

**DOE/EIS-0310-SA-02**  
**September 2013**

**SUPPLEMENT ANALYSIS FOR THE NUCLEAR  
INFRASTRUCTURE PROGRAMMATIC  
ENVIRONMENTAL IMPACT STATEMENT  
FOR PLUTONIUM-238 PRODUCTION FOR  
RADIOISOTOPE POWER SYSTEMS  
(DOE/EIS-0310-SA-02)**



**U.S. DEPARTMENT OF ENERGY**

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## ACRONYMS AND ABBREVIATIONS

ANL-W	Argonne National Laboratory-West
AMWTP	Advanced Mixed Waste Treatment Project
ASER	Annual Site Environmental Report
ATR	Advanced Test Reactor
B&W	Babcock and Wilcox
BEA	Bureau of Economic Analysis
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act</i>
CFA	Central Facilities Area
Consolidation EIS	<i>Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems</i>
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EBR	Experimental Breeder Reactor
EIS	environmental impact statement
ETTP	East Tennessee Technology Park
ft <sup>2</sup>	square feet
FCF	Fuel Conditioning Facility
FDPF	Fluorinel Dissolution Process Facility
FFTF	Fast Flux Test Facility
FMEF	Fuels and Materials Examination Facility
FMF	Fuel Manufacturing Facility
FONSI	Finding of No Significant Impact
GTCC	Greater-than-Class C
h	hour
HEU	highly enriched uranium
HFEF	Hot Fuel Examination Facility
HFIR	High Flux Isotope Reactor
ICP	Idaho Cleanup Project
IDEQ	Idaho Department of Environmental Quality
IFDP	Integrated Facility Disposition Project
INEEL	Idaho National Engineering and Environmental Laboratory
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
LANL	Los Alamos National Laboratory
LCF	latent cancer fatality
LLW	low-level waste
MEI	maximally exposed individual
MFC	Materials and Fuels Complex
mrem	millirem
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	<i>National Environmental Policy Act</i>
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
NI	nuclear infrastructure

NI PEIS	<i>Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility</i>
NNSA	National Nuclear Security Administration
Np-237	neptunium-237
NpO <sub>2</sub>	neptunium oxide
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
PEIS	programmatic environmental impact statement
PIDAS	perimeter intrusion, detection, and assessment system
PM <sub>2.5</sub>	particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
Pu-238	plutonium-238
REDC	Radiochemical Engineering Development Center
RCRA	<i>Resource Conservation and Recovery Act</i>
ROD	Record of Decision
ROI	region of influence
RPS	radioisotope power system
RWMC	Radioactive Waste Management Complex
SA	supplement analysis
SDA	Subsurface Disposal Area
SHPO	State Historic Preservation Office
SNM	special nuclear materials
SRS	Savannah River Site
TDEC	Tennessee Department of Environment and Conservation
TRU	Transuranic
TRUPACT	Transuranic Package Transporter
WIPP	Waste Isolation Pilot Plant
U-233	uranium-233
USFWS	U.S. Fish and Wildlife Service
UPF	Uranium Processing Facility
Y-12	Y-12 National Security Complex
ZPPR	Zero Power Physics Reactor

## CONVERSION FACTORS FOR MEASURES USED IN THIS SUPPLEMENT ANALYSIS

English to Metric		
Multiply	By	To get
Acres	0.4046873	Hectares
Square feet	0.092903	Square meters
Miles	1.6093	Kilometers
Feet	0.3048	Meters
Inches	2.54	Centimeters
Tons (short)	0.90718	Metric tons
Pounds	0.45359	Kilograms
Gallons	3.78533	Liters
Cubic yards	0.76456	Cubic meters

Metric to English		
Multiply	By	To get
Hectares	2.47104	Acres
Square meters	10.764	Square feet
Kilometers	0.62137	Miles
Meters	3.2808	Feet
Centimeters	0.3937	Inches
Metric tons	1.1023	Tons (short)
Kilograms	2.2046	Pounds
Liters	0.26418	Gallons
Cubic meters	1.3079	Cubic yards



## 1.0 INTRODUCTION

### 1.1 Overview

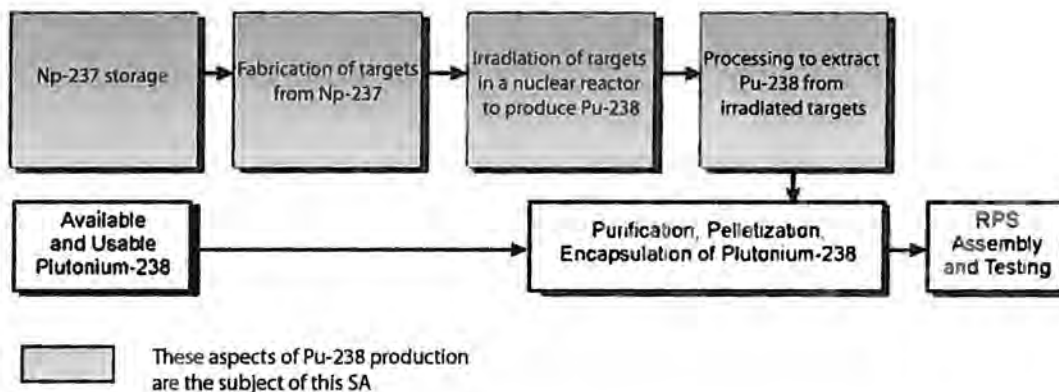
Under the authority of the *Atomic Energy Act* of 1954, as amended, the Department of Energy’s (DOE) missions include: (1) producing isotopes for research and applications in medicine and industry; (2) meeting nuclear material needs of other Federal agencies; and (3) conducting research and development activities for civilian use of nuclear power. In order to meet related mission requirements, DOE is responsible for maintaining the necessary nuclear material and infrastructure required to supply plutonium-238 (Pu-238) fueled Radioisotope Power Systems (RPSs) to support the National Aeronautics and Space Administration (NASA) and national security missions. RPSs are used when conventional (non-nuclear) power systems relying on battery, chemical or solar energy sources cannot reliably provide electric power to meet mission requirements.

**Plutonium-238**

Pu-238 is a radioactive isotope—a form of plutonium that gives off energy as rays and particles. When Pu-238 undergoes radioactive decay, the energy emitted in the form of alpha particles and gamma rays is converted into electricity using a system known as thermoelectric conversion. A power system fueled by Pu-238 is very reliable and can last for decades.

The properties of the Pu-238 isotope make it ideal for use in RPSs, providing a long-term, reliable heat source to produce electrical power.

The process of producing Pu-238 for RPSs involves the fabrication of targets containing neptunium-237 (Np-237), irradiating those targets in a nuclear reactor to transform some of the Np-237 into Pu-238, and the extraction and purification of the Pu-238 from those targets. The nuclear infrastructure required to produce Pu-238 for RPSs consists of: (1) a facility to store DOE’s existing inventory of Np-237 oxide in a manner consistent with DOE’s current safeguards and security requirements; (2) a facility to fabricate targets containing Np-237 for insertion in a nuclear reactor for irradiation; (3) a reactor to irradiate the targets; and (4) a facility to extract and purify the Pu-238 produced in those targets. Figure 1-1 shows the nuclear infrastructure necessary to produce RPSs.



Source: Modified from DOE 2005.

**Figure 1-1. Nuclear Infrastructure Necessary to Produce Radioisotope Power Systems.**



## 1.2 Background

Since 1992, when its last plutonium production reactor at the Savannah River Site (SRS) was permanently shut down, the United States has been unable to produce Pu-238. Lacking any source of domestic production of Pu-238, DOE signed a five-year contract in 1992 to purchase up to 10 kilograms (22 pounds) of Pu-238 per year from Russia, not to exceed 40 kilograms (88 pounds) total. This purchase agreement was executed through a series of contracts and extensions. Purchases were suspended in 2009 due to a restructuring of the Russian nuclear industry and a need to establish a new contracting arrangement. Although DOE plans to pursue a new agreement under new terms with Russia, this process could delay any delivery of Pu-238 by three or more years, and such an arrangement will always be a risk to NASA missions (DOE 2013). Mission guidance from NASA during the 1999-2000 timeframe indicated that the U.S. inventory of Pu-238 reserved for U.S. space missions was likely to be depleted by 2005. Therefore, DOE initiated a review of the adequacy of its nuclear infrastructure to meet NASA's long-term demands for Pu-238-fueled RPSs.

Partially in response to this need, on December 15, 2000, DOE issued the *Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility* (DOE/EIS-0310; DOE 2000a) (hereafter, Nuclear Infrastructure [NI] PEIS) to evaluate the potential enhancements to its nuclear infrastructure that would allow it to meet its Pu-238 responsibilities over the next three to four decades. The NI PEIS included an assessment of the No Action Alternative and five programmatic alternatives as listed below.

- Alternative 1—Restart the Fast Flux Test Facility (FFTF);
- Alternative 2—Use Only Existing Operational Facilities;
- Alternative 3—Construct New Accelerator(s);
- Alternative 4—Construct New Research Reactor; and
- Alternative 5—Permanently Deactivate FFTF (with No New Missions).

As shown on Table S-1 of the NI PEIS, many sub-alternatives (“options”) were analyzed for the programmatic alternatives. After considering the potential environmental impacts, costs, public comments, nonproliferation issues, and programmatic factors, DOE decided to implement the Preferred Alternative (Alternative 2, Option 7). Under that alternative, DOE decided to use the High Flux Isotope Reactor (HFIR) located at the Oak Ridge National Laboratory (ORNL) on the Oak Ridge Reservation (ORR) (Figure 1-2) and the Advanced Test Reactor (ATR) at the Idaho National Laboratory (INL) (formerly known as the Idaho National Engineering and Environmental Laboratory [INEEL]) (Figure

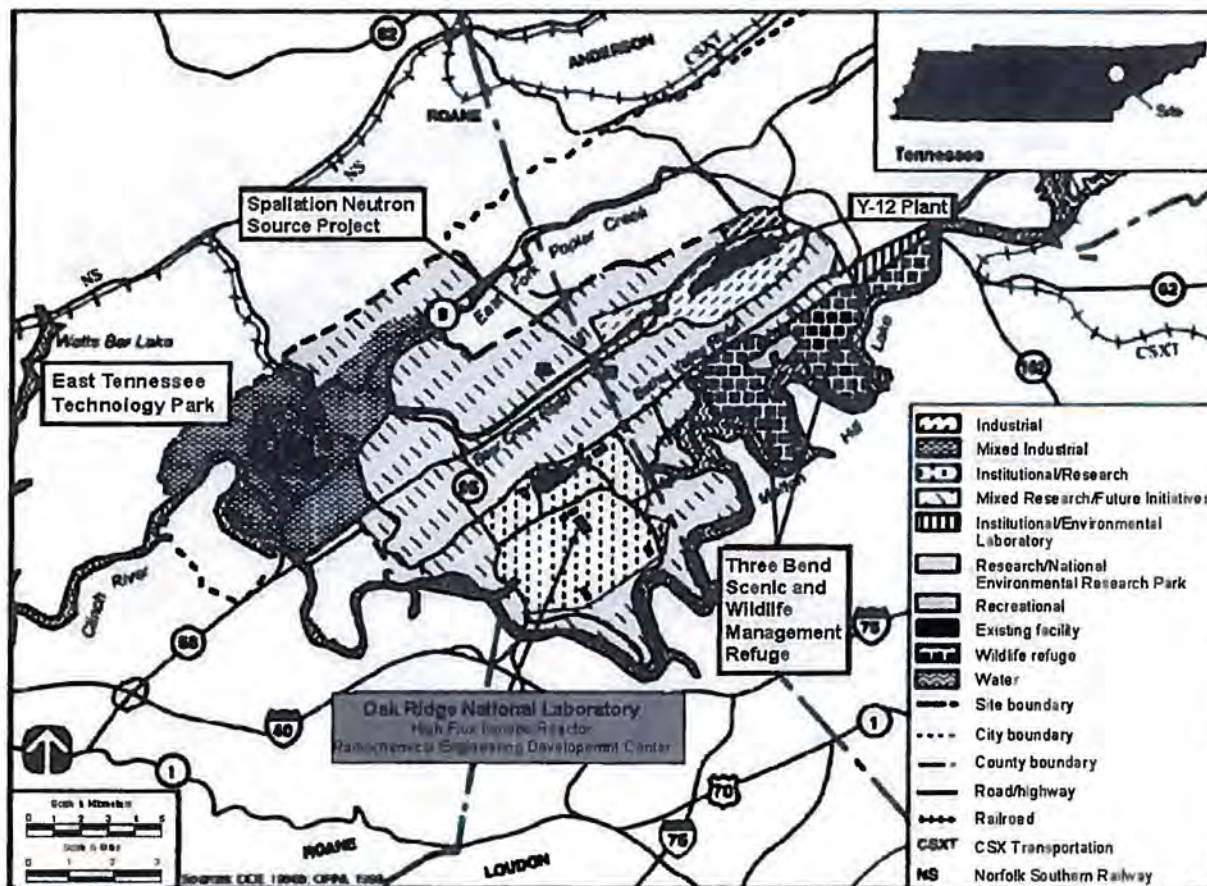
### High Flux Isotope Reactor (HFIR)

A light-water cooled and moderated test reactor with a full authorized power level of 85 megawatts located at the Oak Ridge National Laboratory.

### Advanced Test Reactor (ATR)

A light-water cooled and moderated test reactor with a full power level of 250 megawatts (typically operates at 140 megawatts or less) located at Idaho National Laboratory.

1-3) to irradiate Np-237 targets for the production of Pu-238.



**Figure 1-2. Oak Ridge Reservation.**

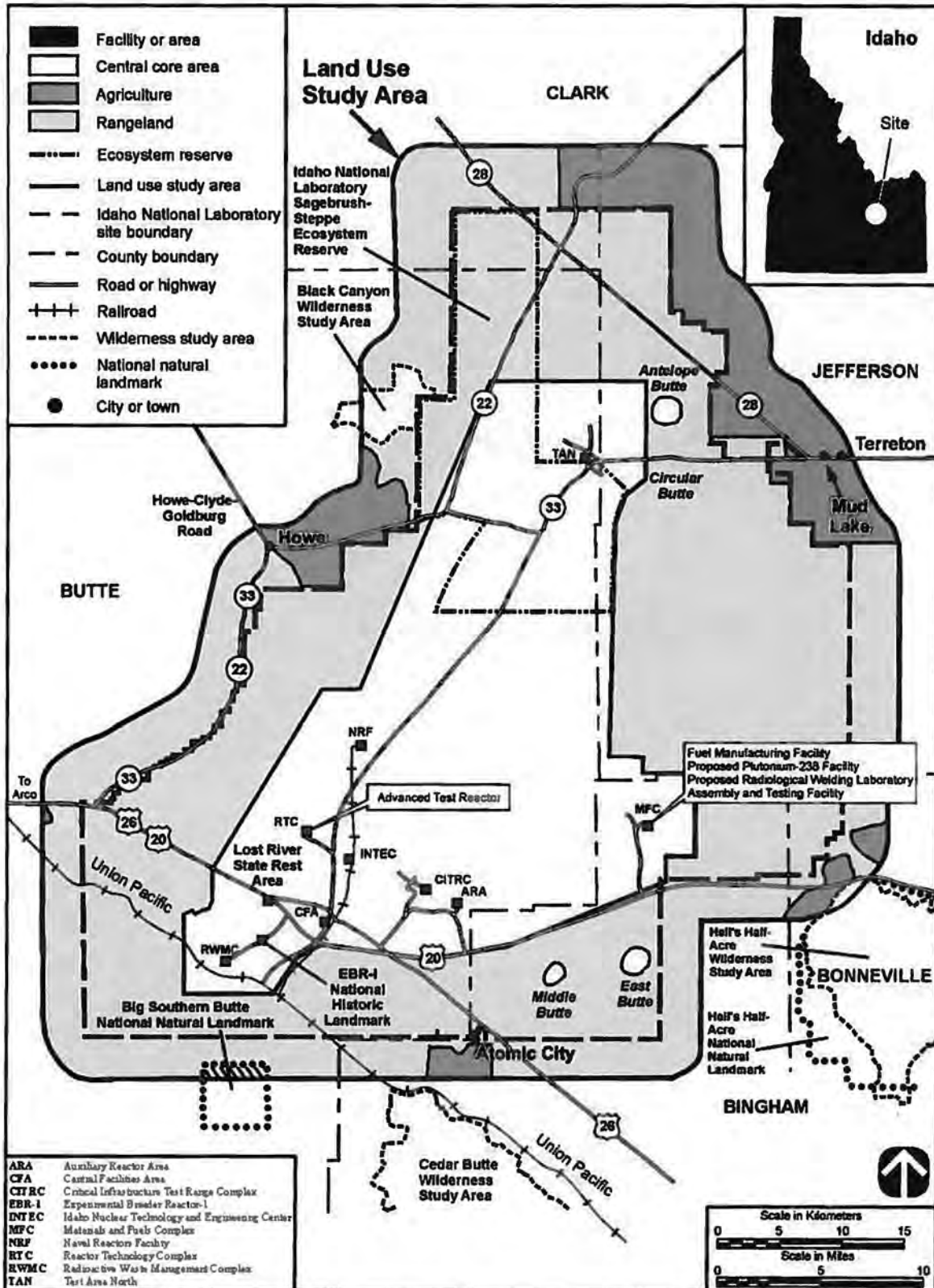
The Radiochemical Engineering Development Center (REDC), also located at ORNL, was selected for storage of neptunium (in the form of neptunium oxide [NpO<sub>2</sub>], which is a chemically stable form of Np-237). The REDC was also selected for fabricating targets and processing irradiated targets to recover Pu-238.

The decision also allowed for continued purchase of Pu-238 from Russia to meet near-term space mission requirements while reestablishing domestic production capabilities. The Record of Decision (ROD) for the NI PEIS was published in the *Federal Register* on January 26, 2001 (66 FR 7877).

**Radiochemical Engineering Development Center (REDC)**

A chemical processing facility at the ORNL used for processing highly radioactive materials in hot cells using remote handling equipment.





Source: DOE 2005.

Figure 1-3. Idaho National Laboratory.

Subsequent to the terrorist attacks of September 11, 2001, DOE instituted enhanced security measures for all special nuclear materials (SNM), including separated Np-237, which is controlled and accounted for by DOE as a SNM for safeguards and security purposes. Because the REDC did not meet the requirements for storage of SNM, in 2004, DOE prepared a Supplement Analysis (SA) for the NI PEIS to evaluate changing the storage location of NpO<sub>2</sub> from REDC to the Argonne National Laboratory-West (ANL-W) (currently known as the Materials and Fuels Complex [MFC] at INL) (DOE 2004). The purpose of that 2004 SA was to determine whether further *National Environmental Policy Act* (NEPA) review was required. DOE determined that no additional NEPA documentation was necessary and amended the NI PEIS ROD to change the NpO<sub>2</sub> storage location from REDC to the MFC at INL (69 FR 50180, August 13, 2004). Consistent with this decision, NpO<sub>2</sub> for use as target material for production of Pu-238 was transported from SRS to INL. DOE intends to continue to store the NpO<sub>2</sub> at INL. By the end of fiscal year 2004, DOE had taken no other action or incurred any expenses to implement the NI PEIS ROD related to production of Pu-238.

### Special Nuclear Material (SNM)

Special nuclear material (SNM) is defined by the *Atomic Energy Act* of 1954, as amended, as (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of section 51, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing, but does not include source material.

