



Surplus Plutonium Disposition Program

Sachiko McAlhany, Senior Technical Advisor, NA-23

Todd Shrader, Manager, Carlsbad Field Office, DOE-EM

Samuel Callahan, Director, Office of Security, AU-50

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— PERMANENT THREAT REDUCTION —



**MATERIAL MANAGEMENT
AND MINIMIZATION**

CONVERT, REMOVE, DISPOSE

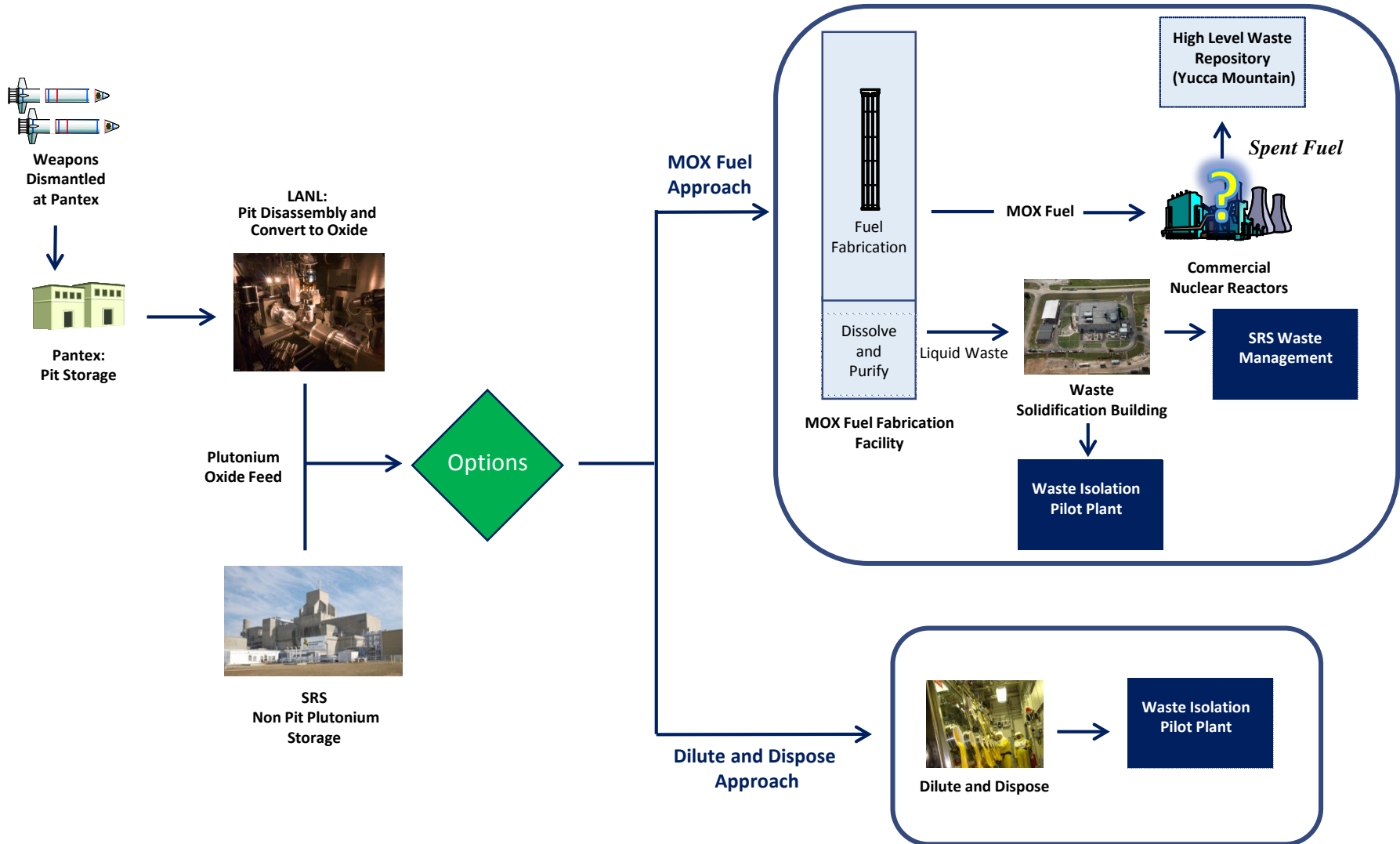
Reviewed and determined to be **UNCLASSIFIED**.

