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

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The Department of Energy Proposes to:

- **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

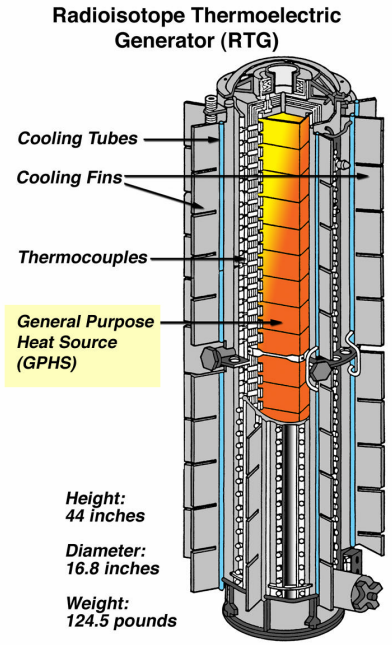
- **Engage the public, Tribes, Federal, States, and local agencies early in the process**
- **Provide a forum for DOE to communicate information about the proposed action**
- **Solicit comments regarding the scope of the EIS**
  - Alternatives to be considered
  - Identify issues that should be addressed 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)

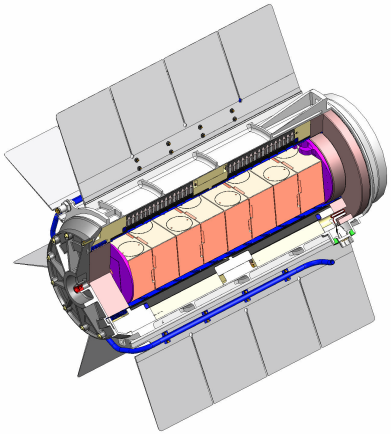
- **Pu-238 is the radioisotope used in the RPSs**
- **The only proven and available technology for national security and space missions**
  - Provides source of electrical power or heat for long periods of time without maintenance
  - Operates in harsh and remote environments
- **RPSs have been used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

RPS

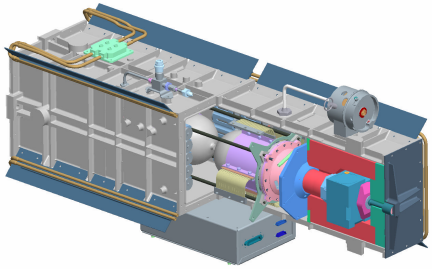
- Radioisotope Thermoelectric Generator (RTG)



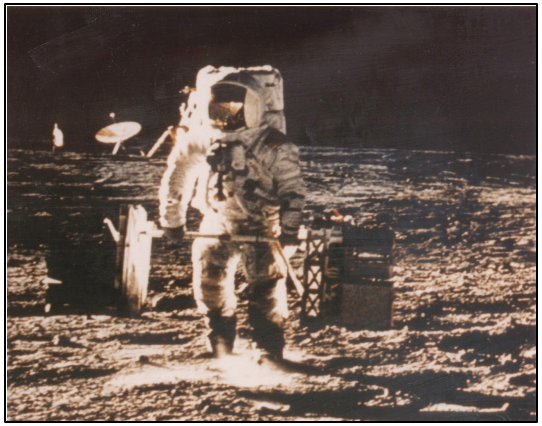
- Multi-mission RTG



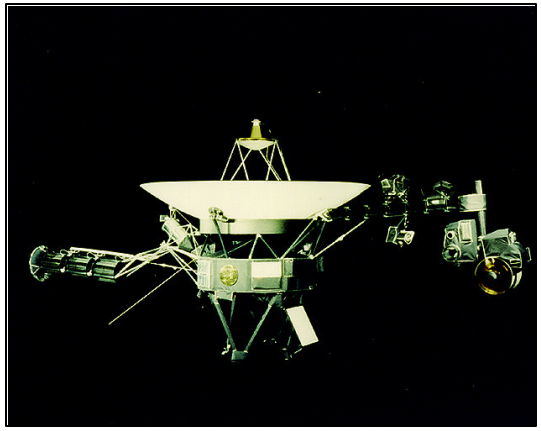
- Stirling Radioisotope Generator (SRG)