On November 16, 2004, DOE published a *Notice of Intent to Prepare an Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems* (DOE/EIS-0373; DOE 2005) (hereafter, Consolidation EIS) (69 FR 67139). At that time, DOE's ongoing or yet-to-be-reestablished operations were or were planned to be located at three DOE sites in Idaho, New Mexico, and Tennessee, requiring transportation of nuclear materials that could be avoided by proposed consolidation. DOE's preferred alternative was to transfer the purification and encapsulation of Pu-238 functions from Los Alamos National Laboratory (LANL) in New Mexico to INL, and to reestablish Pu-238 production (target fabrication, target irradiation, and post-irradiation target processing) at INL, rather than at ORNL as was decided in NI PEIS ROD. INL already had ongoing RPS assembly and test operations. DOE also proposed construction of a new facility at INL to house the Pu-238 related operations. A "bridge" alternative was proposed to provide for Pu-238 processing in existing facilities (target fabrication and post-irradiation target processing at ORNL, and Pu-238 purification and encapsulation at LANL) during the construction of the new Pu-238 processing building at INL.

The Notice of Availability for the Draft Consolidation EIS was published on July 1, 2005 (70 FR 38131). In response to public comments, DOE withheld finalizing the Consolidation EIS pending analysis of additional "bridge" alternatives. At the time this analysis was being conducted, availability of funds for construction of the new Pu-238 building at INL became less likely. DOE has now made a programmatic decision that production of Pu-238 as proposed under the Consolidation EIS is no longer a reasonable alternative due to excessive cost of consolidation. Since DOE will not pursue the proposed consolidation of nuclear operations related to RPSs, the Consolidation EIS was canceled on January 9, 2013 (78 FR 1848).

DOE now believes that, as decided in the NI PEIS ROD, and as modified in the amended NI PEIS ROD to store the  $\text{NpO}_2$  at INL, Alternative 2, Option 7 offers the optimum approach to Pu-238 production for both NASA and national security programs. As stated previously, other than the decision to store  $\text{NpO}_2$  at INL, the decision was never implemented for production of Pu-238. Because that decision was not implemented at that time, DOE has decided to prepare this SA to determine if there are substantial changes to the proposed action, or significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. DOE informed the public that it was preparing this SA by publishing a Notice of Intent in the *Federal Register* on January 9, 2013 (78 FR 1848; DOE 2013). DOE's determination whether further NEPA documentation is required will be announced in the *Federal Register*. The SA and determination will be made available to the public and posted on the DOE NEPA website; copies will also be provided upon request and will be available for inspection in the appropriate DOE public reading room(s).

### 1.3 Purpose and Need for this Supplement Analysis

Because the NI PEIS ROD was issued approximately 12 years ago, and the amended ROD for the 2004 SA was issued approximately 8 years ago, DOE is preparing this SA in accordance with DOE's NEPA Implementing Procedures at 10 CFR 1021.314 prior to proceeding with earlier decisions to produce Pu-238. As previously described in the NI PEIS (Section S.1, Purpose and Need for Agency Action), DOE's missions include: (1) producing isotopes for research and applications in medicine and industry; (2) meeting nuclear material needs of other Federal agencies; and (3) conducting research and development activities for civilian use of nuclear power. In order to meet related mission requirements, DOE is responsible for maintaining the necessary nuclear material and infrastructure required to supply Pu-238-fueled RPSs to support NASA and national security missions. Since 1992, when its last plutonium production reactor at the SRS was permanently shut down, the U.S. has been unable to produce Pu-238. Accordingly, DOE must establish an infrastructure capable of producing Pu-238 and proposes to do so in accord with the ROD issued following the NI PEIS, and the amended ROD following the 2004 SA. The proposed action, establishing a Pu-238 production infrastructure, as previously analyzed in the NI PEIS and the 2004 SA, has not changed. This SA provides an analysis of the changes in the potential environmental impacts, if any, associated with the NI PEIS and 2004 SA. If there are substantial changes in environmental impacts, or there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts, DOE will prepare a supplemental EIS in accordance with 40 CFR 1502.9. Otherwise, DOE may make a determination that Pu-238 production can be implemented without further NEPA analysis.

#### National Environmental Policy Act (NEPA)

NEPA requires the preparation of an EIS for every major Federal action that could significantly affect the quality of the human environment. NEPA's main purpose is to provide environmental information to decisionmakers and the public so actions are based on an understanding of the potential environmental consequences of a proposed action and its reasonable alternatives.



## 1.4 National Environmental Policy Act Documents Related to Pu-238 Production

- ***Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility*** (DOE/EIS-0310) (DOE 2000a). On December 15, 2000, DOE published the NI PEIS which included an analysis of the potential environmental effects of: 1) neptunium storage at INL; 2) target fabrication and Pu-238 processing at ORNL and INL; 3) target irradiation at ATR and HIFR; and 4) Pu-238 separation (target processing) at ORNL and INL. In the 2001 ROD (66 FR 7877), DOE decided, among other decisions, to reestablish domestic production of up to five kilograms per year of Pu-238, using ORNL for target fabrication and processing, ATR at INL and the HIFR at ORNL for target irradiation, and to ship the inventory of Np-237 oxide from SRS to ORNL, where targets would be fabricated and processed. It was assumed that continued purchase of Pu-238 from Russia would be used to meet near-term NASA mission requirements while reestablishing domestic production capabilities. The implementation of these decisions related to Pu-238 production is the subject of this SA.
- ***Supplement Analysis, Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility*** (DOE/EIS-0310-SA-01) (DOE 2004). In August 2004, DOE published this SA and issued an amended ROD, published in the *Federal Register* on August 13, 2004 (69 FR 50180), in which DOE decided to amend its decision on the storage location for the Np-237 oxide from ORNL to INL. This decision has been implemented and the material is currently stored at INL.
- ***Draft Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to the Production of Radioisotope Power Systems*** (DOE/EIS-0373D) (DOE 2005). In June 2005, DOE published this draft EIS, which analyzed the potential environmental impacts from consolidation of all RPS nuclear production operations at INL. The analysis of alternatives in this draft EIS was based on a requirement to produce up to 5 kilograms of Pu-238 per year and analyzed the potential environmental effects of continued storage of Np-237 oxide at INL, target fabrication and processing at INL and target irradiation at INL and ORNL. Due to excessive cost of consolidation, it no longer appears to be a reasonable alternative. Therefore, the Consolidation EIS has been canceled.
- ***Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico*** (DOE/EIS-0380) (DOE 2008a). The Pu-238 produced from processing targets will be shipped to LANL for further processing and preparation as fuel for RPS generators. This has been an ongoing activity at LANL and there are no proposals to change this. As a result, this activity is beyond the scope of this SA. The potential environmental impacts at LANL of these activities have been analyzed in the *Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE/EIS-



0380) issued on May 16, 2008 and its Record of Decision published on September 26, 2008 (73 FR 55833).

- **SRS NEPA Documents.** The production of Pu-238 has also been part of the historic mission at SRS. In the 1980s and early 1990s, Np-237 targets were fabricated and irradiated at SRS in facilities no longer operational and Pu-238 was separated from targets in the HB Line at H-Canyon at SRS. A number of NEPA documents have analyzed the potential environmental effects of isotope production, including Pu-238, at SRS. The most recent include: *Final Environmental Impact Statement Savannah River Site, Interim Management of Nuclear Materials* (DOE/EIS-0220) (DOE 1995a) and the *Surplus Plutonium Disposition Environmental Impact Statement* (DOE/EIS-0283) (DOE 1999a). DOE is in the process of preparing a Supplemental EIS for the Surplus Plutonium Disposition Environmental Impact Statement and has published a draft in July 2012 (DOE/EIS-0283-S2) (DOE 2012a). All three of these documents contain analysis of potential environmental effects of continued operation of H-Canyon and related facilities at SRS. There are no proposals in this SA that would affect activities at SRS.

## 1.5 Changes Since the Preparation of the Programmatic EIS

This section describes changes (mission and programmatic [Section 1.5.1], environmental [Section 1.5.2], and regulatory [Section 1.5.3]) that have occurred since the NI PEIS was issued in 2000 that may be relevant to the Pu-238 production infrastructure. These changes provide the basis for the analyses in this SA.

### 1.5.1 Mission and Programmatic Changes

Over approximately the past two decades, the United States has met its Pu-238 requirements by recovering Pu-238 from the previously-produced domestic inventory, purchased foreign-produced material, recycled heat sources, and processing equipment residues. Depending on needs, the annual production requirement for Pu-238 could vary from approximately 1.5 kilograms per year to as much as 5 kilograms per year. Consistent with the NI PEIS, this SA evaluates the potential environmental impacts associated with the annual production of up to 5 kilograms of Pu-238 per year (DOE 2012b).

Without a long-term supply of Pu-238, DOE would not be able to provide the RPSs that may be required for national security programs and potential future space missions, and DOE would not fulfill the intended space nuclear power role assigned to DOE in the National Space Policy statement issued on September 19, 1996. This assigned role of maintaining the space nuclear capability is also consistent with the DOE's charter under the *Atomic Energy Act* of 1954, as amended. Although there are no changes in DOE's mission to produce Pu-238, or in the reasonably foreseeable quantities of Pu-238 required for use in RPSs, because DOE has not produced Pu-238 since 1992, the proposed Pu-238 production addressed in this SA represents a change to the status quo.

## 1.5.2 Environmental Changes

Environmental changes pertain to changes in the environmental resources that provide the baseline for evaluating environmental impacts or changes in the parameters and assumptions used for the environmental impacts analyses. This section summarizes environmental changes at INL and ORNL because facilities only at these two sites will be used for Pu-238 production pursuant to the 2001 NI PEIS ROD and the 2004 amended ROD. Environmental changes are assessed primarily by using information from the *Idaho Comprehensive Land Use and Environmental Stewardship Report 2011* (INL 2011a), *Idaho Annual Site Environmental Report 2011* (INL 2011b), *Five-Year Review of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Response Actions at the Idaho National Laboratory Site-Fiscal Years 2005-2009* (DOE-ID 2011) and the *2011 Oak Ridge Reservation Annual Site Environmental Report* (ORR 2012). The analysis demonstrates that the baseline natural environment depicted in the NI PEIS has not changed appreciably. For a detailed baseline description of the environmental aspects, please refer to the NI PEIS. Only the changes since the issuance of the NI PEIS are described in the following sections.

### *Idaho National Laboratory*

In February 2005, with the separation of the national laboratory and environmental restoration missions into two separate contracts, the INEEL was renamed INL, its current designation. At that time, the research capabilities of the INEEL and the ANL-W were combined. The operation of INL and the environmental restoration efforts were split into two contracts managed by DOE's Office of Nuclear Energy (NE) and Office of Environmental Management (EM) to allow each mission to remain focused (INL 2011a). NE activities are generally focused on nuclear energy research, sustainable energy systems, and unique national and homeland security missions. EM activities are generally focused on waste management of various hazardous and radioactive materials, spent nuclear fuel management, and environmental remediation of contaminated soils and groundwater sites, primarily from legacy projects at the INL Site. EM activities are currently carried out through the Idaho Cleanup Project (ICP) (INL 2011a). The ICP involves the safe environmental cleanup of the INL Site, which was contaminated with waste generated during World War II-era conventional weapons testing, government-owned research and defense reactor operations, laboratory research, fuel reprocessing, and defense missions at other DOE sites (INL 2011b). Major new facilities within the past decade at INL have included: Center for Advanced Energy Studies (2008), Test Train Assembly Facility (2009), Technical Support Building (2009), Radiation Measurement Laboratory (2009), Radiochemistry Laboratory Expansion at MFC (2009), Radioanalytical Chemistry Laboratory (2010), Energy Systems Laboratory (2012), Integrated Waste Treatment Unit (2012), and the Research and Education Facility (under construction, completion planned in 2013).

### *Oak Ridge Reservation/Oak Ridge National Laboratory*

The ORR is home to two major DOE operating components, ORNL and the Y-12 National Security Complex (Y-12). A number of other facilities are located on ORR, including the East Tennessee Technology Park (ETTP), site of a former gaseous diffusion plant that is undergoing environmental restoration and transition to a private sector business/industrial park. Principal activities at ORNL are generally focused on nuclear energy research, basic and applied sciences,

and waste management. Y-12's main mission is to support the nuclear weapons program. Major new facilities within the past decade at ORR have included: Research Support Center at ORNL (2005), Highly Enriched Uranium Materials Facility at Y-12 (2010), New Steam Plant at Y-12 (2010), Chemical and Materials Science Building at ORNL (2011), and the Biomass Steam Plant at ORNL (2012).

Since issuance of the NI PEIS, plans to disposition approximately 1,500,000 square feet of aged, expensive-to-maintain facilities located at ORNL are proposed as part of the DOE Oak Ridge Office Integrated Facility Disposition Project (IFDP). The purpose of the IFDP is to eliminate the high-risk legacies of the Manhattan Project and Cold War, complete the ORR environmental cleanup mission, and enable the ongoing modernization of ORNL and Y-12. Specifically, the IFDP includes: (1) Demolition of 327 facilities at ORNL and 112 at Y-12; (2) Completion of remedial actions at 119 sites at ORNL and 118 sites at Y-12; (3) Reconfiguration activities at ORNL and Y-12 including road upgrades and construction of new treatment/storage facilities to support IFDP; and (4) Operation of existing and future waste treatment and disposal facilities.

### **1.5.2.1 Land Resources**

#### ***Idaho National Laboratory***

Under the ICP at INL there have been notable changes to land resources at INL. Land within the INL site is classified as industrial and mixed use. The current primary use of the INL site is to support facility and program operations. Generalized land uses at INL and vicinity are shown in Figure 1-3.

Since the 2004 Amended NI PEIS ROD, INL completed construction of a new Radiochemistry Laboratory at MFC and modifications are underway to convert an existing facility to provide additional space for radiological fuel development (INL 2011a). In addition, two of the major facilities at the MFC (the Experimental Breeder Reactor II [EBR-II] and Zero Power Physics Reactor [ZPPR])<sup>1</sup> have been decommissioned. Other support buildings, such as the Sodium Process Facility and Sodium Components Maintenance Shop, are tentatively scheduled for decommissioning. MFC will continue to use all other support facilities for current work scope. Additional buildings are tentatively planned that could add hundreds of additional personnel at MFC (INL 2011a).

In the Advanced Test Reactor Complex where the ATR is located, the recent decontamination and decommissioning (D&D) of the Materials Test Reactor (MTR) helped facilitate transformation of the ATR Complex. With MTR shutdown and ancillary facilities removed, INL completed a new Technical Support Building (16,400 square feet [ft<sup>2</sup>]) in 2009 that provides essential office space for ATR Complex engineers and operators. Also in 2009, INL completed a Test Train Assembly Facility (4,483 ft<sup>2</sup>) containing high-precision equipment for experiment test train assembly and the Radiation Measurement Laboratory (6,929 ft<sup>2</sup>). A new radiochemistry laboratory (4,600 ft<sup>2</sup>) that is necessary to support ATR began operation in fiscal year 2010. A second support facility is proposed for 2016 (INL 2011a, INL 2011c).

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<sup>1</sup> Although the ZPPR has been decommissioned, the facility has been repurposed and is intended to support ongoing missions at INL.



### ***Oak Ridge Reservation/Oak Ridge National Laboratory***

Generalized land uses at ORNL and vicinity are shown in Figure 1-2. The site is classified as an industrial area that encompasses a number of facilities dedicated to energy research. ORNL is divided into two major cleanup areas under the IFDP, Bethel Valley and Melton Valley. REDC and HFIR are in the Melton Valley in the 7900 Area of ORNL. The 7900 Area is situated on a low ridge in Melton Valley. There have been no changes in the classification or management of land resources at ORNL or ORR since the issuance of the NI PEIS.

#### **1.5.2.2 Visual Resources**

##### ***Idaho National Laboratory***

Although INL has a comprehensive facility and land use plan, no specific visual resource standards have been established. INL facilities have the appearance of low-density commercial/industrial complexes widely dispersed throughout the site. Structure heights generally range from 10 to 100 feet; a few stacks and towers reach 250 feet. The tallest structure at MFC is the Fuel Conditioning Facility stack, which is 200 feet in height. Facilities that stand out from the highway include the Transient Reactor Test Facility, Hot Fuel Examination Facility, the EBR-II containment shell, and ZPPR. No new large scale construction has taken place at the site to alter the visual aesthetics.

##### ***Oak Ridge National Laboratory***

ORNL remains a highly developed area. There has been no change in ORNL's visual resource contrast Class IV rating since the NI PEIS was issued.

#### **1.5.2.3 Noise**

There have been no notable changes to noise impacts at INL or ORNL since the NI PEIS was issued. Major noise sources at INL and ORNL include various industrial facilities, equipment, and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles). Most INL industrial facilities are far enough from the site boundary that noise levels from these sources are not measurable or are barely distinguishable from background levels at the boundary. No distinguishing noise characteristics within ORNL have been identified. REDC and HFIR are 1.6 miles from the site boundary; thus, the noise levels at the site boundary from these sources are barely distinguishable from background noise levels. There are no new significant noise sources which could contribute to historically low background noise levels at either of the sites.

### 1.5.2.4 Air Quality

#### *Idaho National Laboratory*

INL is within the Eastern Idaho Intrastate Air Quality Control Region #61. None of the areas within INL and its surrounding counties are designated as nonattainment areas with respect to the National Ambient Air Quality Standards (NAAQS) for criteria air pollutants (EPA 2012). The nearest nonattainment area for particulate matter is in Logan, Utah which is about 155 miles to the south.

During recent sampling, MFC was determined to be contributing about 0.01 percent to the total radiological emissions at INL (INL 2011b). Radiological air emissions are primarily associated with spent fuel treatment at the Fuel Conditioning Facility (FCF), waste characterization at the Hot Fuel Examination Facility (HFEF), and fuel research and development at the Fuel Manufacturing Facility (FMF). These facilities are equipped with continuous emission monitoring systems. Median annual gross beta concentrations were detected to be well within DOE standards and historical measurements taken within the last 13 years. Precipitation monitoring detected tritium concentrations that are well within the historical normal range at the INL Site. Suspended Particulate Monitoring indicated that particulate concentrations were higher at offsite locations than at the INL Site stations. Sampling for gross alpha activity, gross beta activity, and specific radionuclides, primarily strontium-90, cesium-137, plutonium-239/240, and americium-241, indicated no new trends in 2010. All measured results were below health-based regulatory limits (INL 2011b).

#### **National Ambient Air Quality Standards (NAAQS)**

Standards defining the highest allowable levels of specific pollutants in the ambient air (i.e., the outdoor air to which the public is exposed). Because the U.S. Environmental Protection Agency must establish the criteria for setting these standards, the regulated pollutants are called *criteria* pollutants. Criteria pollutants include sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and two size classes of particulate matter (less than or equal to 10 micrometers [0.0004 inch] in diameter and less than or equal to 2.5 micrometers [0.0001 inch] in diameter). Primary standards are established to protect public health; secondary standards are established to protect public welfare (e.g., visibility, crops, animals, buildings).

#### *Oak Ridge Reservation/Oak Ridge National Laboratory*

ORR is located in Anderson and Roane counties, Tennessee in the Eastern Tennessee and Southwestern Virginia Interstate Air Quality Control Region #207. The EPA has designated Anderson County as a basic nonattainment area for the 8-hour (h) Ozone standard as part of the larger Knoxville 8-h basic Ozone nonattainment area, which encompasses several counties. In addition, the EPA has designated Anderson and Roane counties as a nonattainment area for the particulate matter with an aerodynamic diameter less than or equal to 2.5 microns (PM<sub>2.5</sub>) air quality standard. Air quality in the Oak Ridge area is classified as an attainment area with the NAAQS for all other criteria pollutants for which EPA has made attainment designations (EPA 2012). The primary source of criteria pollutants at ORR has been emissions from steam plants at both ORNL and Y-12. A new (2010) Steam Plant at Y-12 uses natural-gas-fired package boilers with new burner technology instead of coal, creating much cleaner emissions (NNSA 2011).

