Proposed Consolidation of Nuclear Operations Related to the Production of Radioisotope Power Systems

Timothy A. Frazier
Office of Nuclear Energy, Science and Technology
U.S. Department of Energy
Washington, D.C.
December 2004
Consolidate the nuclear activities related to the production of radioisotope power systems (RPSs) required for U.S. Government national security and space exploration missions at a single, highly secure Department of Energy site
DOE’s Ongoing RPSs Production Nuclear Operations

- Located at DOE sites:
  - Idaho National Laboratory (INL) in Idaho
  - Los Alamos National Laboratory (LANL) in New Mexico
  - Savannah River Site (SRS) in South Carolina

- Previously decided and planned to locate additional nuclear operations at the Oak Ridge National Laboratory (ORNL) in Tennessee
  - No action has been taken to do so

- Requires nuclear material to be transported between the states

- Requires separate highly secure sites
Proposed Consolidation

- **Consolidated operations would include:**
  - Storage of neptunium-237 (Np-237) used in the production of Pu-238
  - Production of Pu-238 used for the RPSs
  - Purification and encapsulation of Pu-238
  - Assembly and testing of RPSs
Key Drivers for the Consolidation of Nuclear Operations

- Ensuring a continuing supply of Pu-238 for national security mission requirements will be available after the end of this decade
- Decreasing reliance on Russian Pu-238 for space missions
- Reducing costs associated with RPS production
- Consolidating nuclear materials related to RPS production
## Key Drivers for Consolidation of Nuclear Operations

- Increasing the security of nuclear material in the post 9/11 environment
- Reducing risks associated with transporting nuclear materials
- Continuing to enhance the protection of the public and environment
Public Scoping Meetings

- Engage the public, Tribes, Federal, States, and local agencies early in the process
- Provide a forum for DOE to communicate information about the proposed action
- Solicit comments regarding the scope of the EIS
  - Alternatives to be considered
  - Identify issues that should be addressed in the EIS
- Accept written or oral comments regarding the scope of the EIS
  - Additional information is contained in the provided packets
- Address relevant comments in the EIS
Radioisotope Power Systems (RPSs)

- Pu-238 is the radioisotope used in the RPSs
- The only proven and available technology for national security and space missions
  - Provides source of electrical power or heat for long periods of time without maintenance
  - Operates in harsh and remote environments
- RPSs have been used for U.S. national security and space exploration for decades
- Proven record of safety and performance
RPS

- Radioisotope Thermoelectric Generator (RTG)
- Multi-mission RTG
- Stirling Radioisotope Generator (SRG)
Examples of space missions that have used RPSs:

- Apollo
- Voyager
- Galileo
- Ulysses
- Cassini
New Horizons Mission to Pluto

Launch: January 2006

Arrival: July 2015
Nuclear Infrastructure Required for RPS Production

- Domestic production of Pu-238
- Purification and encapsulation of Pu-238
- Assembly and testing
Domestic Production of Pu-238

- No current domestic capability to produce Pu-238 exists
- Was produced at Savannah River Site
- National security requirements for Pu-238 being met from existing domestic inventory
- Domestic inventory being augmented by purchases from Russia for space missions
Domestic Production of Pu-238 – Current Status

- Nuclear Infrastructure Programmatic EIS Record of Decision (January 2001) decided and planned to establish production at the Oak Ridge National Laboratory (ORNL)
  - Not yet established
  - Still viable under No Action Alternative

- Would involve the:
  - Fabrication of Np-237 targets at ORNL
  - Irradiation of targets at Idaho National Laboratory
  - Extraction of Pu-238 from the targets at ORNL

- Np-237 stored at Idaho National Laboratory until needed for production of Pu-238
Purification and Encapsulation of Pu-238

- Previously conducted at various DOE sites
  - Mound Site in Miamisburg, Ohio
  - Savannah River Site
- Current Status
  - Ongoing at Los Alamos National Laboratory
  - Involves the:
    - Purification of Pu-238
    - Pelletization of purified Pu-238
    - Encapsulation of Pu-238 pellet
Assembly and Testing of RPS

- Previously located at the Mound Site
- Nuclear operations at the Mound Site evaluated post 9/11
- Implementation of the increased security requirements at the Mound Site were cost prohibitive
- Transferred to Idaho National Laboratory into an existing highly secure area
Assembly and Testing of RPS – Current Status

- Ongoing at the Idaho National Laboratory in the recently commissioned Space and Security Power Systems Facility
- Preparations continue for the assembly and test of a RPS for the New Horizons mission to Pluto
- Involves the:
  - Assembly of the heat sources
  - Assembly of RPSs
  - Testing of the RPSs
Alternatives Identified

- No Action
- Consolidation at Idaho National Laboratory
- Other reasonable alternatives identified through scoping
Current Operations

- Idaho National Lab
- Los Alamos National Lab
- Savannah River Site

Pu-238 = Plutonium-238
Np-237 = Neptunium-237
Inter-site Transportation Route
Current Operations

• SRS converting Np-237 solution to Np-237 oxide
• SRS ships Np-237 oxide to INL for storage
• LANL purifying existing stockpile of Pu-238
• LANL produces Pu-238 oxide pellets
• LANL encapsulates Pu-238 pellets
• LANL ships encapsulated Pu-238 to INL
• INL assembles and tests Radioisotope Power Systems (RPS) at the Space and Security Power Systems Facility
No Action Alternative

Pu-238 = Plutonium-238
Np-237 = Neptunium-237
Inter-site Transportation Route

Total shipping distance is more than 8,000 miles.
No Action Alternative

- INL stores and ships Np-237 oxide to ORNL
- ORNL purifies Np-237 oxide
- ORNL fabricates Np-237 targets and ships targets back to INL
- INL irradiates Np-237 targets and ships targets back to ORNL
- ORNL extracts the Pu-238 from the targets
- ORNL ships Pu-238 oxide to LANL
- LANL purifies, produces, and encapsulates Pu-238 oxide pellets
- LANL ships encapsulated Pu-238 to INL
- INL assembles and tests RPS at the Space and Security Power Systems Facility
Proposed Consolidation Alternative

Pu-238 = Plutonium-238
Np-237 = Neptunium-237
Inter-site Transportation Route
Proposed Consolidation Alternative

- INL stores the Np-237 oxide
- INL purifies the Np-237 oxide
- INL fabricates Np-237 targets
- INL irradiates Np-237 targets
- INL extracts the Pu-238 from the NP-237 targets
- INL purifies and encapsulates Pu-238 oxide pellets
- INL assembles and tests RPS at the Space and Security Power Systems Facility
Alternatives Considered but Dismissed

- **Consolidation at LANL**
  - No operating reactor at the site
  - Shipment of targets to INL for irradiation still required
  - DOE’s goal of consolidation not met

- **Consolidation at ORNL**
  - Operating reactor on site, but not capable of meeting programmatic production requirements
  - Shipment of targets to INL for irradiation still required
  - DOE’s goal of consolidation not met
Public Comments Received to Date

- Address waste generation, minimization, and disposal
- Address the transportation of nuclear materials
- Does the proposed action include reprocessing (proliferation and high level waste)?
- Is calcination equivalent to incineration?
- Does the proposed action support nuclear weapons?
- Adequacy of the High Efficiency Particulate Air (HEPA) filters