DC/RO: C. R. Dyer, Sr. QA Specialist

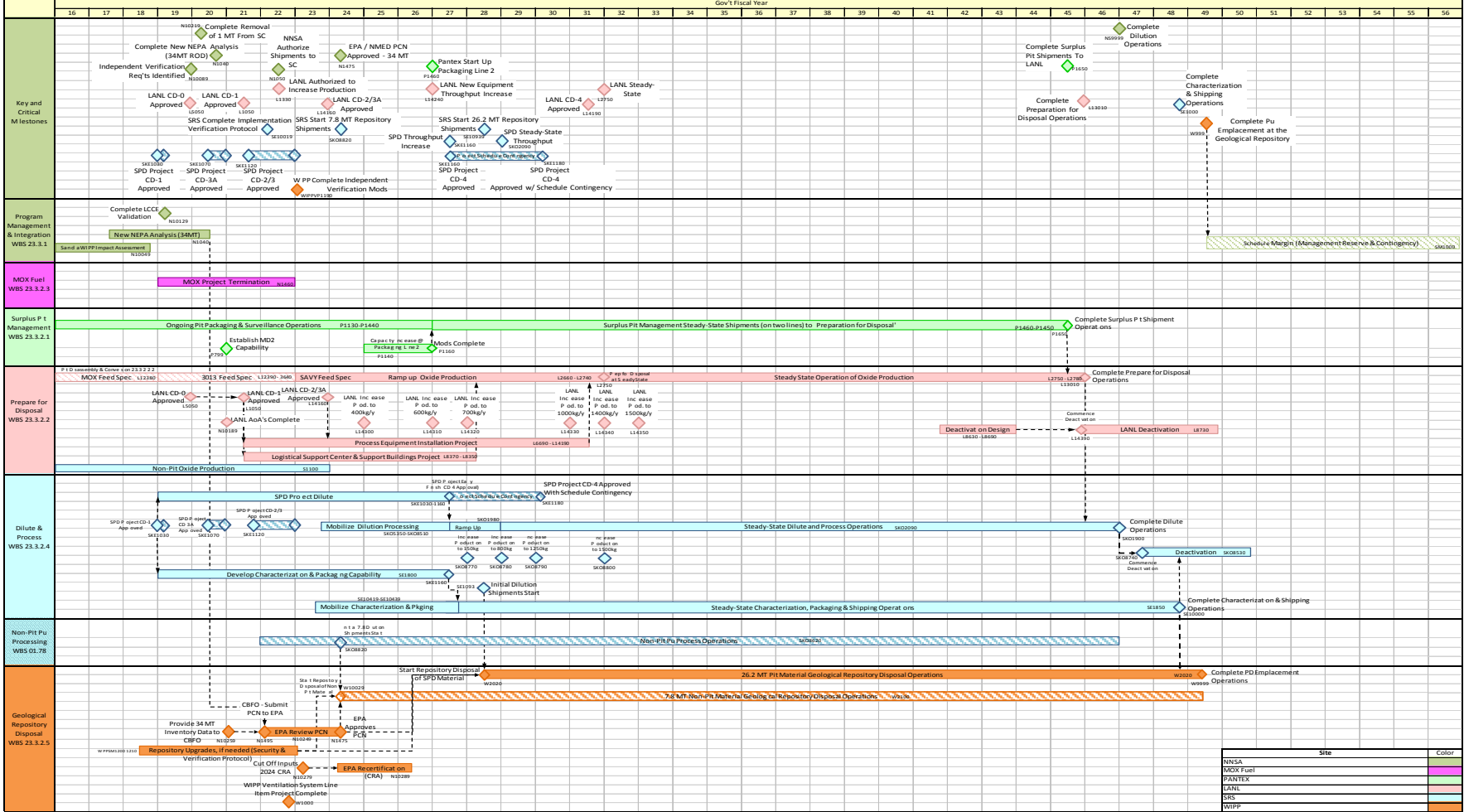
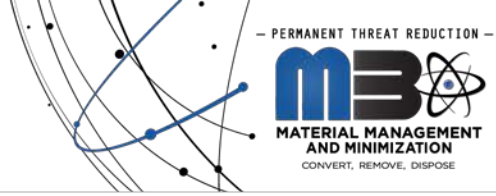
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Surplus Plutonium Disposition Program