Similarly, a new (2012) Biomass Steam Plant at ORNL has allowed four fossil-fuel boilers to be shut down.

The site-wide Title V Major Source Operating Permit includes requirements that are generally applicable to large operations such as a national laboratory (e.g., asbestos and stratospheric ozone), as well as specific requirements directly applicable to individual air emission sources. Source-specific requirements include National Emission Standards for Hazardous Air Pollutants (NESHAPs) for Radionuclides, requirements applicable to sources of ambient air criteria pollutants, and requirements applicable to sources of other hazardous air pollutants (non-radiological). In April 2009, an application was submitted to the State of Tennessee to renew this site-wide permit and the application was also updated in September 2010. As a result, the State of Tennessee issued a new site-wide Title V Operating Permit to DOE-UT-Battelle on September 1, 2011 (ORR 2012).

Airborne discharges from the DOE Oak Ridge facilities, both radioactive and nonradioactive, are subject to regulation by EPA and the Tennessee Department of Environment and Conservation (TDEC) Division of Air Pollution Control. The first site-wide operating air permit was issued in 2004. To demonstrate compliance with this Title V Major Source Operating Permit, more than 1,500 data points are collected and reported every year. Also, Knox County Air Quality permits are maintained for the offsite National Transportation Research Center. In 2011, an annual compliance report was submitted for this permit. In summary, there were no *Clean Air Act* violations or exceedances in 2011 (ORR 2012).

The major radiological emission point sources for ORNL include 7911 Melton Valley complex in the 7900 Area, which includes HFIR and the REDC. The calculated radiation dose to the maximally exposed individual (MEI) from all radiological airborne release points at ORR during 2011 was 0.3 millirem (mrem). The dose contribution to the MEI from all ORNL radiological airborne release points was 0.24 mrem. This dose is well below the NESHAP standard of 10 mrem and is less than 0.08 percent of the roughly 300 mrem that the average individual receives from natural sources of radiation.

### **1.5.2.5 Water Resources**

#### ***Idaho National Laboratory***

The NI PEIS noted that the principal environmental concern at INL in previous years has been the discharge of service wastewater to groundwater through the injection well resulting in a groundwater plume containing elevated concentrations of tritium, strontium-90, technetium-99, sodium, chloride, and other solutes. With the initiation of the ICP in 2005, significant monitoring and remediation activities have commenced at INL. Recently, surface water, groundwater, and drinking water monitoring data are collected and reported to comply with environmental protection objectives of the DOE. Liquid effluent and groundwater monitoring was performed in 2011 at ATR Complex, Central Facilities Area (CFA), INTEC, and MFC of INL. All parameters were found to be below applicable health-based standards, with the exception of some groundwater samples from INTEC that had elevated levels of aluminum, iron, and manganese. It appears these were due to sediment in unfiltered samples (INL 2011b).



Eleven drinking water systems were monitored in 2011 for parameters required by “Idaho Rules for Public Drinking Water Systems.” Water samples collected from drinking water systems were well below drinking water limits for all relevant regulatory parameters. Because workers are potentially impacted from radionuclides in the CFA distribution system, the dose from ingesting tritium to a CFA worker was calculated. The dose was 0.22 mrem for 2011. This is below the EPA standard of 4 mrem/year for public drinking water.

Surface water runoff from the Subsurface Disposal Area (SDA) of the Radioactive Waste Management Complex of INL was sampled in 2011 for radionuclides. Results were within historical measurements, with americium-241 and plutonium-239/240 about the same as the previous year’s results and no permit limits were exceeded (INL 2011b).

MFC is a wastewater reuse-permitted facility. For MFC’s Industrial Waste Pond and Industrial Waste Ditch, DEQ has issued a permit LA-000160-01, effective May 2010 to April 2015. The permit generally requires that data from groundwater monitoring wells at the INL Site comply with the Idaho groundwater quality primary constituent standards and secondary constituent standards (IDAPA 58.01.11).

A small increase in water use and sanitary wastewater generation is anticipated, mainly attributable to increased staffing levels at the MFC. Also, there would be a very small increase in process wastewater generation, but there would be no radiological liquid effluent discharge to the environment under normal operations. Therefore, storage of  $\text{NpO}_2$  at the MFC site would not measurably increase water use or change the quality or quantity of effluents discharged.

### ***Oak Ridge National Laboratory***

Three radiological contaminant constituents exceeded their respective reference values in 2003: tritium, gross alpha activity, and gross beta activity. In particular, one monitoring well located down-gradient of the HFIR complex indicates that a statistically significant upward trend continues to be observed for tritium. This is attributed to the tritium leak from the process waste drain line that occurred in 2000. This was repaired during the summer of 2001. Overall, most monitoring locations immediately down-gradient of HFIR and the point of release continue to show a decrease in tritium with the results indicating that the tritium plume is moving down-gradient away from HFIR toward eventual discharge into Melton Branch. Groundwater quality monitoring in the interior of Melton Valley shows that in general groundwater contaminant concentrations are declining or are stable following remedial actions (ORR 2012).

ORNL’s water distribution system is designated as a “non-transient, non-community” water system by TDEC’s Bureau of Environment Division of Water Supply. The city of Oak Ridge supplies potable water to the ORNL water distribution system and meets all regulatory requirements for drinking water. In 2011, sampling results for ORNL’s water system residual chlorine levels, bacterial constituents, and disinfectant by-products were all within acceptable limits.

### 1.5.2.6 Geology and Soils

#### *Idaho National Laboratory*

INL is on the northwestern edge of the eastern Snake River Plain. The Arco Segment of the Lost River Fault is thought to terminate about 4.3 miles from the INL boundary. The Howe Segment of the Lemhi Fault terminates near the northwest boundary of the site (DOE 2000a). Both segments are considered capable,<sup>2</sup> having experienced movement at least once in the last 35,000 years.

Four basic soilscapes exist at INL: (1) river-transported sediments deposited on alluvial plains, (2) fine-grained sediments deposited into lake or playa basins, (3) colluvial sediments originating from bordering mountains, and (4) wind-blown sediments over lava flows. No prime farmland lies within INL boundaries (DOE 2000a). INL has conducted geological investigations since the 1960s.

Within INL, economically viable sand, gravel, pumice, silt, clay, and aggregate resources exist. Several quarries supply these materials to various onsite construction and maintenance projects. Geothermal resources are potentially available in parts of the Eastern Snake River Plain (DOE 2000a).

INL continuously monitors seismic activities and these results are incorporated into seismic and volcanic hazards assessments. High-quality assessments of geologic hazards are attained through cooperative investigations and peer review by numerous knowledgeable scientists from the U.S. Geological Survey, the Nuclear Regulatory Commission, major universities, other national laboratories, seismic hazard consultants, earthquake engineering firms, and seismic experts coordinated by the State of Idaho (INL 2011a). Monitoring at INL for earthquakes began in 1972. Since then, 35 small magnitude micro-earthquakes (magnitude less than 2.0) have been detected on or near the site (INL 2012). The largest historic earthquake (magnitude 7.3 Borah Peak) near INL took place in 1983, as stated in the NI PEIS.

New construction at the ATR Complex occurred in 2005 and a short-term, temporary disturbance to the local geology and soils occurred. The storage of NpO<sub>2</sub> at INL and irradiation of Np-237 targets in ATR would not result in impacts on geological resources at INL. Due to the developed nature at INL and because no new construction would take place, impacts on geological resources would be minimal, if any.

The use of INL to store NpO<sub>2</sub> would not be expected to result in significant change in impacts on geologic or soil resources, versus those already analyzed in the NI PEIS. Because there would be no construction, there would be no disturbance to either geologic or soil resources at INL. Hazards from large-scale geologic conditions at INL, such as earthquakes and volcanoes, were evaluated in the NI PEIS. The conclusion remains that these hazards present a low risk to specially designed or upgraded facilities and is not revisited here.

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<sup>2</sup> In part, a capable fault is one that may have had movement at or near the ground surface at least once within the past 35,000 years, or has had recurring movement within the past 500,000 years. Further definition can be found in 10 CFR 100, Appendix A.

### ***Oak Ridge Reservation/Oak Ridge National Laboratory***

ORR is located in the Tennessee portion of the Valley and Ridge Physiographic Province, which is part of the southern Appalachian fold-and-thrust belt. As a result of thrust faulting and differential erosion rates, a series of parallel valleys and ridges have formed that trend southwest–northeast.

Two geologic units on ORR consist of dolostone and limestone, which create the “Knox Aquifer.” The aquifer flows over substantial areas, and large quantities of water may move long distances and is the primary source of groundwater for many streams and most large springs on ORR. The remaining geologic units on ORR are composed predominantly of shales, siltstones, and sandstones with a subordinate and locally variable amount of carbonate bedrock.

Because HFIR would be used to irradiate Np-237 targets, there would be no new construction and no disturbance to either geologic or soil resources in the 7900 Area of ORNL. Hazards from large-scale geologic conditions at ORNL, such as earthquakes and volcanoes, were evaluated in the NI PEIS. The analysis determined that these hazards present a low risk to specially designed or upgraded facilities (such as HFIR and REDC), and is not revisited here.

#### **1.5.2.7 Ecological Resources**

##### ***Idaho National Laboratory***

Since the NI PEIS was issued, changes to threatened and endangered species at the INL have been limited to changes in several species designations by the U.S. Fish and Wildlife Service (USFWS) and the Idaho Department of Fish and Game. Key changes are presented below:

**Special Status Wildlife.** The most recent USFWS list (May 9, 2011) includes two threatened and endangered species and three candidate species that may occur within the five counties that encompass the INL Site. The Canada lynx (*Lynx canadensis*) and the grizzly bear (*Ursus arctos horribilus*) are threatened species. Neither is expected to be present on the INL Site. The gray wolf (*Canis lupus*) was delisted on May 5, 2011, and is no longer afforded protection under the *Endangered Species Act* in Idaho; wolf populations in Idaho are managed by the State. Greater sage-grouse (*Centrocercus urophasianus*), yellow-billed cuckoo (*Coccyzus americanus*), and the wolverine (*Gulo gulo*) are candidate species. Sage-grouse are generally considered obligates of the sagebrush-steppe system, requiring sagebrush for nesting, winter feeding, and shelter from weather and predators throughout the year. Sage-grouse are abundant at the INL Site. The yellow-billed cuckoo is a riparian-obligate species and is primarily associated with willow-cottonwood riparian forest in southeastern Idaho. Wolverines are listed as candidate species in the county but no record sightings of them have been made.

Several other animal species were designated as sensitive that may be present on the INL Site. The bald eagle (*Haliaeetus leucocephalus*) was delisted in 2007, but is still protected under the Bald and Golden Eagle Protection Act. This species often winters in the Little Lost River Valley just north of the INL Site and several have been known to winter on the INL Site. The American peregrine falcon (*Falco peregrinus*) (delisted, but being monitored) has been observed infrequently on the northern portion of the INL Site (INL 2011a).



**Special Status Plants.** The most recent USFWS list (December 2010) includes one threatened plant species that may occur within the five counties that encompass the INL site: Ute ladies'-tresses orchid (*Spiranthes diluvialis*). In addition, there are several sensitive plant species that may be present on the INL Site (INL 2011a).

New construction at the ATR Complex occurred in 2005 and a short-term, temporary disturbance to the local environment occurred. However, DOE does not anticipate new construction for Pu-238 production and therefore no additional adverse effects are expected to the Federally- and state-listed special status species compared to those already analyzed in the NI PEIS. Therefore additional consultation with the USFWS and with the Idaho Department of Fish and Game is not deemed required.

The storage of NpO<sub>2</sub> at INL and irradiation of Np-237 targets in ATR would not result in impacts on ecological resources at INL. No new construction would occur that could cause direct disturbance to ecological resources, including wetlands. There would be no loud noises that would adversely impact wildlife. As noted in Section 1.5.2.5, Water Resources, there would be no change in impacts on aquatic resources because significant amount of additional water would not be withdrawn from or discharged to site surface water and effluent chemistry would not measurably change. Due to the developed nature at INL and because no new construction would take place, impacts on threatened and endangered species would be minimal or not occur.

#### ***Oak Ridge Reservation/Oak Ridge National Laboratory***

**Special Status Wildlife.** The NI PEIS noted only two Federally-listed threatened or endangered species observed on or near ORR: the gray bat (*Myotis grisescens*) and the bald eagle (*Haliaeetus leucocephalus*). The gray bat continues to remain endangered while the bald eagle was delisted in 2007. The bald eagle is still protected under the Bald and Golden Eagle Protection Act (ORR 2012).

**Special Status Plants.** Four species (spreading false-foxglove [*Aureolaria patula*], Appalachian bugbane [*Actaea rubifolia*], tall larkspur [*Delphinium exaltatum*], and butternut [*Juglans cinerea*]) have been under review for listing at the Federal level and were listed under the formerly used "C2" candidate designation. These species are now informally referred to as "special concern" species by the USFWS. The most recent addition (2009) to the ORR list of state-protected plants is American barberry (*Berberis canadensis*), which is listed as a species of special concern by the state. Also, early in 2011 butternut was confirmed to be currently extant on ORR. The Tennessee Heritage Program scientific advisory committee met in 2009 to revise the state list, but its changes to the state list are not yet official. Hairy sharp-scaled sedge (*Carex oxylepis* var. *pubescens*) has not been observed during recent surveys. Michigan lily (*Lilium michiganense*) is believed to have been extirpated from the ORR by the impoundment at Melton Hill (ORR 2012).

Consultation to comply with Section 7 of the *Endangered Species Act* was conducted for the NI PEIS with the USFWS. It resulted in the USFWS concluding that it does not anticipate adverse effects to Federally-listed endangered species that occur near the project area. DOE does not anticipate any additional adverse effects to the Federally- and state-listed special status species compared to those already analyzed in the NI PEIS. Therefore additional consultation with the

USFWS and with the Tennessee Department of Environment and Conservation is not deemed required.

The irradiation of Np-237 targets would also take place in the existing HFIR facility at ORR. No new construction would occur that could cause direct disturbance to ecological resources, including wetlands. There would be no loud noises that would adversely impact wildlife. There would be no change in impacts on aquatic resources because additional water would not be withdrawn from or discharged to site surface waters and effluent chemistry would not measurably change. Due to the developed nature of the facilities proposed at ORR sites, and because no new construction would take place, impacts on threatened and endangered species would be minimal or not occur.

### **1.5.2.8 Cultural and Paleontological Resources**

#### ***Idaho National Laboratory***

Efforts to inventory INL Site cultural resources are ongoing. These investigations have been completed in project-specific localities and areas identified within research projects. To date, approximately 10 percent of the INL Site has been inventoried for archaeological sites, resulting in an inventory of nearly 3,000 resources (INL 2011a). In 2011, D&D activities associated with the ICP involved several MFC facilities, including MFC-766, Sodium Boiler Building, and MFC-767, Experimental Breeder Reactor-II (EBR-II) Reactor Plant Building. A cultural resources review was conducted to determine potential effects to EBR-II from D&D activities. It was determined that these activities would have an adverse impact on this historic property and consultation was initiated with the Idaho State Historic Preservation Office (SHPO).

#### ***Oak Ridge National Laboratory***

No American Indian sacred sites or cultural items have been found within or immediately adjacent to REDC or HFIR (DOE 2000a). The Graphite Reactor is the closest culturally significant property to REDC and HFIR. However, neither the Graphite Reactor nor any of the other eligible National Register of Historic Places structures is located within the 7900 Area. No prehistoric sites have been located within or immediately adjacent to the REDC or HFIR (ORR 2012).

### **1.5.2.9 Socioeconomics**

The NI PEIS defined the region of influence (ROI) for both INL and ORNL (described below) and the analysis in this SA uses that same defined ROI. As would be expected, the population of the ROI has changed since the NI PEIS was prepared. Population information from the 2010 Census, which is now available at most tracking levels, was used in this analysis.

#### ***Idaho National Laboratory***

Statistics for employment and regional economy are presented for a regional economic area defined by the Bureau of Economic Analysis (BEA), which encompasses 13 counties around INL. Statistics for population, housing, and local transportation are presented for the ROI, a four

county area (Bonneville, Bingham, Bannock, and Jefferson Counties) in which a majority of INL employees resided when the NI PEIS was prepared. In 1997, INL employed 8,291 persons; in 2011 INL employment grew to 8,452 persons (about 5 percent of the regional economic area civilian labor force).

**Regional Economic Characteristics.** In 1996, the civilian labor force in the regional economic area was 150,835. In 2010, the civilian labor force was 167,340, an increase of 10.9 percent. In 2010, the annual unemployment rate for the regional economic area increased from the 1996 unemployment rate of 4.8 percent to 7.2 percent, which was less than the annual unemployment rate for Idaho (8.8 percent) (BLS 2012a).

**Population and Housing.** In the NI PEIS, the 1996 population of the ROI totaled 213,547. Between 1996 and 2010, the ROI population increased by 21 percent. The 2010 ROI population was 258,820. The total number of housing units in the ROI in 2010 was 97,785, an increase of 40 percent since 1990. The 1990 ROI homeowner vacancy rate was 2.1 percent, compared to 3.7 percent in 2010 (Census 2012a).

**Community Services.** Community services analyzed in the ROI include public schools, law enforcement, fire suppression, and medical services. There are 20 school districts with 133 schools serving the INL ROI (DOE 2011a). Law enforcement is provided by 12 municipal, county, and local police departments (USACops 2013). Fire suppression services are provided by 11 municipal, county, and local fire departments (Fire 2012a). There are nine hospitals that serve residents of the ROI (Idaho Hospitals 2013).

### ***Oak Ridge Reservation/ Oak Ridge National Laboratory***

Statistics for employment and regional economy are presented for a regional economic area defined by the BEA, which encompasses 18 counties around ORR. Statistics for population, housing, and local transportation are presented for the ROI, a four county area (Anderson, Knox, Loudon, and Roane Counties) in which a majority of ORR employees resided when the NI PEIS was prepared. In 1998, ORR employed 14,215 persons; in 2011 the ORR employed 12,100 persons (about 2 percent of the regional economic area civilian labor force).

**Regional Economic Characteristics.** In 1998, the civilian labor force in the regional economic area was 484,774. In 2010, the civilian labor force was 602,833, an increase of 24.3 percent. In 2010, the annual unemployment rate for the regional economic area increased from the 1998 unemployment rate of 4.1 percent to 9.3 percent, which was slightly less than the annual unemployment rate for Tennessee (9.8 percent) (BLS 2012b).

**Population and Housing.** In the NI PEIS, the 1998 population of the ROI totaled 528,017. Between 1998 and 2010, the ROI population increased by 16 percent. The 2010 ROI population was 610,092. The total number of housing units in the ROI in 2010 was 277,107, an increase of 23 percent since 1998. The 1990 ROI homeowner and rental vacancy rate was 1.7 percent, compared to 5.6 percent in 2010 (Census 2012b).

