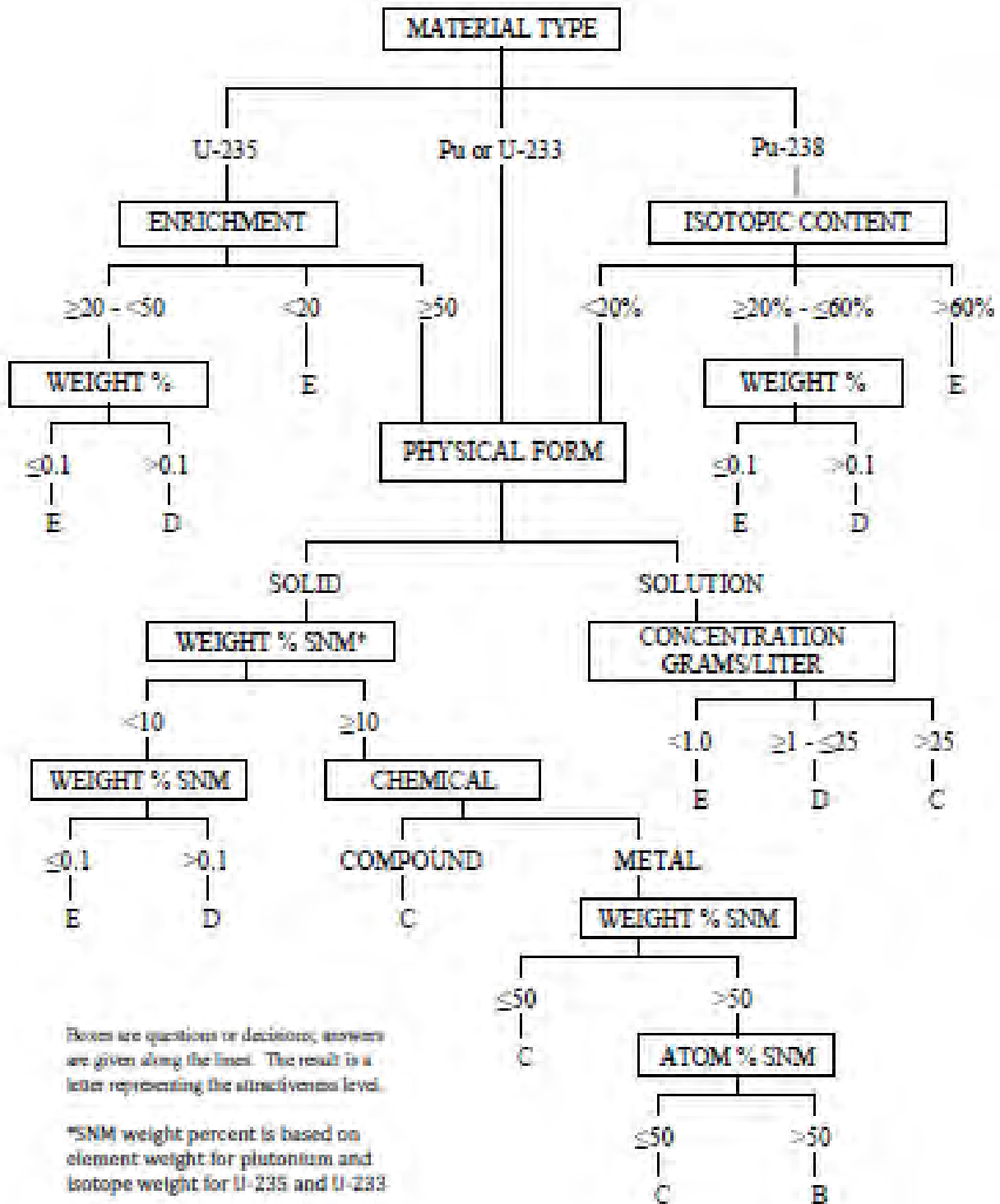
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nuclear materials may still need to be protected and controlled pursuant to termination requirements and other Department of Energy security directives.

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**Figure 3-1.**

DECISION TREE FOR DETERMINATION OF MATERIAL ATTRACTIVENESS LEVEL FOR SNM





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**FIGURE 3-2**

EXAMPLE OF SAFEGUARDS TERMINATION PROCESS

