Department of Energy

Surplus Fissile Materials Control and Disposition

Overview

June 15, 1994

Significant Changes In World Events

Year	Event				
1989	Berlin Wall Falls				
1990	Pu Reactors Shutdown at Hanford & SRS				
1991	Bush Arms Reduction Initiatives	Failed Soviet Coup	Nunn-Lugar Passed		
1992	Production of W 88 Warhead Canceled	Bush / Yeltsin Accord	Nuclear Testing Moratorium Begins	START I Ratified (Followed by START II) (I/93)	Termination of HEU & Pu Production for Weapons
1993	Clinton / Yeltsin Summit	Gore / Chernomyrdin Commission	Clinton Policy on Fissile Materials (Interagency Working Group Tasked)	Constitutional Crisis in Russia	O'Leary Openness Initiative
1994	Clinton / Yeltsin Summit	O'Leary / Mikhailov Agreements			

Presidential Nonproliferation and Export Control Policy Statement

September 27, 1993

- **Framework for U.S. efforts to prevent the proliferation of weapons of mass destruction.**

- **Fissile Materials:**
  - **Comprehensive Approach: Eliminate accumulation of stockpiles of HEU or Pu and ensure highest standards of safety, security, and international accountability.**
  - **Nuclear Weapons Council to identify surplus materials.**
  - **Offering of surplus fissile materials from dismantled weapons for IAEA inspection.**
  - **Tasked Interagency Working Group to initiate comprehensive review of long-term options for Pu disposition, taking into account technical, nonproliferation, environmental, budgetary, and economic considerations. Russia and other nations to be invited to participate in study.**

Excerpts from Joint U.S. Russian Summit Statement

January 14, 1994

- International verifiable ban on production of fissile materials for weapons would be important contribution to nonproliferation.
- Agreed to cooperate with each other and other states to elaborate measures designed to prevent accumulation of excessive stocks of fissile materials and over time, to reduce stocks.
- Agreed to establish joint working group to consider:
  - Including in their voluntary IAEA safeguards offers, all fissionable materials not associated with national security.
  - Steps to ensure transparency and irreversibility of process for reducing nuclear weapons including possibility of putting portion of fissionable material under IAEA safeguards.
- Tasked their experts to study jointly, options for long-term disposition of fissile materials, particularly Pu, taking into account the issues of nonproliferation, environmental protection, Safety, and technical and economic factors.

Recent Studies on Excess Nuclear Materials

(Brief Topical Summaries)

	OTA (9 / 93)	RAND (11 / 93)	NAS (1 / 94)
Declare Inventories	Specify amount of excess material (mutual disclosure)		Declare quantities of all materials, establish measures to confirm
Vulnerability in Existing Storage	Strengthen ES&H management, external oversight		
International Monitoring, MC & A	Reciprocal monitoring arrangements		Reciprocal, secure monitored storage
FSU Material Disposition	Jointly study disposition options	Buy it, or have them burn it, but don't let storage continue	" Clear & Present Danger " U.S. should lead by example
U.S. Material Disposition — Near-term	Storage (new facility) Interagency Task Force: plans & siting	Storage	Storage, with strengthened international controls
Mid to Long-term	Gov't MOX reactor, vitrify, or continue storage (national commission)	LWR reactors, vitrify, or continued storage	Introduce radioactive barriers (existing reactors or vitrify)
Ultimate	Advanced reactor / converter, or disposal	Disposal	Elimination options (advanced reactors, accelerators), disposal

Recent Studies on Excess Nuclear Materials

(continued)

	OTA	RAND	NAS
Concern for Broader Context	US, FSU dismantlement efforts, use linkage with other needs.	Commercial separated plutonium inventory world wide & discourage fuel reprocessing.	Improve safeguards: all materials, beyond the spent fuel standard.
Public Involvement, Openness	Review legal basis for classification. Lack of communication has led to low credibility, now impeding effort.		Need to muster sustainable consensus, allow adequate participation by affected parties.
Organization	Need new organization to manage surplus material.		Strengthen IAEA, improve interagency coordination.
Economics		Pu - no value	Pu - negative economic value

Initiative for Control & Disposition of Surplus Nuclear Materials

Secretary's Charge:

- Provide safe, secure, and environmentally sound control, storage and ultimate disposition of surplus fissile materials.
- Promote effective nonproliferation policies and set an example for other nations to follow.
- Operate in an open and transparent manner and ensure stakeholder participation in the decisionmaking process.
- Develop consensus and effectively integrate surplus nuclear materials control and disposition efforts across DOE.
- Project reports to the Under Secretary.