**Community Services.** Community services analyzed in the ROI include public schools, law enforcement, fire suppression, and medical services. There are 7 school districts with 145



schools serving the ROI. Educational services are provided for approximately 81,729 students by an estimated 5,216 teachers for the 2005 to 2006 school year. The student-to-teacher ratio in these school districts ranges from a high of 18:1 in the Lenoir City School District in Loudon County to a low of 14:1 in the Oak Ridge School District. The student-to-teacher ratio in the ROI was 16:1 (NNSA 2011). Law enforcement is provided by 18 municipal, county, and local police departments (DOJ 2011). Fire suppression services are provided by 28 municipal, county, and local fire departments (Fire 2012b). There are eleven hospitals that serve residents of the ROI (NNSA 2011).

### 1.5.2.10 Human Health

#### *Idaho National Laboratory*

INL conducts both radiological and non-radiological operations which have the potential to impact the health of the public and workers. For purposes of this SA, the potential impacts associated with radiological operations are most relevant. The NI PEIS stated that the collective worker dose at the site was approximately 65 person-rem/year and the total population dose (50-mile radius around the site) from existing operations at the site was approximately 0.075 person-rem/year (DOE 2000a). Based on more recent information, the collective worker dose at the site is approximately 127 person-rem/year (DOE 2012c) and the total population dose (50-mile radius around the site) from existing operations at INL is approximately 0.8 person-rem/year (DOE 2011a). Table 1-1 presents the potential doses to workers and the 50-mile population presented in the NI PEIS and based on current information for INL. As shown in that table, both the total worker dose and total population doses are currently higher than the doses presented in the NI PEIS. The primary reason for these dose increases is due to the startup of the Idaho Cleanup Project, which began operations in approximately 2005, and the Advanced Mixed Waste Treatment Project (AMWTP), which began operations in approximately 2004. When the NI PEIS was prepared, neither of these projects was operational and consequently did not contribute to the collective worker dose or the 50-mile population dose. In 2011, these two projects contributed approximately 73.3 person-rem to the collective worker dose (DOE 2012c). Although there are no specific data regarding the contribution of these two projects to the 50-mile population dose, it is reasonable to assume that these two projects also contributed to an increase in that dose. Additionally, the 50-mile population dose has increased by approximately 15 percent due to a 15 percent increase in the population at INL since the NI PEIS was prepared.

**Table 1-1. Dose Information for INL**

	<b>Data Presented in the NI PEIS</b>	<b>Current Actual Data</b>
Total Worker Dose (person-rem per year)	65	127
50-mile Population Dose (person-rem per year)	0.075	0.8

#### *Oak Ridge Reservation/ Oak Ridge National Laboratory*

ORR conducts both radiological and non-radiological operations which have the potential to impact the health of the public and workers. For purposes of this SA, the potential impacts associated with radiological operations are most relevant. The NI PEIS stated that the total worker dose at the site was approximately 103 person-rem/year and the total population dose (50-mile radius around the site) from existing operations at the site was approximately 60.3 person-rem/year (DOE 2000a). Based on more recent information, the total worker dose at the

site is approximately 66 person-rem/year (DOE 2012c) and the total population dose (50-mile radius around the site) from existing operations at the site is approximately 25.8 person-rem/year (NNSA 2011). Table 1-2 presents the potential doses to workers and the 50-mile population presented in the NI PEIS and based on current information for ORNL. As shown in that table, both the total worker dose and total population doses are lower than the doses presented in the NI PEIS.

**Table 1-2. Dose Information for ORNL**

	<b>Data Presented in the NI PEIS</b>	<b>Current Actual Data</b>
Total Worker Dose (person-rem per year)	103	66
50-mile Population Dose (person-rem per year)	60.3	25.8

### **1.5.2.11 Environmental Justice**

Under Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, Federal agencies are responsible for identifying and addressing the possibility of disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands. Minority populations refer to persons of any race self-designated as Asian, Black, Native American, or Hispanic. Low-income populations refer to households with incomes below the Federal poverty thresholds.

In this SA and the NI PEIS, there are both similarities and differences in the methodology that was used to determine the potentially affected populations related to environmental justice (and health effects). Both analyses used the latest available census data (the NI PEIS used 1990 data and this SA uses 2010 data) and both used counties and block groups to identify potentially affected populations. However, because the boundaries of counties and block groups generally do not coincide with boundaries of the ROI (a 50-mile radius centered on the ATR at INL and HFIR/REDC at ORNL), some counties and block groups lie partially inside and partially outside the 50-mile radius. In this SA, the populations of counties or block groups that intersected or were within the 50-mile radius were wholly included in population counts. Block groups that fell within a 50-mile radius and which met the criteria described below were identified as minority or low-income populations. Such a methodology is conservative, in that it could include higher populations than may actually exist within the 50-mile radius. As described in Appendix K, the NI PEIS estimated the potentially affected populations for these particular counties and block groups by assuming that populations were uniformly distributed throughout the area of each county or block group. For example, if 30 percent of the area of a block group lies within 50 miles of the site, it was assumed that 30 percent of the population residing in that block group would be at potential risk. Although there are differences in the methodology for determining the population counts, these differences do not create a discernible difference in the impact results.

As mentioned above, the ROI for the environmental justice analysis was defined as an area within a 50-mile radius centered on the ATR at INL and HFIR/REDC at ORNL. The threshold used for identifying minority and low-income communities surrounding specific sites were

developed consistent with CEQ guidance (CEQ 1997) for identifying minority populations using either the 50 percent threshold or another percentage deemed “meaningfully greater” than the percentage of minority or low-income individuals in the general population. CEQ guidance does not provide a numerical definition of the term “meaningfully greater.” Additionally, DOE has not issued guidance on the topic; therefore, CEQ guidance was supplemented using the U.S. Nuclear Regulatory Commission “Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions” (69 FR 52040). The policy statement directs analysts to consider environmental justice matters in greater detail “if the percentage in the impacted area significantly exceeds that of the State or County percentage for either the minority or low-income population.” “Significantly” is defined by staff guidance to be 20 percentage points. The percentage of minority or low-income individuals in the general population is defined in this SA as the lower of the average percentage of minority or low-income individuals living in the state(s) in which the ROI lies or in the counties that are at least partially included within the ROI. The geographic area with the lower percentage of minority or low-income individuals is used to provide for greater conservatism. As the tables show, the thresholds of the ROIs differ in some cases due to changes in the geographic areas included in the general population percentage defined above. For the impact assessment, the analysis of environmental justice used block group spatial resolution.

**Table 1-3. Site-Specific Thresholds for Identification of Minority and Low-Income Communities Within the 50-Mile Region of Influence (percentage)**

Population	INL	ORR
Minority Population	36.0 <sup>b</sup>	29.0 <sup>a</sup>
Low-Income Population	34.0 <sup>a</sup>	36.0 <sup>b</sup>

<sup>a</sup> Indicates the county(ies) as the lower general population percentage.

<sup>b</sup> Indicates the state(s) as the lower general population percentage.

### ***Idaho National Laboratory***

The ROI for the environmental justice analysis was defined as an area within a 50-mile radius surrounding ATR that encompasses parts of 11 counties in Idaho. In the decade between 2000 and 2010, the total population of the 11-county area increased by approximately 15 percent to 324,259. In 2010, minorities made up approximately 18 percent of the population of the 11-county area surrounding ATR. In 2010, approximately 35 percent of the total national population was comprised of persons self-designated as members of a minority group. Minorities made up 16 percent of the State of Idaho’s total population (Census 2012a). At the time of the 2010 census, Hispanics were the largest minority group within the 11-county area, consisting of approximately 13 percent of the population. American Indian and Alaska Natives made up approximately 2 percent and Asians made up nearly 1 percent (Census 2012a).

In 2010, the poverty threshold was \$17,552 for a family of three with one related child under 18 years of age. A total of 38,925 persons, or approximately 12 percent, residing within the 11-county area around ATR reported incomes below that threshold (Census 2012c). Data obtained during the 2010 census show that of the total national population, approximately 14 percent reported incomes below the poverty threshold. Percentages for those below the poverty threshold in Idaho were approximately 14 percent (Census 2012c).

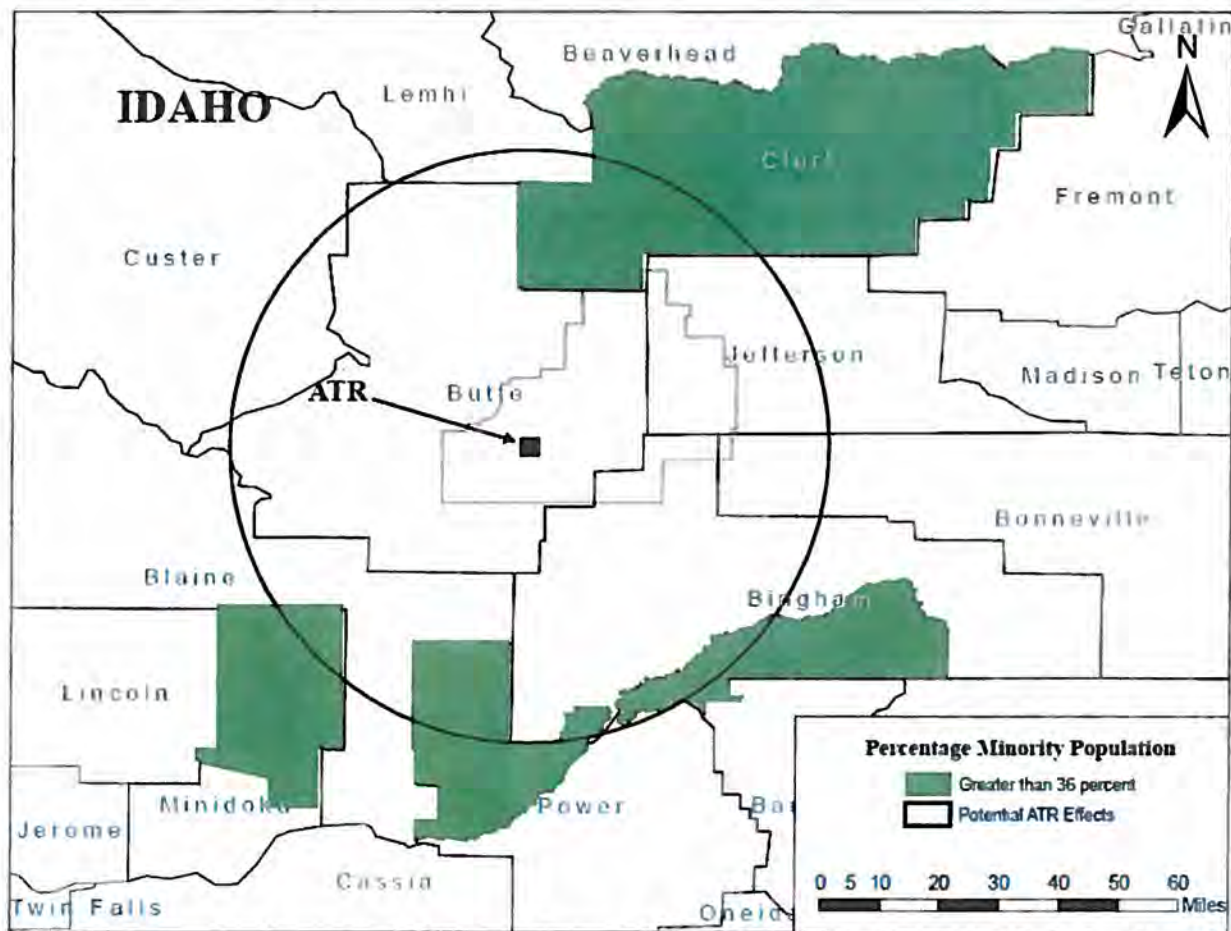


Minority and low-income populations are identified as block groups for which the percentage of minority or low-income percentages exceeds the site specific thresholds (Table 1-3). Of the 35 block groups within the 50-mile radius of ATR, 8 contained minority populations. No block groups contained low-income populations. Figure 1-4 show the geographical distribution of minority populations residing near INL in 2010 (no low-income populations were identified). Table 1-4 presents the data related to minority and low-income populations from the NI PEIS and based on current information for INL. As shown in that table, the minority population percentage has increased while the low-income population decreased slightly compared to the percentages presented in the NI PEIS.

**Table 1-4. Minority and Low-Income Populations for INL<sup>a</sup>**

	Estimate in NI PEIS	Current Estimate
Minority Population Percentage	10.1	17.5
Low-income Population Percentage	12.6	12.0

<sup>a</sup> As discussed in Section 1.5.2.11, the methodology for determining the potentially affected populations related to environmental justice (and health effects) differs in this SA from the methodology used in the NI PEIS. Although there are differences in the methodology for determining the population counts, these differences do not create a discernible difference in the impact results.



**Figure 1-4. Minority Populations Residing Within 50 Miles of ATR.**

**Oak Ridge Reservation**

The ROI for the environmental justice analysis was defined as an area within a 50-mile radius surrounding HFIR/REDC that encompasses parts of 26 counties in Tennessee, Kentucky, and North Carolina. In the decade between 2000 and 2010, the total population of the 26 counties increased by approximately 27 percent to 1,565,573. In 2010, minorities made up approximately nine percent of the population of the 26-county area surrounding HFIR/REDC. In 2010, approximately 35 percent of the total national population was comprised of persons self-designated as members of a minority group. Minorities made up 27 percent of the States of Tennessee, Kentucky, and North Carolina’s total population (Census 2012a). At the time of the 2010 census, Hispanics and Blacks were the largest minority groups within the 26-county area, each consisting of approximately 4 percent of the population. Two or more races made up approximately one percent and Asians made up nearly 1 percent (Census 2012a).

In 2010, the poverty threshold was \$17,552 for a family of three with one related child under 18 years of age. A total of 217,110 persons, or approximately 16 percent, residing within the 26-county area around HFIR/REDC reported incomes below that threshold (Census 2012c). Data obtained during the 2010 census show that of the total national population, approximately 14 percent reported incomes below the poverty threshold. Percentages for those below the poverty threshold in Tennessee, Kentucky, and North Carolina were approximately 16 percent (Census 2012c).

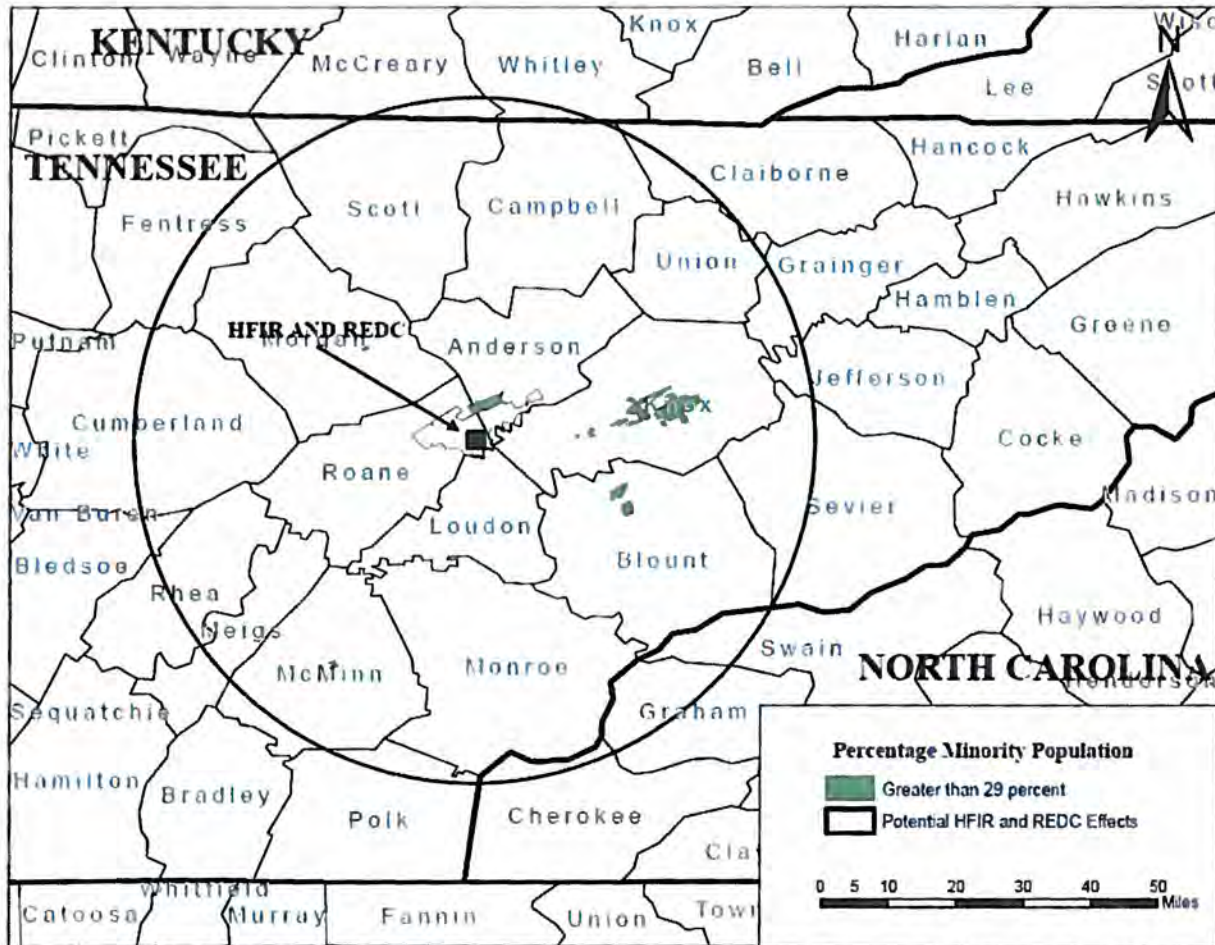
Minority and low-income populations are identified as block groups for which the percentage of minority or low-income percentages exceeds the site specific thresholds (Table 1-3). Of the 683 block groups within the 50-mile radius of HFIR/REDC, 37 contained minority populations only and 35 block groups contained low-income populations only. Nine block groups contained both minority and low-income populations. Figures 1-5 and 1-6 show the geographical distribution of minority and low-income populations residing near HFIR/REDC in 2010. Table 1-5 presents the data related to minority and low-income populations from the NI PEIS and based on current information for ORNL. As shown in that table, the minority and low-income population percentages increased compared to the percentages presented in the NI PEIS.

**Table 1-5. Minority and Low-Income Populations for ORR<sup>a</sup>**

	<b>Estimate in NI PEIS</b>	<b>Current Actual Data</b>
Minority Population Percentage	6.1	9.3
Low-income Population Percentage	16.0	16.4

<sup>a</sup> As discussed in Section 1.5.2.11, the methodology for determining the potentially affected populations related to environmental justice (and health effects) differs in this SA from the methodology used in the NI PEIS. Although there are differences in the methodology for determining the population counts, these differences do not create a discernible difference in the impact results.