Missions

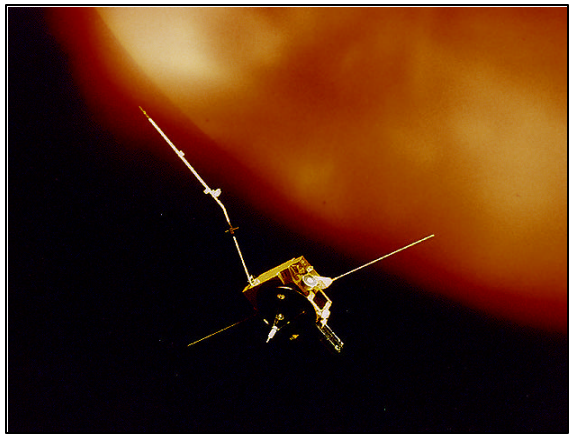


Apollo

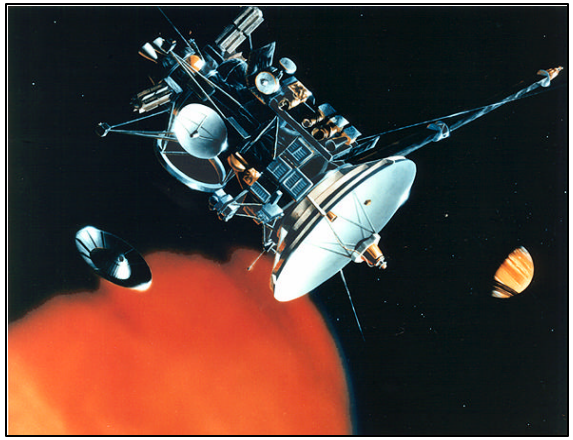


Voyager

Galileo



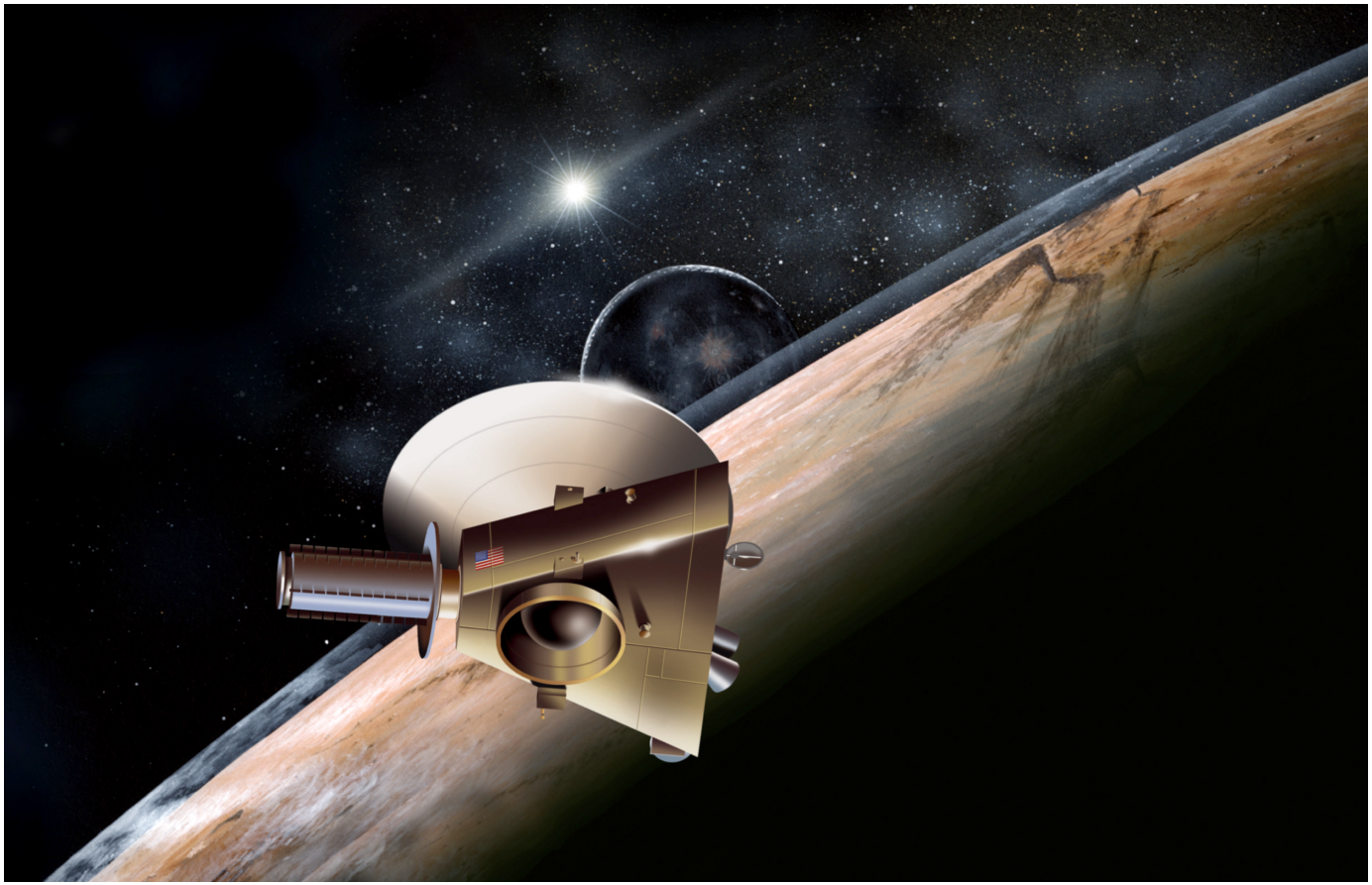
Ulysses



Cassini