MFFF Approach and Dilute and Dispose Approach

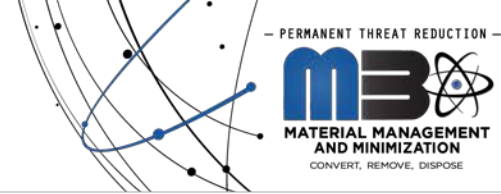


Proposed Surplus Plutonium Disposition Master Summary Schedule



Site	Color
NNSA	Light Green
MOX Fuel	Purple
PANTEX	Light Blue
LANL	Light Orange
SRS	Light Green
WIPP	Light Orange

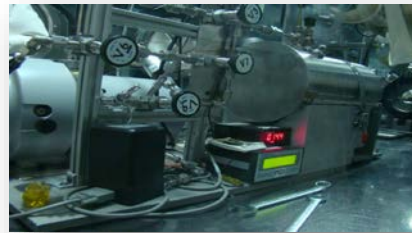
Savannah River Site – Dilute and Dispose Process



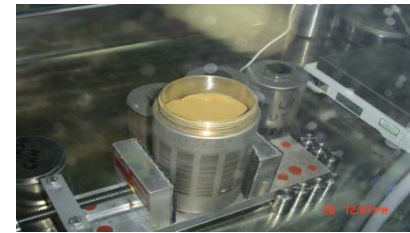
- Dilute and Dispose involves diluting plutonium oxide with inhibitor materials, packaging it into approved containers, and disposing of the diluted plutonium as TRU waste at WIPP for permanent disposal.
- Requires installation of additional equipment to meet higher capacity requirements



Can with Pu oxide is placed in a glovebox



Puncture device vents can prior to opening to relieve any pressure



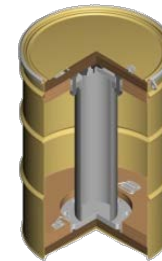
Pipe cutter opens outer and inner can



Pu oxide is placed in new can along with dry inhibitor to dilute Pu to less than 10 weight percent



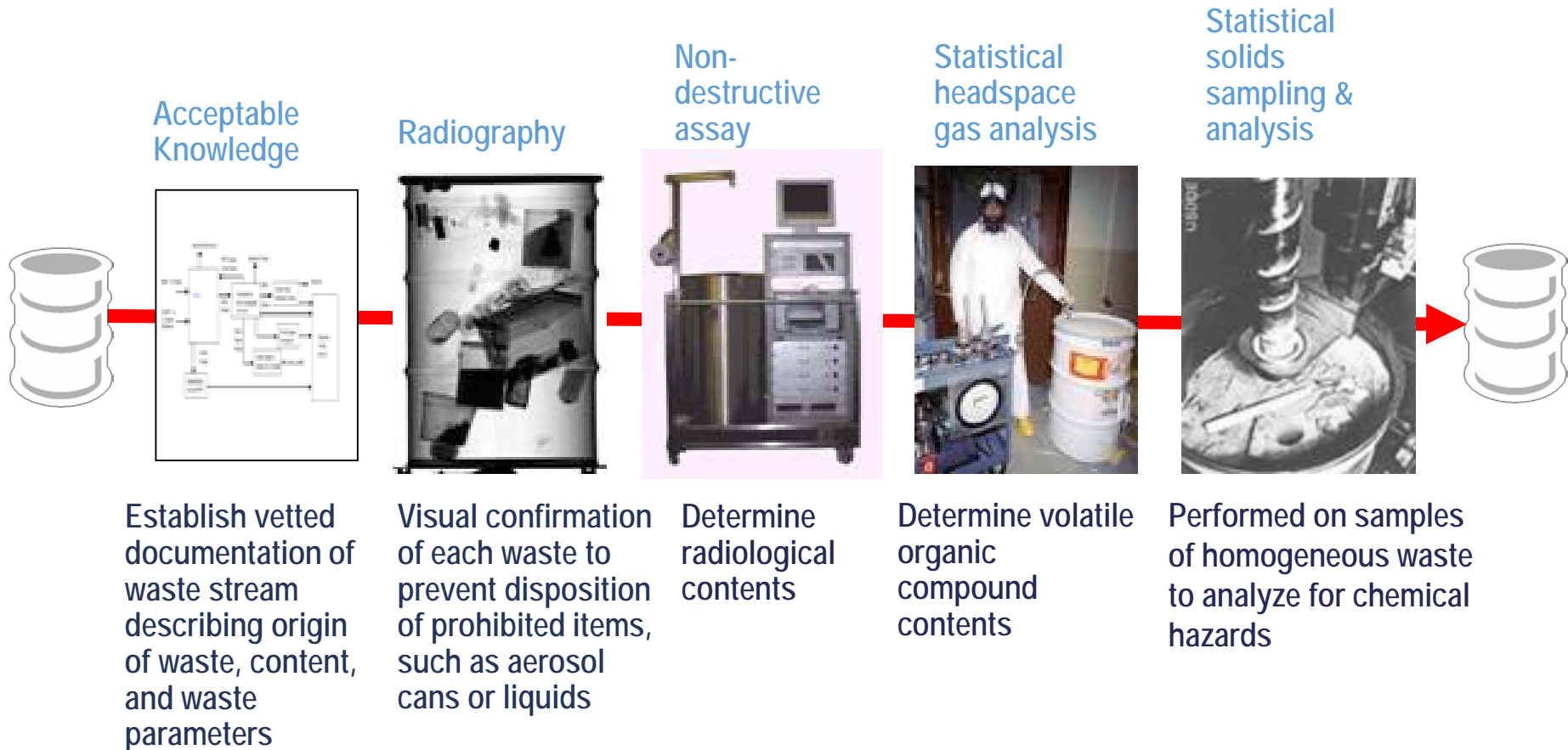
Can is sealed and mechanically manipulated to further homogenize contents