**Figure 1-5. Minority Populations Residing Within 50 Miles of HFIR and REDC.**



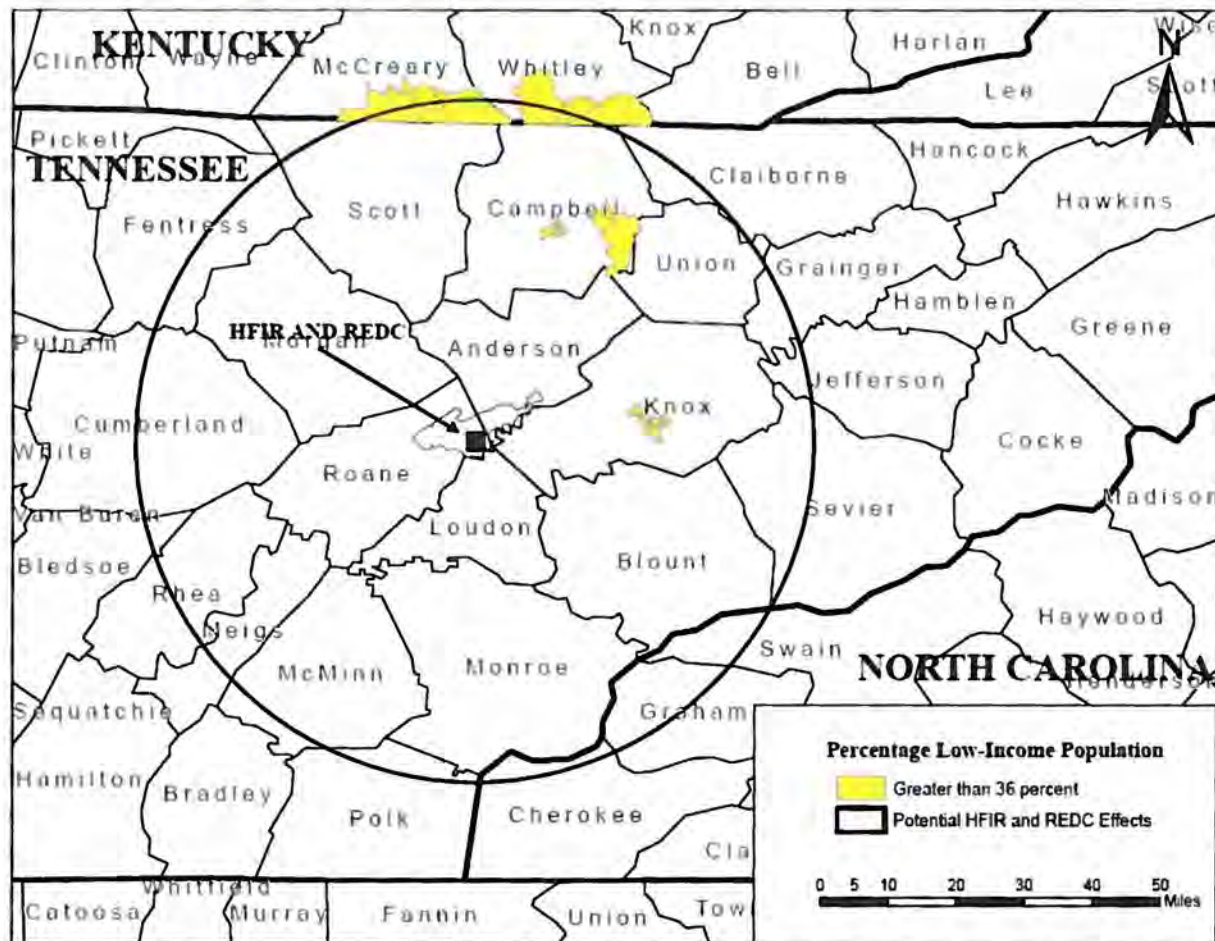


Figure 1-6. Low-Income Populations Residing Within 50 Miles of HFIR/REDC.

### 1.5.2.12 Waste Management

#### *Idaho National Laboratory*

Existing activities at INL generate both radioactive and non-radioactive wastes. For purposes of this SA, the potential radioactive wastes are most relevant. The NI PEIS stated that INL annually generated about 8,400 cubic yards of low-level waste (LLW) and about 300 cubic yards of mixed LLW (that is, wastes that have both a hazardous and radioactive constituent) (DOE 2000a). Based on more recent information, in 2010, more than 1,614 cubic yards of mixed LLW and 4,192 cubic yards of LLW were shipped off the

**Low-level Waste (LLW)**  
 Radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste or by-product material as defined by Section 11e (2), (3) and (4) of the *Atomic Energy Act of 1954*, as amended.

INL for treatment or disposal or both. Approximately 31 cubic yards of newly generated LLW were disposed of at the Subsurface Disposal Area in 2010. In accordance with the INL Site Treatment Plan, INL began receiving mixed waste from offsite locations for treatment in January 1996. Mixed waste has been received from other sites within the DOE complex. A backlog of

mixed waste is being managed in *Resource Conservation and Recovery Act* (RCRA)-permitted storage units at the INL Site. During 2010, INL treated or processed 6,802.9 cubic yards of legacy mixed waste, and 1,314.3 cubic yards of mixed LLW (INL 2011b).

### ***Oak Ridge Reservation/Oak Ridge National Laboratory***

Existing activities at ORR generate both radioactive and non-radioactive wastes. For purposes of this SA, the potential radioactive wastes are most relevant. The NI PEIS stated that ORR annually generated about 388,000 cubic yards of LLW, about 16 cubic yards of contact-handled transuranic (TRU) waste, about 15 cubic yards of remote-handled TRU waste, and about 2,100 cubic yards of mixed LLW (DOE 2000a). Based on more recent information, ORR generates approximately 9,500 cubic yards of solid LLW and 750 gallons of liquid LLW annually. Liquid LLW is treated (solidified) at on-site facilities. All LLW is transported off-site for disposal. ORR generates approximately 150 cubic yards of solid mixed LLW and 1,000 gallons of liquid mixed LLW. DOE operates a regional mixed LLW treatment facility at ORR. This includes the onsite treatment of ORR waste and could include treatment of some mixed LLW generated from other sites (NNSA 2011). During 2010, 373 cubic yards of contact-handled TRU waste and 71 cubic yards of remote-handled TRU waste were processed at the site. In 2010, 463 cubic yards of contact-handled TRU waste and 42 cubic yards of remote-handled TRU waste were shipped off-site (ORR 2012).

<p style="text-align: center;"><b>Transuranic (TRU) Waste</b></p> <p>Radioactive waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for (a) high-level radioactive waste; (b) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the EPA, does not need the degree of isolation required by the disposal regulations (40 CFR Part 191); or (c) waste that the NRC has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61.</p>
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## **1.5.3 Changes in DOE's Approach to NEPA Analyses**

### **1.5.3.1 Intentional Destructive Acts**

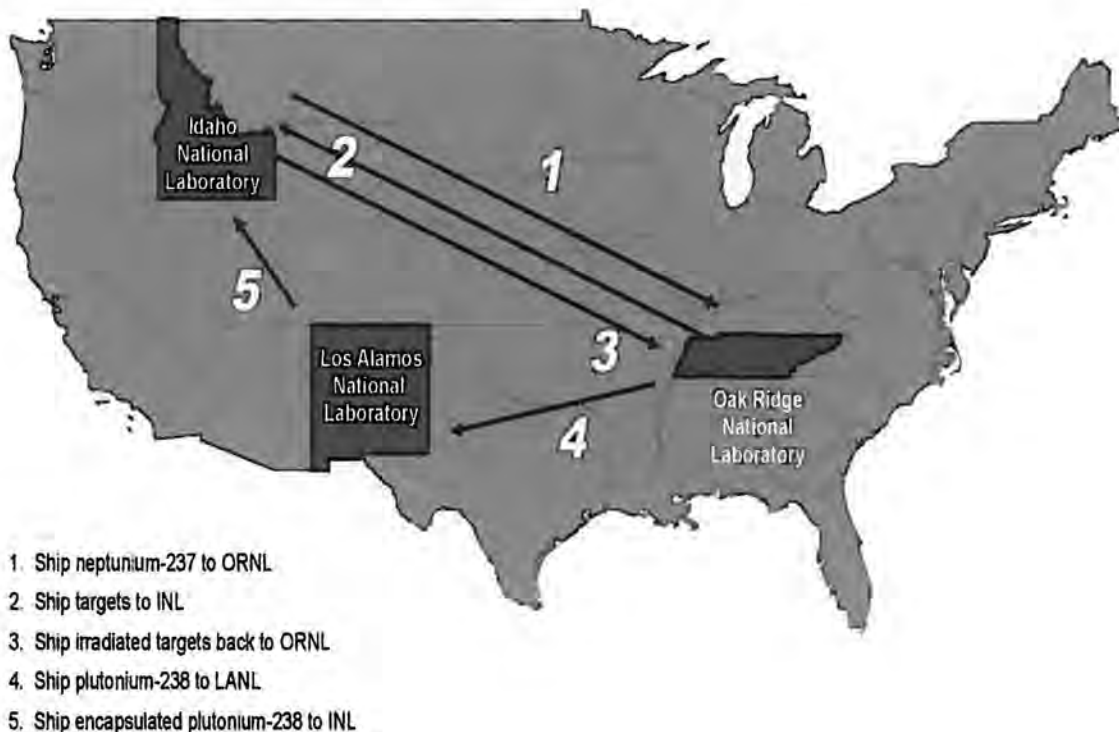
When the NI PEIS was prepared in 2000, DOE NEPA documents did not normally include an analysis of intentional destructive acts. Following the terrorist attacks of September 11, 2001, DOE has implemented measures to minimize the risk and consequences of potential terrorist attacks on its facilities and now, consistent with Council on Environmental Quality guidance, also analyzes the potential impacts of intentional destructive acts in NEPA documents.

It is not possible to predict whether intentional attacks would occur at any site, or the nature or types of such attacks. Nevertheless, DOE has re-evaluated security scenarios involving malevolent, terroristic, or intentionally destructive acts to assess potential vulnerabilities and identify improvements to security procedures and response measures. Security at its facilities is a critical priority for DOE. Therefore, DOE continues to identify and implement measures to defend and deter attacks. DOE maintains a system of regulations, orders, programs, guidance, and training that form the basis for maintaining, updating, and testing site security to preclude and mitigate any postulated terrorist actions.



The conservative assumptions inherent in the accidents analyzed in the NI PEIS for the Pu-238 production infrastructure assumed initiation by natural events, equipment failure, or inadvertent worker actions. The accidents evaluated in the NI PEIS included beyond-design-basis earthquakes and large-break-loss-of-coolant accidents, both of which could cause radiological materials to be released to the environment. These same events could be caused by intentional malevolent acts by saboteurs or terrorists. However, the resulting radiological release and consequences to workers and the public would be similar, regardless of the nature of the initiating event. Notwithstanding the remote risk of a terrorist attack that affected operations at any Pu-238 production facilities, in the remote likelihood that a terrorist attack would successfully breach the physical and other safeguards at DOE facilities resulting in the release of radionuclides, the potential consequences would be no worse than those of the highest consequence accident analyzed in the NI PEIS.

There is also a potential for attempted sabotage or terrorist attack during transport. Figure 1-7 illustrates the transportation associated with Pu-238 production. Although it is not possible to predict the occurrence of sabotage or terrorism or the exact nature of such events if they were to occur, DOE has examined acts of sabotage and terrorism for spent nuclear fuel and high-level radioactive waste shipments (see the *Final Supplemental Environmental Impact Statement for a*



Source: DOE 2005.

**Figure 1-7. Transportation for Pu-238 Production.**

*Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* [DOE/EIS-0250F-S1, June 2008] [DOE 2008b]). That analysis conservatively estimated (that is, tended to overstate the risk) the potential impacts of a terrorist event in which a high energy density device penetrated a rail or truck cask of spent nuclear fuel. DOE estimated that there would be 28 latent cancer fatalities in the exposed population if the sabotage event occurred in an urban area. If the sabotage event took place in a rural area, DOE estimated that the probability of a single latent cancer fatality in the exposed population would be 0.055 (1 chance in 20) (DOE 2008b). The quantities of radioactive materials transported for Pu-238 production would be significantly lower than the quantities of the materials used for the above analysis. For example, a typical spent nuclear fuel cask contains up to 6 metric tons of radioactive materials, including approximately 200 ounces of Pu-238, while the maximum quantity of Pu-238 that would be transported for Pu-238 production would be less than approximately 13 ounces (DOE 2008b, DOE 2001). Therefore, the above estimates of risk bound the risks from an act of sabotage or terrorism involving the radioactive material transported for Pu-238 production.

### **1.5.3.2 Dose Conversion Factor**

In converting doses to potential cancer fatalities, the NI PEIS used a factor of  $5 \times 10^{-4}$  fatality per rem for the public, and a factor of  $4 \times 10^{-4}$  fatality per rem for workers. The value for workers was lower due to the absence of children and the elderly, who were considered to be more radiosensitive (DOE 2000a). Since publication of the NI PEIS, DOE Guidance (DOE 2003) recommends that agencies use a conversion guidance factor of  $6 \times 10^{-4}$  fatality per rem for both workers and members of the public. The DOE guidance recommends use of factors developed by the Interagency Steering Committee on Radiation Standards (ISCORS 2002). Using the higher conversion factor would increase the potential radiological impacts presented in the NI PEIS by 50 percent for workers and 20 percent for the public. Table 3-1 presents the results of this change, along with the results of other changes that have occurred since publication of the NI PEIS.

### **1.5.3.3 Greenhouse Gas Analysis**

In February 2010, the Council on Environmental Quality (CEQ) provided draft guidance memorandum for public consideration and comment on the ways in which Federal agencies can improve their consideration of the effects of greenhouse gas (GHG) emissions and climate change in their evaluation of proposals for Federal actions under NEPA (CEQ 2010). That draft guidance is intended to help explain how agencies of the Federal government should analyze the environmental effects of GHG emissions and climate change when they describe the environmental effects of a proposed agency action in accordance with NEPA. Where appropriate, DOE NEPA documents now consider the potential impacts associated with GHG emissions. Under the CEQ draft guidance, if a proposed action would be reasonably anticipated to cause direct emissions<sup>3</sup> of 25,000 metric tons or more of carbon dioxide-equivalent (CO<sub>2</sub>-

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<sup>3</sup> Direct GHG emissions are from sources that are owned or controlled by the reporting entity. This can include emissions from fossil fuels burned on site, emissions from agency-owned or agency-leased vehicles, and other direct sources. Indirect GHG emissions result from the generation of electricity, heat, or steam generated off site but purchased by the reporting agency. Indirect GHG emissions also result from employee travel and commuting.



equivalent) GHG emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. For long-term actions that have annual direct emissions of less than 25,000 metric tons of CO<sub>2</sub>-equivalent, CEQ encourages Federal agencies to consider whether the action's long-term emissions should receive similar analysis. CEQ does not propose this as an indicator of a threshold of significant effects, but rather as an indicator of a minimum level of GHG emissions that may warrant some description in the appropriate NEPA analysis for agency actions involving direct emissions of GHGs. With respect to the production of Pu-238, annual direct GHG emissions would be essentially zero metric tons of CO<sub>2</sub>-equivalent and would be a negligible consideration. The indirect GHG emissions associated with transportation (both workers and material transports) would be well below 25,000 metric tons of CO<sub>2</sub>-equivalent.

## **1.6 Alternatives Considered But Eliminated From Detailed Analysis**

This SA evaluates the use of existing facilities identified in the NI PEIS and 2004 SA for Pu-238 production to meet reasonably foreseeable requirements. In preparing this SA, DOE considered, but did not identify any other reasonable alternatives that should be considered for detailed analysis to meet mission requirements. This section discusses alternatives that were considered but eliminated from detailed analysis in this SA.

In June 2006, DOE established a Pu-238 Supply Program Alternatives Analysis Team (Team) to provide an experienced and independent comparative evaluation of the various potential options DOE could consider for production of Pu-238 (DOE 2012b). The Team was provided with DOE's programmatic objectives for Pu-238 production:

- Any required source material must be readily available in the United States, without requiring the development of reprocessing technologies or investment in systems to separate material from identified sources.
- It must be cost, schedule, and risk competitive with existing baseline technology.
- Any identified facilities required to support the concept must be available to the program for the entire life cycle (notionally 35 years, unless the concept is so novel as to require a shorter duration).
- It must present a solution that can generate at least 1.5 kilograms of Pu-238 per year, for at least 35 years.
- It must present a low-programmatic risk, near-term solution to NASA's urgent mission need.

In evaluating potential options for Pu-238 production, the Team reviewed the alternatives/options analysis for those options in the NI PEIS and the summary of the reasons certain irradiation facilities were dismissed from further consideration in the NI PEIS. The Team also dismissed alternatives based on immature technology that were not considered feasible for near-term implementation.

The Team developed six options, all of which would use existing facilities, to reestablish Pu-238 production. All of the six options include continuing neptunium storage at INL, and irradiation at HIFR at ORNL and ATR at INL:

- Option 1a: Target fabrication and target processing at ORNL (existing Pu-238 Production Infrastructure)
- Option 1b: Target fabrication at Babcock and Wilcox (B&W) facility, target processing at ORNL
- Option 2a: Target fabrication and processing at INL
- Option 2b: Target fabrication at B&W facility, target processing at INL
- Option 3a: Target fabrication at ORNL and target processing at SRS
- Option 3b: Target fabrication at B&W facility and target processing at SRS (DOE 2012b).

In developing these options, the Team did not reconsider use of the Fuels and Materials Examination Facility (FMEF) at Hanford or the Fluorinel Dissolution Process Facility (FDPF) at INL for target fabrication and chemical processing, even though these options were analyzed as reasonable alternatives in the NI PEIS. The NI PEIS ROD identifies the programmatic reason for selecting the preferred alternative, including the use of REDC, as "the Department's confidence in the facilities' cost estimates, technical capabilities, and consistency with existing onsite target irradiation and processing activities." Nothing has changed to improve the relative programmatic attractiveness of these facilities in the intervening years. Both FDPF and FMEF would require significant additional construction, equipment purchase and safeguards and security upgrades in order to be used for Pu-238 production. All of this adds to project risk, cost and time. In addition, the concept for Pu-238 production in REDC is to work on a campaign basis alongside other programs, minimizing the need for dedicated facilities and equipment and their associated overhead costs. Lacking any other use, both FMEF and FDPF would have to be operated as dedicated, stand-alone facilities so all the operational and maintenance cost for this type of operation would have to be borne by the Pu-238 restart program. Both facilities are significantly oversized as to available floor space compared to what would be needed. While a new cost estimate was not prepared, this difference would be expected to significantly increase cost and reduce operational flexibility as compared to the preferred alternative. The NI PEIS also stated that the environmental impacts were estimated to be small for all of the alternatives and so did not provide a reasonable basis for discriminating among alternatives. This conclusion remains valid today.

The *Pu-238 Production Alternatives Analysis Final Report* (DOE 2012b) identified the preferred option as conducting target irradiation at ATR and HFIR, target fabrication and chemical separations processing at ORNL, and continued Np-237 storage at INL. In evaluating the six options identified above, the Team considered the following factors: cost, schedule, risk to all project objectives, environmental impact, worker and public safety, scalability, and transportation/system elements. The Team concluded, in its final report dated September 2012, "It is the collective opinion of the Team that continuing with Option 1a: 'Target fabrication and target processing at ORNL, irradiation at HFIR and ATR, neptunium storage at INL' provides the lowest cost and lowest risk to DOE. It also reestablishes Pu-238 production in the shortest time" (DOE 2012b). After reconsidering the six options described above, the Team concluded that "any of the six options can be made to work. However, there are more cost, schedule, and project risk uncertainties associated with the various options as compared to the preferred Option 1a" (DOE 2012b). Therefore, the Team concluded, and DOE agrees with, this alternatives analysis using the most recent information, and confirms that the decisions announced in the 2001 ROD and the 2004 amended ROD still offer the most appropriate path forward for Pu-238

production. Section 2.0 provides details on the existing Pu-238 production infrastructure described by Option 1a.