Examples of space missions that have used RPSs

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**

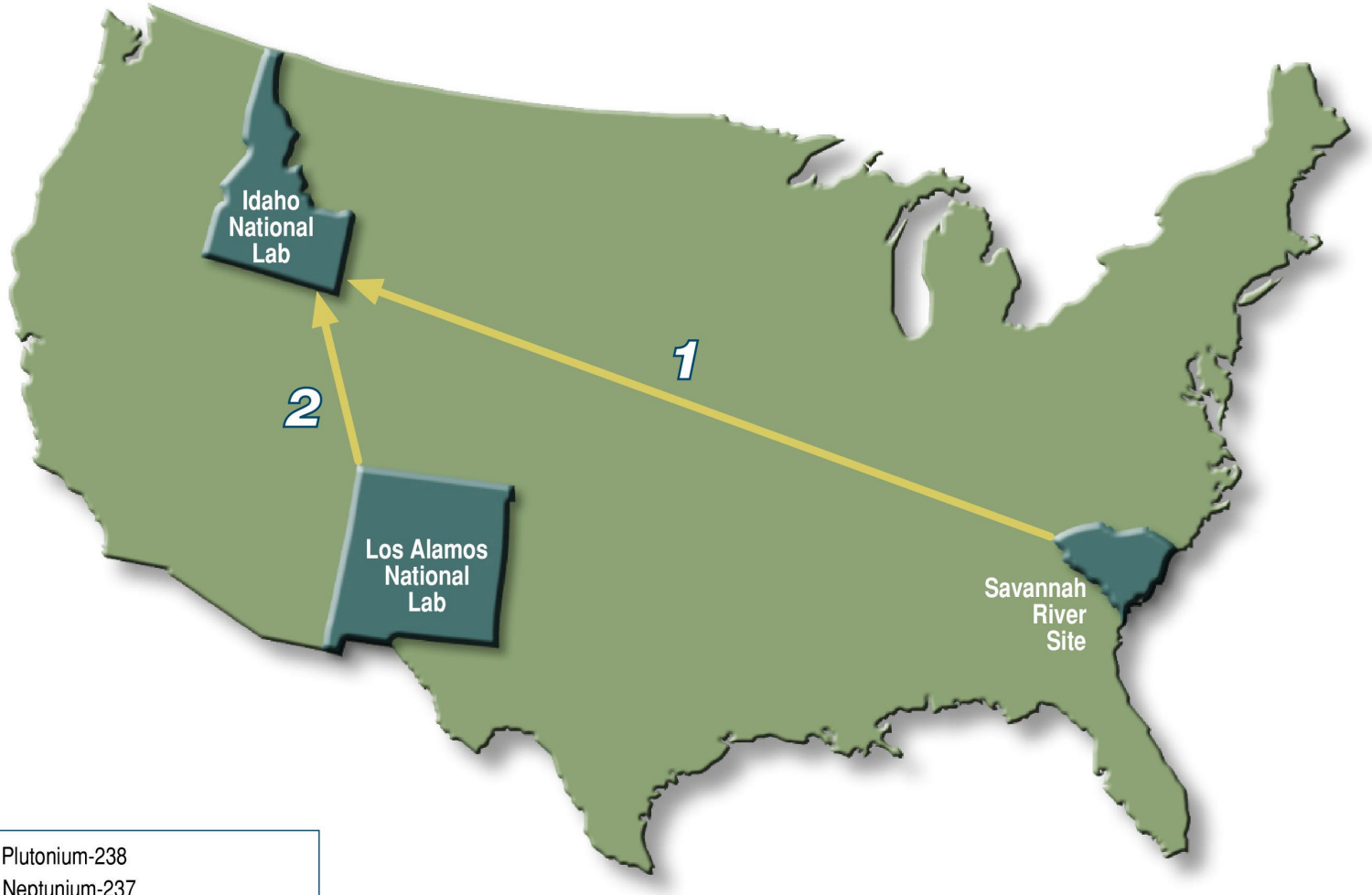
Assembly and Testing of RPS – Current Status