Can is removed from glovebox, assayed, packaged into approved NRC-licensed drum for disposal at WIPP

Characterization

Process to determine the physical, chemical and radiological contents of TRU waste containers to ensure that waste is acceptable for disposal at WIPP



Transportation



Waste containers are loaded into protective shipping containers (such as TRUPACT-II) and shipped via dedicated commercial carrier

Shipping containers are loaded onto specially designed flatbed trailers. State personnel inspect load before departure

Drivers inspect their rigs and load every 3 hours or 150 miles. Some states require additional inspections at their ports of entry

For safety and security reasons, shipments are tracked throughout their journey using a satellite system (TRANSCOM)

WIPP-trained state and local emergency responders (~30,000) along all shipping routes, with frequent exercises

WASTE ISOLATION PILOT PLANT

SERVING OUR NATION FOR FUTURE GENERATIONS. SAFELY DISPOSING THE NATION'S TRANSURANIC WASTE



FILTER BUILDING
FUTURE SITE



Contact Handled Waste Disposal Operations



Each shipment receives security inspection, radiological survey, and documentation review



Shipping containers are unloaded and transferred to the waste handling building thru airlocks



Health physics technicians perform radiological surveys as shipping containers are unloaded



Waste is lifted from shipping containers using overhead cranes

Waste Emplacement

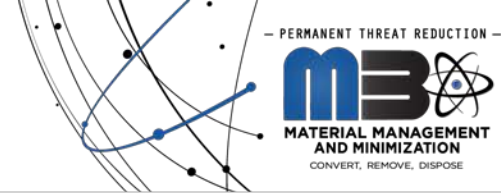


Waste containers are placed on waste hoist for 2155' descent into underground

In underground, waste is removed from the hoist and transported to a disposal room

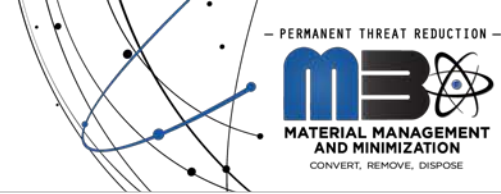
Waste is emplaced in recently mined rooms. Magnesium oxide is placed on waste stack to control solubility of radionuclides in event of hypothetical brine intrusion

Surplus Plutonium Waste Form



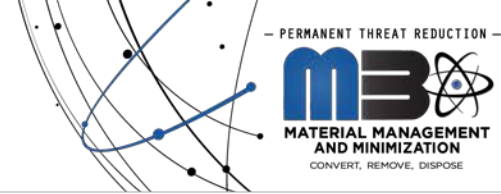
- Composition
 - Ferrous Metals 60 to 85 wt%
 - Inorganic Compounds 10 to 30 wt%
 - Non-Ferrous Metals 5 to 15 wt%
 - Plastic (packaging) 2 to 5 wt%
 - Cementitious Material 0 to 3 wt%
- Blend can and packaging mass for dilute and dispose
 - Shielded Container/Closure ~3,500 g
 - Adulterant ~1,350 g
 - PuO₂ (or other fissile materials) ~170 g (i.e., 150 fissile gram equivalent)
 - Containers and packaging ~250 g
- Meets WIPP Waste Acceptance Criteria
- Sandia prepared report identifying specific adulterant considerations to ensure waste form would not adversely impact WIPP long-term performance