## 2.0 DESCRIPTION OF PROPOSED PU-238 PRODUCTION INFRASTRUCTURE

DOE proposes to implement the decisions made in the NI PEIS ROD and amendment to that ROD (described in Section 1.2) to produce Pu-238 using the facilities described below, as follows:

- Section 2.1 discusses the MFC at INL which stores Np-237;
- Section 2.2 discusses the REDC at ORNL which would fabricate targets from Np-237 and then process irradiated targets;
- Section 2.3 discusses the ATR, which would be used to irradiates targets; and
- Section 2.4 discusses the HFIR, which could also be used to irradiate targets.

### 2.1 Materials and Fuels Complex (MFC) at INL

The Np-237 is currently stored at the MFC. The use of the MFC for storage of special nuclear material (SNM) is consistent with the 2004 SA and amended NI PEIS ROD published on August 13, 2004.

### 2.2 Radiochemical Engineering Development Center (REDC) at ORNL

REDC is a hot cell facility located at ORNL (see Figure 1-2, which shows the location of REDC at ORNL). Target fabrication will be performed in REDC in a glovebox. Irradiated target processing will also be conducted within REDC using an existing hot cell area in which targets will be dissolved to separate neptunium and plutonium from fission products and structural materials of the target. After chemical separations, the solutions will be transferred to separate neptunium and plutonium lines for precipitation, calcination, and packaging. These lines will be located in existing space in REDC. REDC houses analytical laboratories and heavily shielded hot cells used for fabrication of items to be irradiated in HFIR and processing of irradiated items for separation and purification of transuranic elements, process development, and product purification and packaging. The activities required for production of Pu-238 targets would take place in shielded gloveboxes. Pu-238 processing would require some internal modifications to the facility including the installation of additional equipment. The use of REDC for these purposes is consistent with the NI PEIS and ROD published on January 26, 2001.

#### Glovebox

A glovebox is a fully enclosed and ventilated containment device, which is used to protect workers from radioactive materials.

#### Hot Cell

A shielded facility that requires the use of remote manipulators for handling radioactive materials.



## **2.3 Advanced Test Reactor (ATR) at INL**

The ATR (see Figure 1-3, which shows the location of the ATR at the Reactor Technology Complex at INL) is a pressurized, light-water moderated and cooled, beryllium-reflected, enriched-uranium-fueled reactor with an operating power of 250 megawatts (thermal) located at INL. ATR began operation in 1967. It is one of the two reactors (the other being HFIR) planned to be used for target irradiation, as decided in the ROD published on January 26, 2001.

The ATR would continue to operate and meet its current mission requirements including naval reactor research and development, medical and industrial isotope production, and civilian nuclear research and development activities, at its current operating capacities. The reactor vessel is entirely stainless steel and the core internals are replaced every 7 to 9 years (DOE 2000a). INL has an on-going life extension program to ensure ATR will continue to meet its mission requirements. The production planning assumption for ATR is for up to 5 kilograms of Pu-238 per year. The ATR alone would have the capability to meet programmatic requirements for producing up to 5 kilograms of Pu-238 per year. The use of ATR for irradiating Np-237 targets is consistent with the NI PEIS and ROD published on January 26, 2001.

## **2.4 High Flux Isotope Reactor (HFIR) at ORNL**

The HFIR at ORNL (see Figure 1-3) is a pressurized, light water moderated and cooled, beryllium-reflected, enriched-uranium-fueled reactor with an operating power of 85 megawatts (thermal) located at ORNL. HFIR began operation in 1965. HFIR is one of the two reactors to be used for target irradiation, along with ATR, as was decided in the ROD published on January 26, 2001.

HFIR would continue to operate and meet its current primary mission requirements of neutron-science-based research for the DOE Office of Science. In addition, medical and industrial isotope production and civilian nuclear energy research and development activities would be performed on a not-to-interfere basis at its current operating level of 85 megawatts (thermal). The production planning assumption for HFIR is that up to the 2 kilograms of Pu-238 per year can be produced without impacting other ongoing missions at HFIR. A number of measures have been taken to extend the useful life of the reactor and subsequent life-extension programs are expected to enable HFIR to produce Pu-238, as required, over the next 35 years. The use of HFIR for these purposes is consistent with the NI PEIS and ROD published on January 26, 2001.

## **3.0 COMPARISON OF IMPACTS**

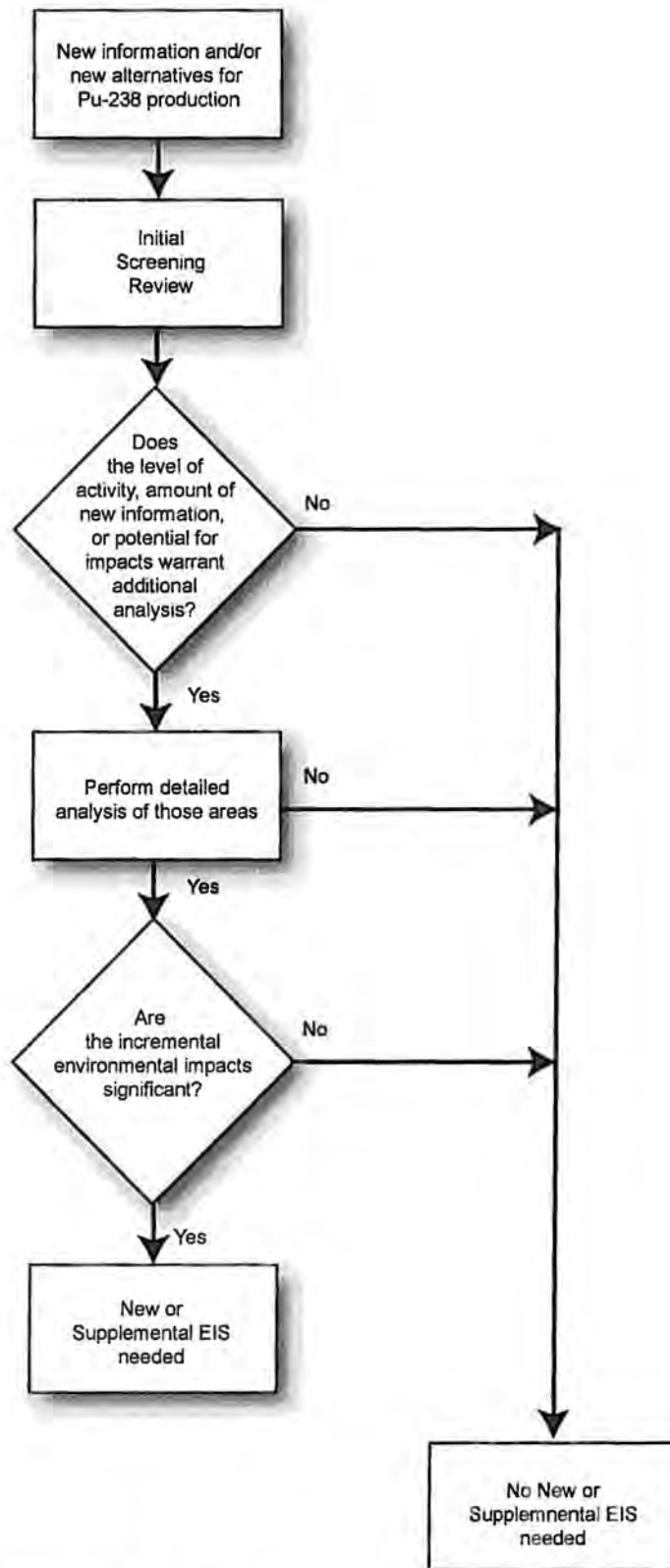
### **3.1 Introduction**

Figure 3-1 illustrates the impact assessment process DOE used in this SA. As this figure indicates, DOE conducted an initial screening review to determine whether there are new circumstances or information relevant to environmental concerns or impacts bearing on implementing the decision to produce Pu-238 which would require the preparation of a Supplemental EIS. This review was intended to identify whether associated levels of activity or potential for impact on a particular resource area, either individually or collectively, warranted additional analysis. No further analysis was to be conducted for those resource areas where it



was evident from the initial screening that associated impacts would be minimal and bounded by the impacts identified in the prior NEPA documents referred to in Section 1.4.

To the extent other resource areas required further analysis to determine (1) whether potential impacts on the areas were outside the envelope of environmental consequences identified in the NI PEIS and the 2004 SA, and (2) if so, whether the impacts could be considered significant within the context of NEPA (40 CFR 1508.27), which would require preparation of a new or supplemental EIS. The “sliding-scale” approach was used such that analyses for the resource areas are in proportion to the potential significance of the impacts.



**Figure 3-1. Impact Assessment Process Used in this Supplement Analysis.**

### 3.2 Environmental Impacts

This section presents: (1) a summary of the environmental impacts from the original NEPA documents (e.g., the NI PEIS and the 2004 SA) for the alternative selected in the ROD for the NI PEIS as modified in the amended ROD for the 2004 SA (hereafter, this is referred to as the “analyzed alternative”); (2) the current estimate of impacts for the analyzed alternative; and (3) an analysis of whether the current estimate of impacts represents significant new circumstances or information relevant to environmental concerns. Table 3-1 presents this information in a comparative fashion for each resource area. The middle column of Table 3-1 presents the impacts previously identified in the NI PEIS and 2004 SA; the last column presents the current estimate of impacts; below these columns, for each resource analyzed, is a brief narrative comparison. For those resources in which impacts have changed, Section 3.2.1 provides a more detailed analysis of these changes. Together, Table 3-1 and Section 3.2.1 document the results of the impact assessment process (as depicted in Figure 3-1) used in this SA.

**Table 3-1. Summary Comparison of Impacts**

Resource Area	Impacts from the NI PEIS and 2004 SA for the Analyzed Alternative	Current impacts for the Analyzed Alternative
<b>Land Resources</b>		
ATR	No impact – use of the facility for Np-237 target irradiation would be compatible with its current mission.	No change from impacts discussed in the NI PEIS.
MFC	No impact - use of this facility would require internal modifications, but no new facilities would be built.	No change from impacts discussed in the NI PEIS or 2004 SA.
HFIR	No Impact - use of the facility for Np-237 target irradiation would be compatible with its current mission.	No change from impacts discussed in the NI PEIS.
REDC	No Impact – use of this facility for Np-237 fabrication would require internal modifications, but no new facilities would be built.	No change from impacts discussed in the NI PEIS.
<b>Comparison to the NI PEIS:</b> There are no notable changes in impacts to land resources at INL or ORNL since the issuance of the NI PEIS. All facilities proposed are existing facilities and would not involve any new construction. Because no additional land would be disturbed and the proposed activities would be compatible with present missions of facilities there would be little or no impacts to land use at INL or ORNL.		
<b>Visual Resources</b>		
INL (ATR and MFC)	No impact – no external modification required.	No change
ORR (HFIR and REDC)	No impact - no external modification required.	No change
<b>Comparison to the NI PEIS and 2004 SA:</b> There are no notable changes in impacts to visual resources at INL or ORNL since the issuance of the NI PEIS. All facilities proposed are existing facilities and would not involve external modifications. Because there would be no change in external appearance there would be little or no impacts to visual resources at INL or ORNL.		
<b>Noise</b>		
ATR	No impact – noise associated with Np-237 target irradiation would be similar to sound levels generated by current reactor operations, as well as other operations in the ATR Complex.	Little or no change



Resource Area	Impacts from the NI PEIS and 2004 SA for the Analyzed Alternative	Current impacts for the Analyzed Alternative
MFC	No impact – noise associated with storage of NpO <sub>2</sub> is included within the sound levels generated by current operations. Changes in traffic volume going to and from MFC would be minor, and would not lead to noticeable changes in noise levels.	Little or no change
HFIR	No impact – noise associated with Np-237 target irradiation would be similar to sound levels generated by current reactor operations.	Little or no change
REDC	No impact – noise impacts would not be expected from Np-237 target fabrication and processing.	Little or no change
<p><b>Comparison to the NI PEIS and 2004 SA:</b> There are no notable changes in impacts to noise resources at INL or ORNL since the issuance of the NI PEIS. Noise associated with Np-237 operations in REDC and HFIR would be similar to sound levels associated with current operations, as well as other operations conducted at ORNL. Onsite noise impacts are expected to be minimal, and offsite noise levels would not be noticeable. Traffic increases would be minor and would not lead to noticeable noise levels either on or offsite. Noise generated during the irradiation of Np-237 targets in HFIR would be similar to sound levels associated with current reactor operations, as well as other operations conducted within the area. Onsite noise impacts would be expected to be minimal, and changes in offsite noise levels would not be noticeable. Changes in traffic volume going to and from HFIR would be small, and would result in only minor changes to onsite and offsite noise levels. There would be no loud noises associated with Np-237 target irradiation that would adversely impact wildlife.</p> <p>The irradiation of Np-237 targets in ATR would not result in noise impacts at INL. Site noise associated with storage of NpO<sub>2</sub> is included within the sound levels generated by current operations. Onsite noise impacts would be expected to be minimal, and offsite noise levels should not change compared to those previously analyzed in the NI PEIS and 2004 SA. Changes in traffic volume going to and from INL would be small and would result in only minor changes to onsite and offsite noise levels.</p>		
<b>Air Quality- Nonradiological Emissions</b>		
ATR	No impact – there would be no measurable increases in nonradiological air pollutant emissions.	No change
MFC	No impact – there would be no measurable increases in nonradiological air pollutant emissions.	No change
HFIR	No impact – there would be no measurable nonradiological air pollutant emissions associated with the operation of HFIR.	No change
REDC	No impact – there would be no measurable nonradiological air pollutant emissions associated with the operation of REDC. Changes in concentrations of NO <sub>2</sub> and SO <sub>2</sub> were determined to be small and would be below the applicable standard even when ambient monitored values and the contribution from other site activities were included.	No change
<p><b>Comparison to the NI PEIS and 2004 SA:</b> There are no notable changes in impacts to air quality at INL or ORNL since the issuance of the NI PEIS. There would be no additional nonradiological air pollutant emissions associated with the storage of NpO<sub>2</sub> at MFC over the next 35 years; thus, there would be no change in</p>		

Resource Area	Impacts from the NI PEIS and 2004 SA for the Analyzed Alternative	Current impacts for the Analyzed Alternative
<p>nonradiological air quality impacts. It is estimated that there would be no measurable nonradiological air pollutant emissions at INL and ORNL associated with Np-237 operations in ATR and HFIR. Further, because there would be little or no change in nonradiological air emissions, there would be little or no change in GHGs at either ORNL or INL.</p>		
<p><b>Water Resources</b></p>		
ATR	No impact – the irradiation of Np-237 would have no measurable impact on water resources.	No change
MFC	No impact – there would be no measurable impact on water resources.	No change
HFIR	No impact – the irradiation of Np-237 would have no measurable impact on water resources.	No change
REDC	No impact – a relatively small increase in water use and sanitary wastewater generation is projected mainly to support the additional staffing.	No change
<p><b>Comparison to the NI PEIS and 2004 SA:</b> There are no notable changes in impacts to water resources at INL or ORNL since the issuance of the NI PEIS. Operations would not be expected to impact water resources as Pu-238 production would not measurably increase water use or change the quality or quantity of effluents discharged. There would be additional process wastewater generated per year, but the quantity would be negligible relative to the total volume of process wastewater generated and treated at the ORNL Process Waste Treatment Complex.</p>		
<p><b>Geology and Soils</b></p>		
INL (ATR and MFC)	No impact – no new construction planned, there would be no disturbance to either geologic or soil resources.	No change.
ORR (HFIR and REDC)	No impact – no new construction planned, there would be no disturbance to either geologic or soil resources.	No change.
<p><b>Comparison to the NI PEIS and 2004 SA:</b> There are no notable changes in impacts to geology and soils at INL or ORNL since the issuance of the NI PEIS. HFIR could be used to irradiate Np-237 targets. Because there would be no construction, there would be no disturbance to either geologic or soil resources in the area of ORNL. Hazards from large-scale geologic conditions at ORNL, such as earthquakes and volcanoes, were evaluated in the NI PEIS. The analysis determined that these hazards present a low risk to specially designed or upgraded facilities (such as HFIR and REDC), and is not revisited here.</p> <p>The use of ATR to irradiate Np-237 targets would not be expected to result in impacts on geologic or soil resources, nor be jeopardized by large-scale geologic conditions. The use of MFC to store NpO<sub>2</sub> would not be expected to result in significant change in impacts on geologic or soil resources, as already analyzed in the NI PEIS. Because there would be no construction, there would be no disturbance to either geologic or soil resources in the MFC Area of the INL. Hazards from large-scale geologic conditions at INL, such as earthquakes and volcanoes, were evaluated in the NI PEIS.</p>		
<p><b>Ecological Resources</b></p>		
INL (ATR and MFC)	No impact – no new construction would occur that could cause direct disturbance to ecological resources, including wetlands	Little or no change
ORR (HFIR and REDC)	No impact – no new construction would occur that could cause direct disturbance to ecological resources, including	Little or no change

Resource Area	Impacts from the NI PEIS and 2004 SA for the Analyzed Alternative	Current impacts for the Analyzed Alternative
	wetlands.	
<p><b>Comparison to the NI PEIS:</b> Since the NI PEIS was issued, changes to threatened and endangered species at the INL have been limited to changes in several species designations by the USFWS and the Idaho Department of Fish and Game. Since the NI PEIS was issued, changes to threatened and endangered species at the ORNL have been limited to changes in several species designations by the USFWS and the Tennessee Wildlife Resources Commission. No new construction would occur at the proposed facilities that could cause direct disturbance to ecological resources, including wetlands.</p>		
<b>Cultural and Paleontological Resources</b>		
INL (ATR and MFC)	No impact – no new construction would occur that could cause impacts to cultural and paleontological resources.	No change
ORR (HFIR and REDC)	No impact – no new construction would occur that could cause impacts to cultural and paleontological resources.	No change
<p><b>Comparison to the NI PEIS and 2004 SA:</b> There are no notable changes in impacts to cultural and paleontological resources at INL or ORNL since the issuance of the NI PEIS. With the current scope, existing facilities will be used at MFC for the NpO<sub>2</sub> storage. Pu-238 production would not require any new construction or disturbance of the ground. Therefore, direct impacts on cultural and paleontological resources would not occur. Also, Native American resources occurring in the vicinity of MFC would not be impacted by the storage of NpO<sub>2</sub>. No prehistoric properties have been located within or immediately adjacent to ORNL's REDC and HFIR.</p>		
<b>Socioeconomics</b>		
<p>INL  <i>Note: The ROI for INL is a four-county area consisting of Bonneville, Bingham, Bannock and Jefferson Counties, which is the same ROI used in the NI PEIS.</i></p>	<p>INL Employment (1997): 8,291                      ROI Population (1996): 213,547                      No impact – no new employment is anticipated.</p>	<p>INL Employment (2011): 8,452                      ROI Population (2010): 258,820</p>
<p>ORNL  <i>Note: ROI is a four-county area consisting of Anderson, Knox, Loudon, and Roane Counties, which is the same ROI used in the NI PEIS.</i></p>	<p>ORR Employment (1998): 14,215                      ROI Population (1998): 528,017                      Target fabrication and processing of Np-237 targets at ORR would require about 41 additional workers to operate these facilities. This level of employment would generate direct and indirect jobs, but would have no noticeable impact on the regional economic area.</p>	<p>ORR Employment (2011): 12,100                      ROI Population (2010): 610,092</p>
<p><b>Comparison to the NI PEIS and 2004 SA:</b> Impacts to socioeconomic resources would not be substantially different from the analyses presented in the NI PEIS. Employment at INL increased slightly, while employment at ORR decreased, but those changes were not related to Pu-238 production. Staffing requirements for Pu-238 production remain the same as those evaluated in the NI PEIS.</p>		
<b>Public and Occupational Health and Safety – Normal Operations<sup>a</sup></b>		
ATR – Total Annual Dose to Population within 50 miles		
Dose (person-rem)	0	No change
35-yr LCF	0	No change
ATR – Maximally exposed individual		
Annual dose (mrem)	0	No change
35-yr LCF risk	0	No change
ATR – Average exposed individual within 50 miles		
Annual dose (mrem)	0	No change
35-yr LCF risk	0	No change