Identifying Excess Fissile Materials

- Confirm inventory baseline.
- Working with programs to define National Security needs:
  - Nuclear Weapons Council
  - Naval Reactors
  - Other Programs
- Everything else is excess.
- Some excess may still be classified and thus not immediately available for international inspection.
- Some material to be held for future program use could be available for international inspection.

Transparency

Goal:

- Reduce the nuclear danger by demonstrating U.S. commitment to international control of fissile materials.

Presidential Guidance:

- Unilaterally make available for International Atomic Energy Agency inspection some fissile materials no longer needed for deterrent .

Deliverable:

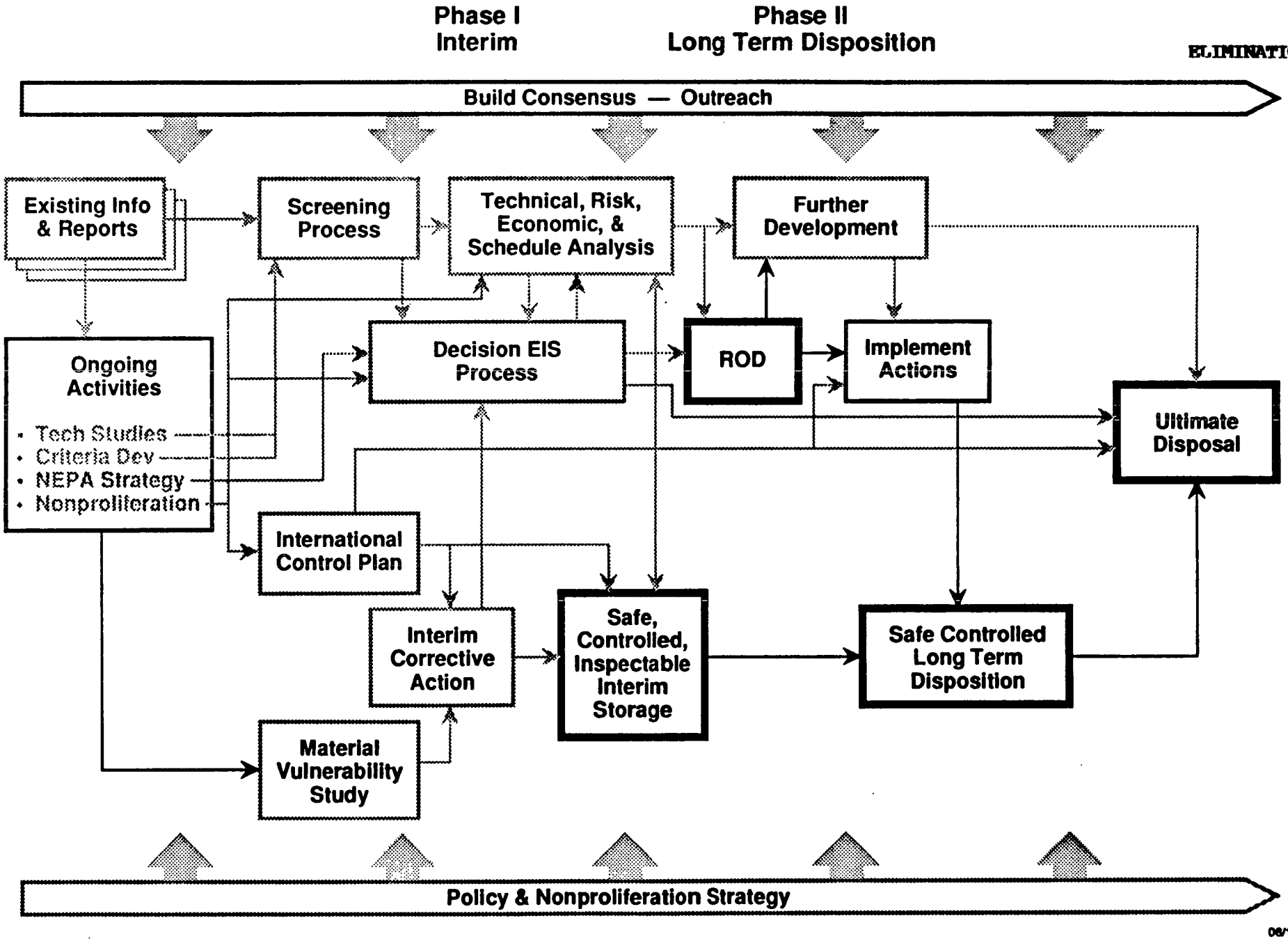
- Begin International Atomic Energy Agency inspection of some amount of highly enriched uranium in vault 16 at the Y-12 plant by September 1994.
- Other sites and materials to follow.