- **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

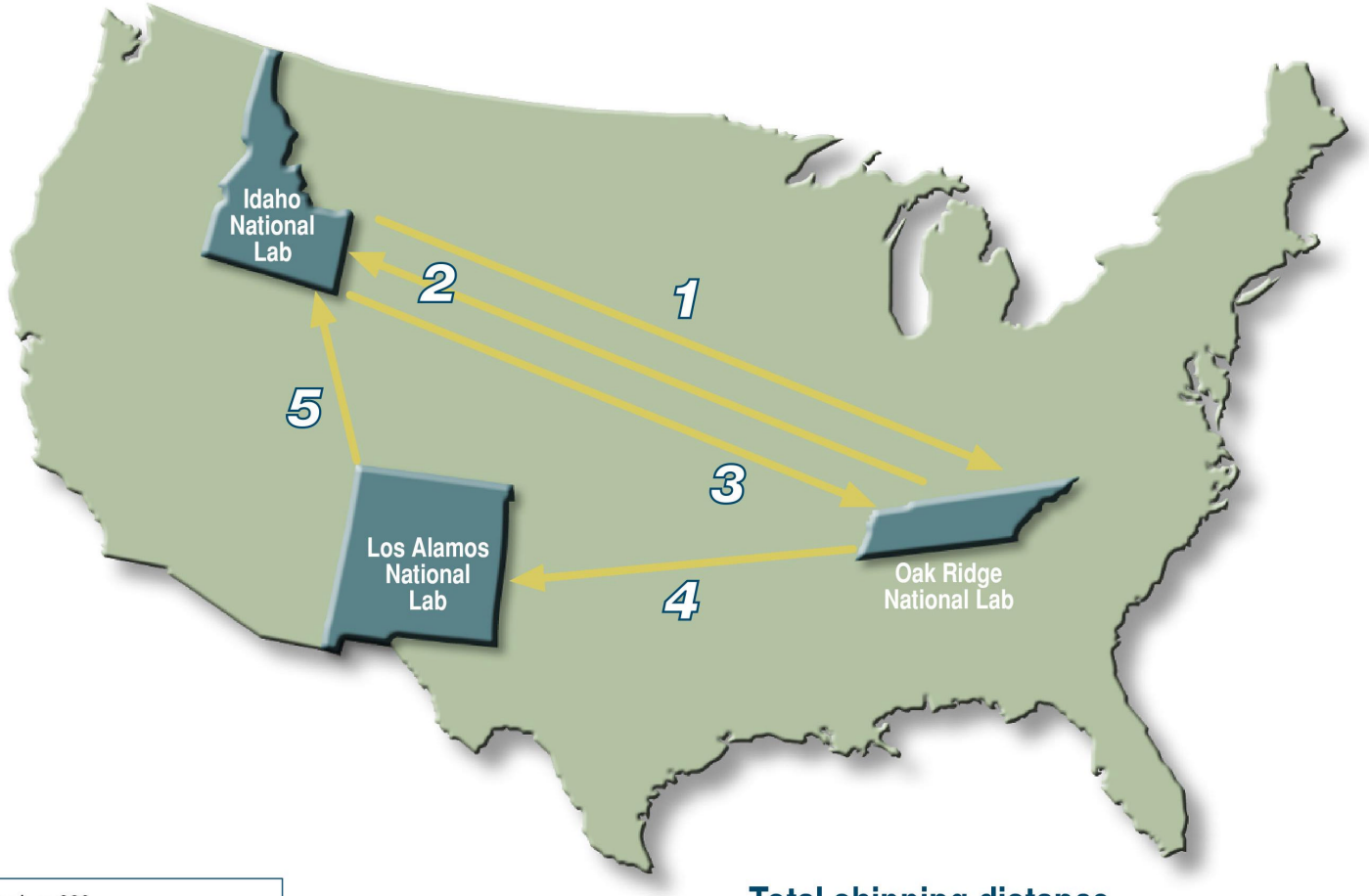


Pu-238 = Plutonium-238
Np-237 = Neptunium-237
Inter-site Transportation Route

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



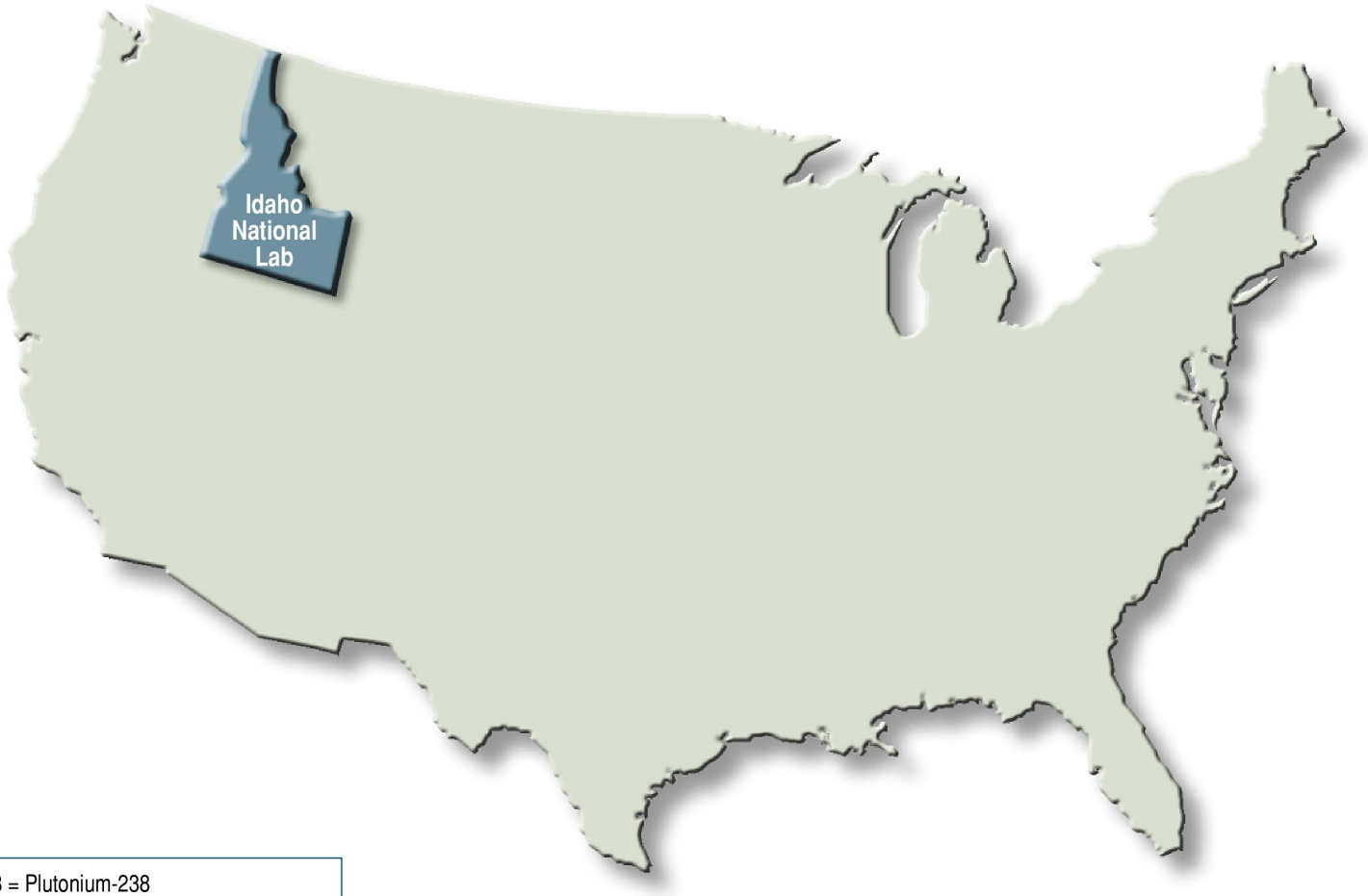
Pu-238 = Plutonium-238
Np-237 = Neptunium-237
Inter-site Transportation Route

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



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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**