Resource Area	Impacts from the NI PEIS and 2004 SA for the Analyzed Alternative	Current impacts for the Analyzed Alternative
<b>ATR – Total annual worker dose</b>		
Dose (person-rem)	0	No change
35-yr LCF risk	0	No change
<b>HFIR – Total Annual Dose to Population within 50 miles</b>		
Dose (person-rem)	0	No change
35-yr LCF	0	No change
<b>HFIR – Maximally exposed individual</b>		
Annual dose (mrem)	0	No change
35-yr LCF risk	0	No change
<b>HFIR – Average exposed individual within 50 miles</b>		
Annual dose (mrem)	0	No change
35-yr LCF risk	0	No change
<b>HFIR – Total annual worker dose</b>		
Dose (person-rem)	0	No change
35-yr LCF risk	0	No change
<b>REDC – Total Annual Dose to Population within 50 miles</b>		
Dose (person-rem)	$8.8 \times 10^{-5}$	$1.1 \times 10^{-1}$
35-yr LCF	$1.5 \times 10^{-6}$	$2.3 \times 10^{-6}$
<b>REDC – Maximally exposed individual</b>		
Annual dose (mrem)	$1.9 \times 10^{-6}$	No change
35-yr LCF risk	$3.3 \times 10^{-11}$	$3.9 \times 10^{-11}$
<b>REDC – Average exposed individual within 50 miles</b>		
Annual dose (mrem)	$7.8 \times 10^{-8}$	No change
35-yr LCF risk	$1.4 \times 10^{-12}$	$2.0 \times 10^{-12}$
<b>REDC – Total annual worker dose</b>		
Dose (person-rem)	12	No change
35-yr LCF risk	0.17	0.25
<b>MFC – Total Annual Dose to Population within 50 miles</b>		
Dose (person-rem)	$3.8 \times 10^{-6}$	$4.4 \times 10^{-6}$
35-yr LCF	$6.7 \times 10^{-8}$	$9.1 \times 10^{-8}$
<b>MFC – Maximally exposed individual</b>		
Annual dose (mrem)	$2.6 \times 10^{-10}$	No change
35-yr LCF	$4.6 \times 10^{-12}$	$5.5 \times 10^{-12}$
<b>MFC – Average exposed individual within 50 miles</b>		
Annual dose (mrem)	ND (The 2004 SA did not calculate this parameter)	$1.4 \times 10^{-8}$
35-yr LCF risk	ND (The 2004 SA did not calculate this parameter)	$2.9 \times 10^{-13}$
<b>MFC – Total annual worker dose</b>		
Dose (person-rem)	12	No change
35-yr LCF risk	0.17	0.25
<p><b>Comparison to the NI PEIS and 2004 SA:</b> Impacts on public human health from normal operations are expected to be very small, as both the NI PEIS and 2004 SA projected. Because workloads are expected to be the same as those analyzed in the NI PEIS and 2004 SA, the only factors that would affect potential impacts would be population changes at the sites and the revised dose conversion factor discussed in Section 1.5.3.2. At INL, the 50-mile population has increased by approximately 15% compared to the population analyzed in the NI PEIS. At ORNL, the 50-mile population has increased by approximately 27% compared to the population analyzed in the NI PEIS. Consequently, this factor alone would increase the total 50-mile population dose at INL by 15% and would increase the total 50-mile population dose at ORNL by 27%. The dose to the average exposed individual within 50 miles, the dose to the maximally exposed individual, and the dose to workers would be unaffected. With respect to the revised dose conversion factor, using the higher conversion factor would increase the potential radiological impacts presented in the NI PEIS by 50% for workers and 20% for the public. These changes are presented in the “current impacts” column above. As shown in that column, the potential impacts</p>		

Resource Area	Impacts from the NI PEIS and 2004 SA for the Analyzed Alternative	Current impacts for the Analyzed Alternative
<p>would remain small (less than 1 latent cancer fatality [LCF] for the public and workers over the 35-year duration of Pu-238 production activities) and well below any regulatory requirements.</p>		
<p><b>Public and Occupational Health and Safety – Facility Accidents<sup>a</sup></b></p>		
<p>ATR</p>	<p>For 35 years of target irradiation, the increased risk of LCF to the maximally exposed offsite individual and to a noninvolved worker would be <math>1.49 \times 10^{-7}</math> and <math>1.95 \times 10^{-6}</math> respectively. The increased number of LCFs in the surrounding population would be <math>7.01 \times 10^{-4}</math>.</p>	<p>For 35 years of Pu-238 production, the increased risk of LCF to the maximally exposed offsite individual and to a noninvolved worker would be <math>1.8 \times 10^{-7}</math> and <math>2.9 \times 10^{-6}</math> respectively. The increased number of LCFs in the surrounding population would be <math>9.7 \times 10^{-4}</math>.</p>
<p>HFIR</p>	<p>For 35 years of target irradiation, the increased risk of LCF to the maximally exposed offsite individual and to a noninvolved worker would be <math>8.68 \times 10^{-9}</math> and <math>3.43 \times 10^{-8}</math> respectively. The increased number of LCFs in the surrounding population would be <math>4.09 \times 10^{-5}</math>.</p>	<p>For 35 years of Pu-238 production, the increased risk of LCF to the maximally exposed offsite individual and to a noninvolved worker would be <math>1.0 \times 10^{-8}</math> and <math>5.1 \times 10^{-8}</math> respectively. The increased number of LCFs in the surrounding population would be <math>6.2 \times 10^{-5}</math>.</p>
<p>REDC</p>	<p>For 35 years of target irradiation, the increased risk of LCF to the maximally exposed offsite individual and to a noninvolved worker would be <math>5.71 \times 10^{-5}</math> and <math>3.50 \times 10^{-4}</math>. The increased number of LCFs in the surrounding population would be 0.157.</p>	<p>For 35 years of Pu-238 production, the increased risk of LCF to the maximally exposed offsite individual and to a noninvolved worker would be <math>6.8 \times 10^{-5}</math> and <math>5.2 \times 10^{-4}</math>. The increased number of LCFs in the surrounding population would be 0.24.</p>
<p>MFC</p>	<p>For 35 years of target irradiation, the increased risk of LCF to the maximally exposed offsite individual and to a noninvolved worker would be <math>1.5 \times 10^{-5}</math> and <math>3.5 \times 10^{-4}</math> respectively. The increased number of LCFs in the surrounding population would be 0.03.</p>	<p>For 35 years of Pu-238 production, the increased risk of LCF to the maximally exposed offsite individual and to a noninvolved worker would be <math>2.2 \times 10^{-5}</math> and <math>4.0 \times 10^{-4}</math> respectively. The increased number of LCFs in the surrounding population would be 0.04.</p>
<p><b>Comparison to the NI PEIS and 2004 SA:</b> Impacts on public human health from accidents are expected to be very small, as both the NI PEIS and 2004 SA projected. Because the facilities used, and the operations, would be as those analyzed in the NI PEIS and 2004 SA, the accident scenarios would not change. Additionally, because workloads are expected to be the same as those analyzed in the NI PEIS and 2004 SA, the only factors that would affect potential impacts would be population changes at the sites and the revised dose conversion factor discussed in Section 1.5.3.2. At INL, the 50-mile population has increased by approximately 15% compared to the population analyzed in the NI PEIS. At ORNL, the 50-mile population has increased by approximately 27% compared to the population analyzed in the NI PEIS. Consequently, this factor alone would increase the total 50-mile population dose at INL by 15% and would increase the total 50-mile population dose at ORNL by 27%. The dose to the average exposed individual within 50 miles, the dose to the maximally exposed individual, and the dose to workers would be unaffected. With respect to the revised dose conversion factor, using the higher conversion factor would increase the potential radiological impacts presented in the NI PEIS by 50% for workers and 20% for the public. These changes are presented in the last column above. As shown in that column, the potential impacts would remain small (much less than 1 LCF for the public and workers over the 35-year duration of Pu-238 production activities) and well below any regulatory requirements.</p>		
<p><b>Environmental Justice<sup>b</sup></b></p>		
<p>INL (ATR and MFC) Percentage Minority Population Percentage Below Poverty Level</p>	<p>10.1 (1990)  12.6 (1990)</p>	<p>17.5 (2010)  12.0 (2010)</p>

Resource Area	Impacts from the NI PEIS and 2004 SA for the Analyzed Alternative	Current impacts for the Analyzed Alternative
ORR (HFIR and REDC) Percentage Minority Population Percentage Below Poverty Level	6.1 (1990)  16.0 (1990)	9.3 (2010)  16.4 (2010)
<p><b>Comparison to the NI PEIS and 2004 SA:</b> Since the issuance of the NI PEIS, the percentage of minority and low-income populations within the ROI has increased, with the exception of the low-income population at INL, which has stayed essentially the same. However, the projected human health risks from normal operations and facility accidents would not be substantially different from the analyses presented in the NI PEIS and 2004 SA, and implementation would not pose significant and adverse environmental risks to persons residing within the potentially affected areas, including minority and low-income persons.</p>		
<p><b>Waste Management</b></p>		
INL (ATR and MFC)	No impacts – virtually no additional waste would be generated as a result of operations at INL.	No change
REDC	<p>Target fabrication and processing in REDC would generate a total of 504 cubic yards of TRU over the 35-year operational period. The impacts of managing the additional quantities of this waste at ORNL would be minimal.</p> <p>Management of additional LLW from 35 years of operating REDC would not have a major impact on ORNL’s ability to manage the waste.</p> <p>Mixed LLW would be stored on site for treatment and disposed in a manner consistent with the site treatment plan. Solid LLW may need to be disposed of offsite because part or all of the storage capacity may not be available.</p>	No change
HFIR	No impacts – virtually no additional waste would be generated as a result of target irradiation operations at ORNL.	No change
<p><b>Comparison to the NI PEIS and 2004 SA:</b> Because production requirements have not changed, waste generation from Pu-238 production activities would not be different than those projected in the NI PEIS. Both INL and ORR have existing waste management infrastructures in-place to manage any wastes generated, including the ability to dispose of waste offsite when appropriate. The amount of TRU waste generated at ORNL would represent approximately 3 percent of the TRU waste currently treated at the site. The existing wastes generated at the sites (see Section 1.5.2.11) would not change any conclusions from the PEIS.</p>		
<p><b>Transportation</b></p>		
<p>The NI PEIS estimated that approximately 563 intersite shipments of radioactive materials would be made by DOE. The total distance traveled on public roads by trucks carrying radioactive materials would be 1.8 million kilometers (1.1 million miles). The 2004 SA reduced the transportation to 0.99 million kilometers (0.60 million miles). Based on the transportation requirements in the 2004 SA, the human health impacts were estimated to be 0.052 latent cancer fatalities to the public, 0.002 latent cancer fatalities to workers, 0.0030 fatalities from vehicle emissions, and 0.024 fatalities related to accidents (collisions). With respect to transportation accidents, public dose was estimated at 0.61 person-rem based on average</p>	<p>For 35 years of Pu-238 production, the human health impacts associated with transportation would be as follows: 0.068 latent cancer fatalities to the public, 0.004 latent cancer fatalities to workers, 0.0039 fatalities from vehicle emissions, and 0.024 fatalities related to accidents (collisions). With respect to transportation accidents, public dose was estimated at 0.80 person-rem based on average population densities along</p>	



Resource Area	Impacts from the NI PEIS and 2004 SA for the Analyzed Alternative	Current impacts for the Analyzed Alternative
population densities along potential transportation routes and 2.6 millirem to the maximally exposed individual.		potential transportation routes and 2.6 millirem to the maximally exposed individual.
<p><b>Comparison to the NI PEIS and 2004 SA:</b> Because production requirements have not changed, transportation requirements and associated impacts have not significantly changed. The only potential change in impacts would be associated with population changes that have occurred across the transportation routes and the revised dose conversion factor discussed in Section 1.5.3.2. Based on a comparison of data from the 2000 Census and 2010 Census, the population across the transportation routes has increased by approximately 9.7%. Consequently, this factor alone would increase the public dose associated with normal transportation, fatalities from vehicle emissions, and public dose from accidents by approximately 9.7%. With respect to the revised dose conversion factor, using the higher conversion factor would increase the potential radiological impacts presented in the 2004 SA by 50% for workers and 20% for the public. These changes are presented in the “current impacts” column above. As shown in that column, the potential impacts would remain small (much less than 1 LCF for the public and workers over the 35-year duration of Pu-238 production activities). Potential traffic fatalities associated with accidents (collisions) for worker commuting and material transport would not be different than analyzed in the NI PEIS and 2004 SA because there would be no change in worker requirements, quantities of material transported, or distances transported.</p>		
<p><b>Intentional Destructive Acts</b></p>		
Pu-238 Production Infrastructure	The NI PEIS and 2004 SA did not include an analysis of intentional destructive acts.	For the ATR, HFIR, REDC, and Np-237 storage at MFC, the potential consequences would be no worse than those of the most conservative accident analyzed in the NI PEIS and 2004 SA. With respect to transportation, based on average population densities for rural and urban areas along potential transportation routes, there would be less than 0.055 latent cancer fatalities in the exposed population if the sabotage event occurred in a rural area and less than 28 latent cancer fatalities if the sabotage event took place in an urban area.
<p><b>Comparison to the NI PEIS and 2004 SA:</b> Notwithstanding the remote risk of a terrorist attack that affected operations at any Pu-238 production facilities, in the remote likelihood that a terrorist attack would successfully breach the physical and other safeguards at DOE facilities resulting in the release of radionuclides, the potential consequences would be no worse than those of the most conservative accident analyzed in the NI PEIS.</p> <p>With regard to intentional destructive acts associated with transportation, there would be less than 0.055 latent cancer fatalities in the exposed population if the sabotage event occurred in a rural area and less than 28 latent cancer fatalities if the sabotage event took place in an urban area, based on average population densities for rural and urban areas along potential transportation routes.</p>		

<sup>a</sup> As discussed in Section 1.5.2.11, the methodology for determining the potentially affected populations related to environmental justice (and health effects) differs in this SA from the methodology used in the NI PEIS. Although there are differences in the methodology for determining the population counts, these differences do not create a discernible difference in the impact results.

### 3.2.1 Additional Analysis of Key Resource Areas

As shown in Table 3-1, there were no notable changes in the potential environmental impacts in the following resource areas: land use, visual, noise, air quality, geology and soils, ecological, cultural and paleontological, socioeconomics, and waste management. As such, those resources do not require further analysis. For those resource areas in which impacts have changed (public and occupational health and safety [normal operations], public and occupational health and safety [accidents], environmental justice, transportation, and intentional destructive acts), this section provides a more detailed analysis of these changes.

**Public and Occupational Health and Safety (Normal Operations).** As presented in Table 3-1, impacts on public human health from normal operations are expected to be very small, as both the NI PEIS and 2004 SA projected. At INL, the annual dose to the 50-mile population would be a maximum of  $4.4 \times 10^{-6}$  person-rem, which would correlate to  $9.1 \times 10^{-8}$  latent cancer fatalities over the 35-year operational period. Such a dose to the 50-mile population would be less than  $2.2 \times 10^{-12}$  percent of the annual dose the 50-mile population would receive from natural and manmade radiation.<sup>4</sup> The increase in dose from Pu-238 operations would be insignificant. At ORNL, the annual dose to the 50-mile population would be a maximum of  $1.1 \times 10^{-4}$  person-rem, which would correlate to  $2.3 \times 10^{-6}$  latent cancer fatalities over the 35-year operational period. Such a dose to the 50-mile population would be less than  $1.1 \times 10^{-11}$  percent of the annual dose the 50-mile population would receive from natural and manmade radiation.<sup>5</sup> The increase in dose from Pu-238 operations would be insignificant. The doses to the maximally exposed individual and workers would be the same as were projected in the NI PEIS and 2004 SA.

**Public and Occupational Health and Safety (Accidents).** As presented in Table 3-1, impacts on public human health from accidents are expected to be very small, as both the NI PEIS and 2004 SA projected. At INL, for 35 years of Pu-238 production, the increased risk of LCF to the maximally exposed offsite individual and to a noninvolved worker would be  $2.2 \times 10^{-5}$  and  $4.0 \times 10^{-4}$  respectively. The increased number of LCFs in the surrounding 50-mile population would be 0.04 over 35 years. These potential impacts, while slightly greater than presented in the NI PEIS and 2004 SA due to an increase in the 50-mile population and the revised dose conversion factor, would be insignificant. At ORNL, for 35 years of Pu-238 production, the increased risk of LCF to the maximally exposed offsite individual and to a noninvolved worker would be  $6.8 \times 10^{-5}$  and  $5.2 \times 10^{-4}$  respectively. The increased number of LCFs in the surrounding 50-mile population would be 0.24 over 35 years. These potential impacts, while slightly greater than presented in the NI PEIS due to an increase in the 50-mile population and the revised dose conversion factor, would be insignificant.

**Environmental Justice.** As presented in Table 3-1, the percentage of minority and low-income populations within the ROI has increased, with the exception of the low-income population at

<sup>4</sup> Based on an average annual radiation dose of 620 millirem from natural and manmade sources that the average person in the U.S. receives (NCRP 2009). For the 50-mile population surrounding INL, the total population dose from natural and manmade sources would be approximately 201,000 person-rem.

<sup>5</sup> Based on an average annual radiation dose of 620 millirem from natural and manmade sources that the average person in the U.S. receives (NCRP 2009). For the 50-mile population surrounding ORNL, the total population dose from natural and manmade sources would be approximately 970,000 person-rem.

INL, which has stayed essentially the same. However, because the projected human health risks from normal operations and facility accidents would be insignificant, implementation of the selected alternative would not result in disproportionate high and adverse impacts to minority and low-income persons. Consequently, the conclusions reached in the NI PEIS and 2004 SA remain valid.

**Transportation.** For 35 years of Pu-238 production, the human health impacts associated with transportation would be as follows: 0.068 latent cancer fatalities to the public, 0.004 LCFs to workers, and 0.0039 fatalities from vehicle emissions. These potential impacts, while slightly greater than presented in the NI PEIS and 2004 SA due to population changes and the revised dose conversion factor, would be insignificant. With respect to transportation accidents, the public dose was estimated at 0.80 person-rem and 2.6 millirem to the maximally exposed individual over 35 years. Similarly, these potential impacts, which would be slightly greater than what was projected in the NI PEIS and 2004 SA due to population changes and the revised dose conversion factor, would be insignificant.

**Intentional Destructive Acts.** The risk of a terrorist attack that could affect operations at any Pu-238 production facilities is considered unlikely given the physical and other safeguards at DOE facilities. However, even if such an attack were to occur and result in the release of radionuclides, the potential consequences would be no worse than those of the most conservative accident analyzed in the NI PEIS. With regard to intentional destructive acts associated with transportation, as discussed in Section 1.5.3.1, studies associated with higher quantities of materials than would be associated with the Pu-238 production program<sup>6</sup> have concluded that there would be less than 0.055 latent cancer fatalities in the exposed population if the sabotage event occurred in a rural area and less than 28 latent cancer fatalities if the sabotage event took place in an urban area, based on average population densities for rural areas and urban areas along potential transportation routes. Given the physical and other safeguards associated with transportation of Pu-238 material such impacts are considered unlikely.

