DOE/EIS-0236

Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management

Summary

United States Department of Energy

February 1996

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CORRECTION SHEET

Please replace the last two paragraphs in section S.1.5 (found on pages S–6 and S–7) with the following two paragraphs:

> Both of these PEISs have progressed to the point where they are scheduled to have their RODs issued by the Fall of 1996, at or about the same time as the ROD for the Pantex Site-Wide EIS, which is scheduled for November 1996. Therefore, DOE is proposing that so long as the RODs of both the Programmatic EISs and the Pantex Site-Wide EIS occur within a short period of time of one another, decisions on the long-term storage of pits would be made in the RODs of the PEISs. A decision relating to the interim storage of pits at Pantex would be made in the ROD of the Pantex Site-Wide EIS pending implementation of the selected long-term storage option.
>
> However, if there is a significant delay in the RODs for either of the PEISs, or if DOE does not make a decision on the long-term storage of pits in those RODs, then there would be a need to make a decision on the location of interim storage of pits uninformed by a decision on long-term storage. In any event, the Pantex Site-Wide EIS will be completed with the analysis of interim storage alternatives, including addressing the issues and comments received from the public on that EIS, to support a decision relating to the storage of pits until a long-term storage decision has been made and implemented.

On page S–41, please replace the second paragraph in section S.5 (Preferred Alternative), with the following:

> Since February 9, 1996, the date when the enclosed Draft PEIS was sent to the printer, DOE has identified additional preferred alternatives. The complete list of preferred alternatives is as follows:
>
> <u>Stockpile Stewardship</u>:
>
> - Construct and operate the National Ignition Facility at Lawrence Livermore National Laboratory (LLNL)
> - Construct and operate the Contained Firing Facility at LLNL
> - Construct and operate the Atlas Facility at Los Alamos National Laboratory (LANL)
>
> <u>Stockpile Management</u>:
>
> - Secondary and Case Component Fabrication—downsize the Y-12 Plant at Oak Ridge Reservation
> - Pit Component Fabrication—re-establish capability and appropriate capacity at LANL
> - Assembly/Disassembly—downsize Pantex Plant
> - Nonnuclear Component Fabrication—downsize Kansas City Plant
>
> There are currently no preferred alternatives for High Explosives Fabrication, and Strategic Reserve Storage of Plutonium Pits or Highly Enriched Uranium.

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COVER SHEET

RESPONSIBLE AGENCY: U.S. Department of Energy

COOPERATING AGENCY: U.S. Environmental Protection Agency

TITLE: Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management (DOE/EIS 0236)

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ABSTRACT: In response to the end of the Cold War and changes in the world's political regimes, the United States is no longer producing new nuclear weapons. Instead, the emphasis of the U.S. nuclear weapons program is on reducing the size of the Nation's nuclear stockpile by dismantling existing nuclear weapons. The Department of Energy (DOE) has been directed by the President and Congress to maintain the safety and reliability of the reduced nuclear weapons stockpile in the absence of underground testing. In order to fulfill that responsibility, DOE has developed a Stockpile Stewardship and Management Program to provide a single highly integrated technical program for maintaining the continued safety and reliability of the nuclear stockpile. The Stockpile Stewardship and Management PEIS describes and analyzes alternative ways to implement the proposed actions for the Stockpile Stewardship and Management Program.

Stockpile stewardship refers to activities associated with research, design, development and testing of nuclear weapons and the assessment and certification of the safety and reliability. The stockpile stewardship portion of the PEIS evaluates the potential impacts of three proposed facilities: the National Ignition Facility (NIF), the Contained Firing Facility (CFF), and the Atlas Facility. The Stockpile Stewardship alternatives involving these facilities could affect four sites: Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), Sandia National Laboratories (SNL), and Nevada Test Site (NTS).

Stockpile management refers to activities associated with the production, maintenance, surveillance, refurbishment, and dismantling of the nuclear weapons stockpile. The stockpile management portion of this PEIS evaluates the potential impacts of carrying out Stockpile Management alternatives at eight sites: Oak Ridge Reservation (ORR), Savannah River Site (SRS), Kansas City Plant (KCP), Pantex Plant (Pantex), LANL, LLNL, SNL, and NTS. The Management alternatives are assessed for nuclear weapons assembly/disassembly (A/D) and for fabricating pits, secondaries and cases, high explosives (HE), and nonnuclear components. The Stockpile Stewardship and Management PEIS also evaluates the No Action alternative of relying on existing facilities in their current configuration and continuing the missions at current sites to achieve both the stockpile stewardship and management missions.

As of February 9, 1996, the date when this PEIS was sent to the printer, the Department had identified only one preferred alternative: to construct and operate the NIF at LLNL. Other preferred alternatives will be announced, as appropriate, when they are identified.

Evaluation of impacts on land resources, site infrastructure, air quality, water resources, geology and soils, biotic resources, cultural and paleontological resources, socioeconomics, environmental justice, as well as radiological and hazardous chemical impacts during normal operation and accidents to workers and the public and impacts on waste management are included in the assessment.

The PEIS presents unclassified information only. A classified appendix has also been prepared to support the purpose of and need for the plutonium-242 to be stabilized at SRS for use in future weapon complex research and development activities.