Actions Thus Far:

- International Atomic Energy Agency visited vault in November 1993.
- Implementation Plan developed.

Nuclear Mat[illegible]s Disposition

Program Logic



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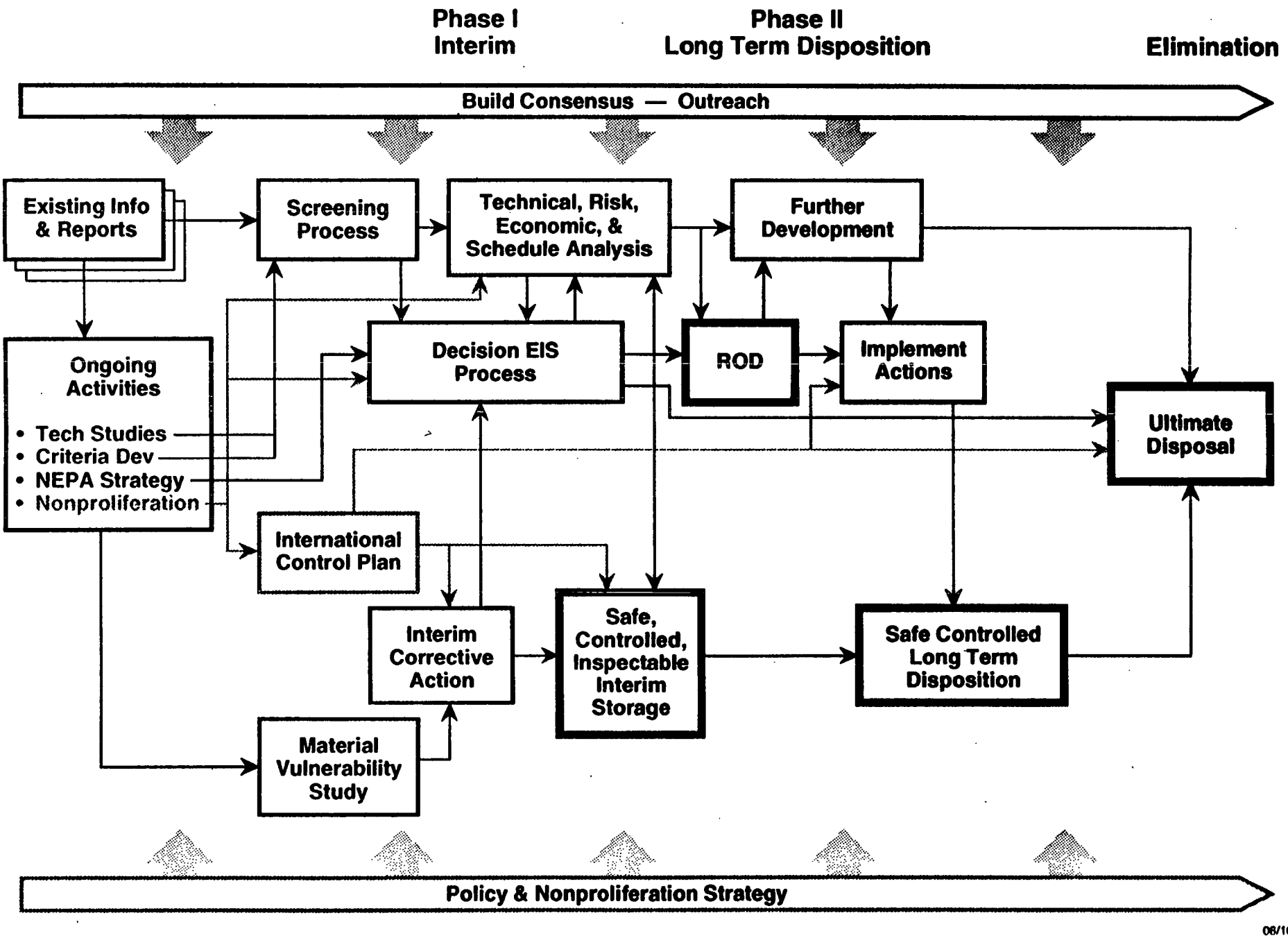
Nuclear Materials Disposition