## 4.0 CUMULATIVE IMPACTS

Council on Environmental Quality regulations (40 CFR 1508.7) define cumulative impacts as “the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.” This section reviews the cumulative impacts analysis presented in the NI PEIS relative to subsequent programmatic decisions and the updated resource area impacts identified in this SA.

### 4.1 Cumulative Impacts Analysis in the NI PEIS

The cumulative impacts analysis in the NI PEIS considered the impacts of (1) constructing (as necessary) and operating the proposed facilities to store, fabricate, irradiate, and process the various targets addressed in this NI PEIS for a total life cycle of 35 years, and (2) deactivating

<sup>6</sup> For example, a typical spent fuel cask contains up to 6 metric tons of radioactive materials, including approximately 200 ounces of Pu-238, while the maximum quantity of Pu-238 that would be transported for Pu-238 production would be less than approximately 13 ounces (DOE 2008b, DOE 2001).



the FFTF. These impacts were added to the environmental impacts of other present and reasonably foreseeable future actions at or near the identified candidate sites to obtain cumulative site impacts under normal conditions. Cumulative transportation impacts were determined by analyzing the impacts along the various routes used to transport the materials associated with nuclear infrastructure activities over the 35-year period.

Cumulative impacts analysis in the NI PEIS provided details of activities that may be implemented in the foreseeable future at candidate sites. The activities below are activities for INL and ORNL (sites included in the Preferred Alternative):

- *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE/EIS-0203) (Record of Decision issued) (DOE 1995b)
- *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel* (DOE/EIS-0218) (Record of Decision issued) (DOE 1996a)
- *Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* (DOE/EIS-0236) (Record of Decision issued) (DOE 1996b)
- *Advanced Mixed Waste Treatment Project Final Environmental Impact Statement* (DOE/EIS-0290) (Record of Decision issued) (DOE 1999b)
- *Final Environmental Impact Statement for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel* (DOE/EIS-0306) (Record of Decision issued) (DOE 2000b)
- *Final Environmental Impact Statement, Construction and Operation of the Spallation Neutron Sources* (DOE/EIS-0247) (Record of Decision issued) (DOE 1999c)
- *Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (DOE/EIS-0269) (Record of Decision issued) (DOE 1999d)
- *Environmental Assessment Melton Valley Storage Tanks Capacity Increase Project—Oak Ridge National Laboratory* (DOE/EA-1044 and Finding of No Significant Impact [FONSI]) (DOE 1995c)
- *Management of Spent Nuclear Fuel on the Oak Ridge Reservation* (DOE/EA-1117 and FONSI) (DOE 1996c)

For this SA, cumulative impacts were assessed by combining the effects of the Pu-238 production activities with the effects of other past, present, and reasonably foreseeable actions at INL and ORNL. Many of these actions occur at different times and locations and may not be truly additive. For example, actions affecting public health could occur at different times and locations across the site; therefore, it is unlikely that the impacts would be completely additive.

The effects were combined irrespective of the time and location of the impact, to bound any uncertainties in the projected activities and their effects. This approach produces a conservative estimation of cumulative impacts for the activities considered.

Implementation of the selected alternative would not require any new construction and would be conducted in currently operational facilities, and future operations would be consistent with current operations at both INL and ORNL. As discussed in Section 3.2, for all resource areas analyzed, there would be no significant changes in impacts compared to the impacts presented in the NI PEIS and 2004 SA. For most resources, a detailed cumulative impact assessment is not meaningful given the lack of impacts associated with implementation of the selected alternative. For example, because the selected alternative would not impact land use, it would not contribute to any cumulative land use impacts associated with current and other reasonably foreseeable actions at either INL or ORNL. The same conclusion is applicable to resources such as visual, geology and soils, ecological, cultural and paleontological, air quality, water resources, and socioeconomics. Given this backdrop, DOE focused this cumulative impact analysis on the following resource areas: human health and environmental justice, waste management, and transportation.

## **4.2 Cumulative Impacts at INL**

This SA evaluates the potential impacts associated with new information, new and proposed projects, and modifications to existing projects at INL since the NI PEIS was issued in 2000. Past and present actions are generally accounted for in Section 1.5.2 of this SA, which provides an update to the affected environment at INL. This cumulative impact section focuses on other reasonably foreseeable projects that are not reflected in Section 1.5.2 of this SA. These actions were identified in Section 4.1 and DOE 2011a based primarily from a review of the Idaho Department of Environmental Quality (IDEQ) and INL websites. The actions listed are planned, under construction, or ongoing and provide an adequate basis for determining potential cumulative impacts at INL.

### **4.2.1 Idaho Nuclear Technology and Engineering Center (INTEC)**

INTEC was established in the 1950s as a location for extracting reusable uranium from spent nuclear fuel. Until 1992, reprocessing efforts recovered more than \$1 billion worth of highly enriched uranium (HEU). The highly radioactive liquid created in this process was turned into a solid through a process known as calcining. Calcining converted more than 8 million gallons of liquid waste to a solid granular material that is now stored in bins awaiting a final disposal location outside Idaho. Past activities at INTEC also included the storage of spent nuclear fuel in water basins to cool it prior to reprocessing. Ongoing activities at INTEC include storage of spent nuclear fuel, management of high-level waste calcine and sodium-bearing liquid waste (some of which was shipped from the Hanford Site), and the operation of the INL CERCLA Disposal Facility, which includes a landfill, evaporation ponds, and a storage and treatment facility (DOE 2011a).

#### **4.2.2 Advanced Mixed Waste Treatment Project**

The AMWTP was constructed by British Nuclear Fuel Limited to prepare TRU waste now buried or stored at INL for permanent disposal at the Waste Isolation Pilot Plant (WIPP) in New Mexico. Most of the waste processed at the AMWTP resulted from the manufacture of nuclear components at the Rocky Flats Plant in Colorado and was shipped to INL in the 1970s and early 1980s. Most of the waste is mixed waste (i.e., it is contaminated with radioactive and nonradioactive hazardous chemicals, such as oil and solvents). The retrieval enclosure houses about 69,714 cubic yards of waste and occupies an area of about 7 acres. After the containers are characterized, they are sent either to the loading facilities for packaging and shipment or to the AMWTP treatment facility for further processing. Following treatment, waste containers go through two major steps at the two AMWTP loading areas: payload assembly and Transuranic Package Transporter Model 2 (TRUPACT II) loading. During payload assembly, waste is separated into payloads that are then individually loaded into TRUPACT II containers for certification and shipping (DOE 2011a).

#### **4.2.3 Remote-Handled Waste Disposition Project**

Operations conducted in support of INL and Naval Reactors Facility missions on the Idaho site generate LLW. DOE classifies some of the LLW generated at the INL as remote-handled LLW because its potential radiation dose is high enough to require additional protection of workers using distance and shielding. In December 2011, DOE prepared the *Final Environmental Assessment for the Replacement Capability for Disposal of Remote-Handled Low-Level Radioactive Waste Generated at the Department of Energy's Idaho Site* (DOE/EA-1793) and FONSI (DOE 2011b). The purpose of the proposed action was to provide disposal capability, beginning in October 2017, to replace the existing Radioactive Waste Management Complex (RWMC) disposal capability, and lasting for upwards of 50 years. The waste disposed of under the proposed action is limited to remote-handled LLW generated from operations at DOE Idaho's site. DOE expects to generate an estimated average volume of 150 cubic meters of remote-handled LLW each year at the INL site. After generation, this waste would be packaged, transported and disposed of in compliance with applicable regulations and standards. The proposed project includes purchase of transport casks as needed to accomplish shipments of waste from the INL site generating facilities to the disposal facility (DOE 2011b).

#### **4.2.4 Disposal of Greater-Than-Class C (GTCC) Low-Level Waste and GTCC-Like Waste**

DOE is currently preparing an EIS (DOE/EIS-0375D) (DOE 2011a) to evaluate the potential environmental impacts associated with the proposed development, operation, and long-term management of a disposal facility or facilities for GTCC LLW and DOE GTCC-like waste. The Draft EIS was published in February 2011. The total volume of GTCC LLW and GTCC-like waste addressed in the EIS is about 15,555 cubic yards (420,000 cubic feet). DOE is evaluating INL as one of six Federally-owned sites as a disposal site for the GTCC waste via a borehole, trench, and/or vault. The GTCC reference location is southwest of the ATR Complex in the south central portion of INL.



#### **4.2.5 Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel at INL**

The DOE Naval Nuclear Propulsion Program is currently preparing an *EIS for the Recapitalization of Naval Spent Nuclear Fuel Handling and Examination Facilities at the Idaho National Laboratory* (77 FR 27448, May 10, 2012 [DOE 2012d]). The proposed action is to ensure the continued availability of the infrastructure needed to support the transfer, handling, examination, and packaging of naval spent nuclear fuel removed from nuclear-powered aircraft carriers and submarines, as well as from land-based prototype reactors for at least the next 40 years. The recapitalization will be carried out as two projects. The first project will be the Spent Fuel Handling Recapitalization Project; the second project, which will be addressed in a separate NEPA document, will be the Examination Recapitalization Project. The EIS will consider the environmental effects related to the Spent Fuel Handling Recapitalization Project. The EIS will evaluate the following alternatives: (1) building a new facility at two potential sites at the Naval Reactors Facility on the INL; (2), an overhaul of the existing Expanded Core Facility; and (3) a No Action Alternative (DOE 2012d).

#### **4.2.6 Resumption of Transient Testing**

DOE is planning to prepare an EA for the Resumption of Transient Testing (RTT) Program. That Program supports the testing of new reactor fuels. That EA is expected to analyze the following alternatives: (1) RTT using the Transient Reactor Test Facility at INL; (2) RTT using the Annular Core Research Reactor at Sandia National Laboratories, New Mexico; and (3) a No Action Alternative.

#### **4.2.7 Cumulative Impacts by Resource Area at INL**

**Waste Management.** Pu-238 production at INL would generate approximately 1.3 cubic yards of LLW over the 35-year operational period. This quantity of waste would represent a small fraction (less than 1 percent) of the wastes currently managed at INL. The Pu-238 wastes would also represent less than 1 percent of the wastes associated with the GTCC program and less than 1 percent of the wastes associated with the Remote-Handled Waste Disposition Project. Pu-238 production would not increase the quantities of spent nuclear fuel from the operation of the ATR. Consequently, there would be no cumulative impacts related to spent nuclear fuel and any potential impacts that could occur as a result of the Spent Fuel Handling Recapitalization Project or RTT using the Transient Reactor Test Facility at INL. Contributions from Pu-238 production would be negligible relative to the cumulative wastes produced by existing and reasonably foreseeable projects at INL.

**Human Health and Environmental Justice.** The human health impacts from Pu-238 production at INL would be much less than 1 percent of the impacts from current operations. The Pu-238 human health impacts would also represent much less than 1 percent of the impacts from the GTCC program, which has determined that annual radiation doses would be 2.6 person-rem/year for the borehole method, 4.6 person-rem/year for the trench method, and 5.2 person-rem/year for the vault method (DOE 2011a). Contributions from Pu-238 production would be negligible relative to the radiological impacts from other reasonably foreseeable actions. Because there would be no significant and adverse environmental risks to persons residing

within the potentially affected areas, there would be no disproportionate significant impacts to minority and low-income persons.

### **4.3 Cumulative Impacts at ORNL**

This SA evaluates the potential impacts associated with new information, new and proposed projects, and modifications to existing projects at ORNL since the NI PEIS was issued in 2000. Past and present actions are generally accounted for in Section 1.5.2 of this SA, which provides an update to the affected environment at ORNL. This cumulative impact section focuses on other reasonably foreseeable projects that are not reflected in Section 1.5.2 of this SA. These actions were identified in Section 4.1 and NNSA 2011. The actions listed are planned, under construction, or ongoing and provide an adequate basis for determining potential cumulative impacts at ORNL.

#### **4.3.1 Oak Ridge Integrated Facility Disposition Project (IFDP)**

The IFDP is a strategic plan for disposing of legacy materials and facilities at ORNL and Y-12 using an integrated approach that results in risk reduction, eliminates \$70 to \$90 million per year in cost of operations, provides surveillance and maintenance of excess facilities, and management of other legacy conditions. Under the IFDP, the D&D of approximately 188 facilities at ORNL, 112 facilities at Y-12, and remediation of soil and groundwater contamination would occur over the next 30 to 40 years. The IFDP will be conducted as a remedial action under CERCLA. Benefits of the IFDP include reduced risk to workers and the public from potential exposure to hazardous and radioactive materials; and the reduction of surveillance and maintenance costs for obsolete, inactive facilities. The IFDP estimates that over the next 15–25 years, 3.8 million square feet of contaminated floor space will become excess as a result of National Nuclear Security Administration (NNSA) Modernization and the relocation of facility activities to ORNL. This clean up would be done under CERCLA and wastes disposed of onsite in CERCLA waste management facilities. The D&D of these facilities would increase the dose to both the public and site workers. Estimates are not possible until more precise plans are finalized.

#### **4.3.2 Uranium-233 (U-233) Disposition**

In January 2010, DOE completed the *Final Environmental Assessment for U-233 Material Downblending and Disposition Project at the Oak Ridge National Laboratory* and issued a FONSI (DOE/EA-1651; DOE 2010). That EA evaluates the impacts of planned activities to modify selected ORNL facilities; process the ORNL inventory of U-233; and transport the processed material to a long-term disposal facility. As a result of this action, radioactive wastes would be generated, workers and public would receive radiological doses, and there would be increased radiological transportation from ORNL to the Nevada National Security Site. These potential cumulative impacts are addressed in Section 4.3.4.

#### **4.3.3 Y-12 Modernization Projects**

Several new facilities have been proposed as part of the integrated modernization efforts at Y-12 and are expected to be constructed after 2015. These facilities represent a vision of the end state

that the NNSA wants to achieve in the next 20 to 25 years at Y-12. Table 3.3-1 of NNSA 2011 lists the future modernization projects that would replace old, outdated facilities. Because planning for these facilities has not been initiated, no detailed quantitative impacts have been assessed. However, modernized facilities would be expected to reduce health impacts to workers and the public, incorporate pollution prevention/waste minimization measures in their operation, and reduce emissions to the environment compared to the facilities that are currently operating. One project, the Uranium Processing Facility (UPF), is a near-term project that can be quantified. The UPF would be constructed by approximately 2022 and would consolidate existing operations into a more efficient facility. However, there would be no significant change in wastes generated at Y-12, human health impacts (including environmental justice), or transportation impacts. As a result, the UPF would not change any of the cumulative impacts presented below.

#### **4.3.4 Cumulative Impacts by Resource Area at ORNL**

**Waste Management.** Pu-238 production at ORNL would generate approximately 2,100 cubic feet of LLW, less than 180 cubic feet of mixed LLW, and 504 cubic yards of TRU waste over the 35-year operational period. Such waste streams would represent a small fraction (about 3 percent) of the wastes currently managed at ORNL. Disposition of U-233 would generate approximately 3,667 55-gallon drums of LLW that would be disposed at the Nevada National Security Site (DOE 2010). Pu-238 production wastes at ORNL would be much less than 1 percent of wastes from the IFDP, U-233 disposition, and other ongoing operations. For example, the wastes generated by other cleanup actions (e.g., 2.7 million cubic yards of CERCLA solid waste and 1.4 billion gallons of CERCLA liquid waste for ORR facilities in the next 10 years [NNSA 2011]) when combined with waste generated from other actions would not exceed existing ORR and offsite waste management facilities capacities and capabilities for treatment, disposal, and/or storage. Contributions from Pu-238 production would be negligible relative to the cumulative wastes produced by existing and reasonably foreseeable projects at ORNL. Therefore, no notable cumulative impacts on waste management facilities are expected.

**Human Health and Environmental Justice.** The human health impacts from Pu-238 production at ORNL would be much less than 1 percent of the impacts from current operations. Current and reasonably foreseeable operations at the site are estimated to result in a population dose of 25.8 person-rem per year to the 50-mile population at ORNL and a collective worker dose of 68.4 person-rem per year (NNSA 2011). Potential doses from the disposition of U-233 would be less than 500 mrem per year for each worker and less than 0.3 mrem to any member of the public (DOE 2010). Pu-238 production at ORNL would result in a population dose of approximately  $1.1 \times 10^{-4}$  person-rem per year to the 50-mile population at ORNL and a collective worker dose of less than 1 person-rem per year. Consequently, contributions from Pu-238 production would be negligible relative to the radiological impacts from other reasonably foreseeable actions and therefore, there would be no notable cumulative impacts. Because there would be no significant and adverse environmental risks to persons residing within the potentially affected areas, there would be no disproportionate significant impacts to minority and low-income persons.

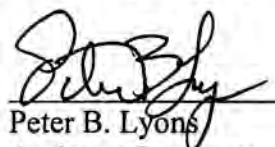


#### 4.4 Cumulative Transportation Impacts

The NI PEIS estimated that approximately 563 intersite shipments of radioactive materials would be made by DOE for Pu-238 production operations. The total distance traveled on public roads by trucks carrying radioactive materials would be 1.8 million kilometers (1.1 million miles). The 2004 SA reduced the transportation to 0.99 million kilometers (0.60 million miles). The potential transportation impacts from Pu-238 operations were estimated to be 0.052 latent cancer fatalities to the public, 0.002 latent cancer fatalities to workers, and 0.0030 fatalities from vehicle emissions. With respect to transportation accidents, public dose was estimated at 0.61 person-rem and 2.6 millirem to the maximally exposed individual. These impacts would be insignificant compared to the transportation impacts associated with other projects at INL and ORNL. For example, under the GTCC Program, there would be about 12,600 shipments, with the total distance covered being 26 million miles. Shipment of all waste by rail would require 4,980 railcar shipments totaling 11 million miles. It is estimated that less than one latent cancer fatality would occur to the public and/or crew members for either mode of transportation, but one fatality from an accident could occur (DOE 2011a). Additionally, with respect to the disposition of U-233, approximately 367 radiological shipments would be made from ORNL to the Nevada National Security Site. It is estimated that less than one latent cancer fatality would occur to the public and/or crew members from such transportation and a risk of less than one fatality from an accident (DOE 2010).

#### 5.0 CONCLUSION AND DETERMINATION

The 2000 NI PEIS (DOE/EIS-0310) (DOE 2000a) and the 2004 SA (DOE/EIS-0310-SA-01) (DOE 2004) evaluated the potential impacts of Pu-238 production. These documents support the 2001 and 2004 RODs issued by DOE to produce Pu-238. However, since DOE has not implemented the decision to produce Pu-238 to date, this SA has been prepared to evaluate if the analyses conducted in the prior documents mentioned above are still valid. DOE Regulations (10 CFR 1021.314) require that a supplemental or a new EIS be prepared when “there are substantial changes to the proposal” or there are “significant new circumstances or information relevant to environmental concerns.” The analysis in this SA indicates that the identified and projected environmental impacts, including cumulative impacts and the impacts that could result from Intentional Destructive Acts, would cause no significant change in the potential impacts identified in the NI PEIS and the 2004 SA. On the basis of the analysis presented in this SA, DOE has determined that there are no significant new circumstances or information relevant to environmental concerns that warrant preparation of a Supplemental NI PEIS or a new EIS and that the 2001 decision referenced above can be implemented without further NEPA review.

  
Peter B. Lyons  
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for Nuclear Energy

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