Repository Performance

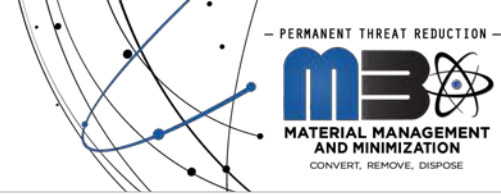


- Sandia also tasked to evaluate the long-term repository performance of emplacing the surplus plutonium at WIPP if added to the waste already emplaced and projected to be emplaced at closure of WIPP
 - Inventory: Generate an inventory report containing the surplus plutonium as input for Performance Assessment calculations (LANL)
 - Criticality: Perform post closure criticality analysis (ORNL)
 - Geo-Mechanics: Simulate the deformation and crushing of CCOs as WIPP creeps closed (SNL)
 - Features, Event, Processes (FEPs): Update FEPs in advance of conducting performance assessment calculation, as needed, considering the possible addition of plutonium to the disposed inventory at closure of WIPP (SNL)
 - Chemistry: Understand the quantity and chemical composition of the diluent material to be used in the Criticality Control Overpack containers (SNL)
 - Performance Assessment: Integrate information listed above into performance assessment calculations to determine whether WIPP would remain compliant with EPA restrictions on cumulative releases over the 10,000-year regulatory period of interest (SNL)
- Schedule: Work suspended: Completion date TBD
- To date, no issues identified

Environmental Regulatory Requirements



- Prepare National Environmental Policy Act (NEPA)
 - NEPA establishes process for decision makers to use in considering potential environmental impacts of major actions
- Utilizes existing technologies within existing operational facilities
 - May require minor, routine permit modifications at the sites for Line Item construction projects during construction
- Have not identified any permit modifications required at WIPP specifically for the proposed 34 MT surplus plutonium mission



- DOE O 474.4 “Safeguards and Security Program” – Defines roles and responsibilities
- DOE O 474.2 “Nuclear Material Control and Accountability” - Establishes requirements for developing, implementing, and maintaining a nuclear material and accountability program
- Termination of Safeguards
 - Must determine that the nuclear material has no programmatic value in consultation with the Program Office and Office of Nuclear Material Integration
 - Must meet criteria for attractiveness level E or if D or higher, approval received from departmental element after consultation with Office of Environment, Health , Safety and Security (AU) and for NNSA facilities, from Associate Administrator for Defense Nuclear Security after consultation with AU
 - For disposal of Category II or greater quantity of Special Nuclear Material, security analysis for theft or diversion of the material performed jointly by shipping and receiving site/facility
 - Ensure that the level of security specified by DOE line management as a condition of termination of safeguards is implemented effectively

Safeguards and Security – Attractiveness Levels

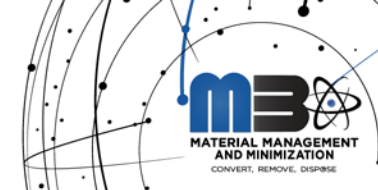


Table C. Graded Safeguards Table

	Attractiveness Level	Pu/U-233 Category (kg)				Contained U-235/Separated Np-237/Separated Am-241 and Am-243 Category (kg)				All E Materials Category IV
		I	II	III	IV ¹	I	II	III	IV ¹	
WEAPONS Assembled weapons and test devices	A	All	N/A	N/A	N/A	All	N/A	N/A	N/A	N/A
PURE PRODUCTS Pits, major components, button ingots, recastable metal, directly convertible materials	B	≥2	≥0.4<2	≥0.2<0.4	<0.2	≥5	≥1<5	≥0.4<1	<0.4	N/A
HIGH-GRADE MATERIALS Carbides, oxides, nitrates, solutions (≥25g/L) etc.; fuel elements and assemblies; alloys and mixtures; UF ₄ or UF ₆ (≥50% enriched)	C	≥6	≥2<6	≥0.4<2	<0.4	≥20	≥6<20	≥2<6	<2	N/A
LOW-GRADE MATERIALS Solutions (1 to 25 g/L), process residues requiring extensive reprocessing; Pu-238 (except waste); UF ₄ or UF ₆ (≥ 20% < 50% enriched)	D	N/A	≥16	≥3<16	<3	N/A	≥50	≥8<50	<8	N/A
ALL OTHER MATERIALS Highly irradiated ³ forms, solutions (<1g/L), compounds; uranium containing <20% U-235 or <10% U-233 ³ (any form, any quantity)	E	N/A	N/A	N/A	Reportable Quantities	N/A	N/A	N/A	Reportable Quantities	Reportable Quantities