Program Logic



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Scope of Work

Plutonium Long - Term Storage and Disposition

- Storage:
  - No action
  - Upgrade - in - Place
  - New consolidated storage
- Meeting the Spent Fuel Standard:
  - Reactors
  - Immobilization
  - Deep geologic disposal
- Beyond the Spent Fuel Standard:
  - Accelerator
  - Deep burn reactors

Storage

- Consider storage of all weapons - usable fissile material.
- Evaluate consequences of no action alternative.
- Prepare preconceptual design, cost estimates and schedules for:
  - Upgrade - in - place facilities
  - Consolidated facility (Plutonium and Uranium)

Spent Fuel Standard

- A level of inaccessibility for plutonium equivalent to that of the plutonium in civilian spent reactor fuel.

- Considers inherent radiation barrier that precludes handling materials except remotely and in heavily shielded facilities.

- Equivalency without radiation barrier (e.g. deep borehole), needs to consider efforts, costs, and time to make plutonium accessible.

Reactor - Based Technology

- Prepare technical and economic evaluations of current and advanced reactor - based options for disposition of surplus plutonium.
- Define and develop process to convert plutonium metal to reactor grade plutonium oxide feed.
- Define fuel fabrication process for MOX fuel and if required develop and demonstrate fuel fabrication process.
- Repository Impacts.

Immobilization

- Assess and select technologies to transform surplus SNM from its initial forms into final acceptable immobilized forms for long - term geologic storage.

- Perform or assess research & development in immobilization projects and determine infrastructure required for specific processes.

- Repository Impacts.

Deep Geologic Disposal

- Examine feasibility of deep borehole disposal and other geologic disposal options.

Accelerator - Based Conversion

- Define preconceptual design data.
- Develop long - term program to resolve key basic science, engineering, and design issues and prioritize program activities.
- Perform small - scale experiments.

Deep Burn Reactors

- HTGR
- Molten Salt Reactor
- Pebble Bed Reactor

Plutonium Disposition - Geologic Repository Impacts Study

- Purpose:
  - Evaluate the impacts of the disposition of excess weapons - grade Plutonium on the current geologic repository program for spent nuclear fuel and high - level radioactive waste.

- Scope:
  - Study will concentrate on FY1994 activities and will deal primarily with the impacts from advanced reactor fuel cycles. This is intended to envelope conventional LWR impacts. The focus in FY1995 will be on vitrification.

Plutonium Disposition - Geologic Repository Impacts Study (continued)

- Approach and Activities:
  - Study will examine technical, institutional and system issues, such as analyses of criticality, thermal loading and long - term radionuclide release on repository performance, analyses of regulations and statutes on repository licensing, and analyses of waste management systems relating to performance.

Plutonium Disposition - Geologic Repository Impacts Study (continued)

- Activities Include:
  - Description of issues, regulatory review, analysis of fuel characteristics, repository design and operational impacts, fuel performance assessment, overall repository performance, analysis of systems impacts, and a final assessment.

- Technology Risk Areas:
  - Study will examine advanced reactors and vitrification technologies. There are uncertainties with these approaches.