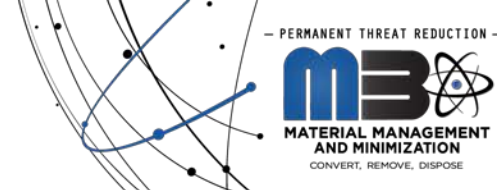
¹The lower limit for Category IV is equal to reportable quantities in this Order.

²The total quantity of U-233 = (Contained U-233 + Contained U-235). The category is determined by using the Pu/U-233 side of this table.

³In this Order "highly irradiated" is defined in Attachment 4(Definitions).

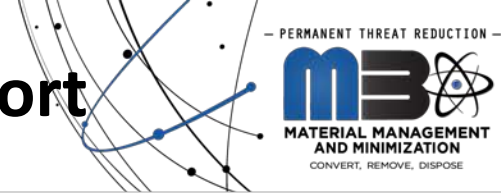
Excerpt from DOE O 474.4

Campaign Plan



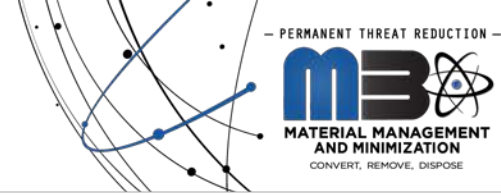
- Documents the security strategies for protection of material, facilities involved, transportation, and equivalencies that may be required throughout the duration of the combined EM and NNSA 40 MT surplus plutonium disposition campaign
 - Describes each facility and the security strategies in place today
 - Identifies roles and responsibilities
 - Aligns and adjusts with installation of new capabilities and increased production
 - Security continues throughout program, including at WIPP, consistent with operations today
 - Evaluates threats periodically throughout the program
 - Identifies processes for contingency planning – incorporates risk mitigation strategies
- Approval by the Deputy Secretary
- Schedule for approval:
 - June 2018 Draft prepared however work suspended
 - Expect approval TBD

LCCE Risks and Opportunities Analysis Report



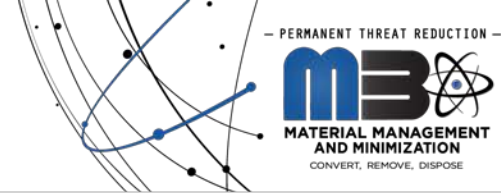
- Documents the results of the Risks and Opportunities Assessment for the dilute and dispose approach
- Identifies risks and opportunities and handling strategies
 - Risks primarily assessed in the following categories: Projects, Operations, Staging, Regulatory, Personnel, Transportation
- Monte Carlo simulation performed on risk impacts to determine Technical and Programmatic Risks Assessment (TPRA) risk and Schedule margin risk at 70% confidence level

LCCE Results and Primary Risks



- 48 active events identified for the dilute and dispose approach (40 risks and 8 opportunities of which 1 risk was avoided)
- Categorized as either Program Risk (16 events) or Execution Risk (29 events)
- Primary Risks:
 - Anomalous Events - Anomalous events occurring at one or more of the sites could interrupt operations, causing an impact to schedule and cost
 - Equipment Failure - higher-than-expected failure rate of infrastructure, processing equipment, or shipping containers could interrupt operations, causing an impact to schedule and cost
 - Impactful Delays: Longer-than-planned durations of activities could extend the schedule and increase cost
 - Examples include: installation of equipment at LANL; execution of the line item project at SRS; ability to hire, qualify, and retain critical staffing; and extended WIPP outages
- Avoided Risk: Insufficient in-line storage at LANL
 - Added sufficient storage safes

LCCE Technology Readiness Assessment and Maturation Plans



- Assesses technologies used in the proposed dilute and dispose approach and identifies activities to further mature technologies if necessary
- Identified 59 technologies required for program implementation
- Identified 5 critical technological elements that are necessary for successful completion of the program including pit cutter, two involving shipping packages, oxidation of Pu/HEU, dilute processing
 - None involve new technologies
 - Limited modifications to existing technologies or expanded demonstration