PUBLIC COMMENTS: In preparing the Draft PEIS, DOE considered comments received by mail or fax, submitted at scoping meetings, transcribed from messages recorded by telephone, and those transmitted via Internet. The public comment period on the DPEIS extends through April 8, 1996.

TABLE OF CONTENTS

Table of Contents ..... S–i
List of Figures and Tables ..... S–ii
Acronyms ..... S–iii

S.1 INTRODUCTION S–1
S.1.1 Background S–3
S.1.2 Alternatives Analyzed in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement S–3
S.1.3 *National Environmental Policy Act* Strategy for Stockpile Stewardship and Management S–5
S.1.4 Related Recently Completed *National Environmental Policy Act* Actions S–6
S.1.5 Other Department of Energy Ongoing *National Environmental Policy Act* Reviews S–6
S.2 PURPOSE OF AND NEED FOR THE STOCKPILE STEWARDSHIP AND MANAGEMENT ACTION S–7
S.2.1 National Security Policy Considerations S–7
S.2.2 Safety and Reliability of the United States Stockpile S–11
S.2.3 Purpose and Need S–15
S.2.4 Proposed Action and Alternatives S–18
S.2.5 Nonproliferation S–19
S.3 ALTERNATIVES S–20
S.3.1 Development of Stockpile Stewardship and Management Program Alternatives S–20
S.3.2 Alternatives Considered but Eliminated from Detailed Study S–22
S.3.3 Underground Nuclear Testing S–24
S.3.4 No Action Alternative S–24
S.3.5 Alternative Sites S–24
S.3.6 Stockpile Stewardship Enhanced Experimental Capability S–26
S.3.7 Stockpile Management S–28
S.4 COMPARISON OF ALTERNATIVES S–31
S.4.1 Stockpile Management S–31
S.4.2 Stockpile Stewardship S–40
S.5 PREFERRED ALTERNATIVE S–41

LIST OF FIGURES

Figure S.1–1 Current Stockpile Stewardship and Management Sites (Includes Recent Consolidation of Three Former Sites). S–2

Figure S.1.1–1 Nuclear Weapons Design. S–4

Figure S.2–1 Policy Perspective of the Stockpile Stewardship and Management Program. S–8

Figure S.2–2 Stockpile Perspective of the Stockpile Stewardship and Management Program. S–9

Figure S.3.1–1 Nuclear Weapons Complex Sites and Stockpile Stewardship and Management Alternatives. S–21

LIST OF TABLES

Table 2.2–1 Distinct and Actionable Findings Summary Since 1958 ..... S–14

Table 3.6–1 Stockpile Stewardship Enhanced Experimental Capability Alternatives S–26

Table 3.7–1 Stockpile Management Alternatives S–28

ACRONYMS

A/D	assembly/disassembly
AHF	Advanced Hydrotest Facility
ARS	Advanced Radiation Source
BEEF	Big Explosive Experimental Facility
CEQ	Council on Environmental Quality
CFF	Contained Firing Facility
Complex	Nuclear Weapons Complex
CTBT	*Comprehensive Test Ban Treaty*
DARHT	Dual-Axis Radiographic Hydrodynamic Test
D&D	decontamination and decommissioning
DP	DOE Office of the Assistant Secretary for Defense Programs
EM	DOE Office of the Assistant Secretary for Environmental Management
DOD	Department of Defense
DOE	Department of Energy
EIS	environmental impact statement
FXR	Flash X-Ray
HE	high explosive(s)
HEPPF	High Explosive Pulsed Power Facility
HEU	highly enriched uranium
K-25	K-25 Site, Oak Ridge Reservation
KCP	Kansas City Plant
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
NEPA	*National Environmental Policy Act*
NIF	National Ignition Facility
NLVF	North Las Vegas Facility
NPR	Nuclear Posture Review
NPT	Nuclear Nonproliferation Treaty
NTS	Nevada Test Site
NWSM	Nuclear Weapon Stockpile Memorandum
NWSP	Nuclear Weapon Stockpile Plan
ORR	Oak Ridge Reservation
Pantex	Pantex Plant
PDD	Presidential Decision Directive
PEIS	programmatic environmental impact statement
R&D	research and development
ROD	Record of Decision
SNL	Sandia National Laboratories/New Mexico
SRS	Savannah River Site
START	Strategic Arms Reduction Talks
Y-12	Y-12 Plant, Oak Ridge Reservation

SUMMARY

S.1 INTRODUCTION

The Department of Energy (DOE) is the Federal agency responsible for providing the Nation with nuclear weapons and ensuring that those weapons remain safe and reliable. This programmatic environmental impact statement (PEIS) analyzes the potential consequences to the environment if certain changes to the Nuclear Weapons Complex (Complex) are implemented to support DOE's Stockpile Stewardship and Management Program.

Stockpile stewardship and stockpile management describe DOE's management of the nuclear weapons program. While these terms are not new, DOE has recently redefined them in light of its current roles and responsibilities. Stockpile stewardship comprises the activities associated with research, design, development, and testing of nuclear weapons, and the assessment and certification of their safety and reliability. These activities have been performed at the three DOE weapons laboratories and the Nevada Test Site (NTS). Stockpile management comprises operations associated with producing, maintaining, refurbishing, surveilling, and dismantling the nuclear weapons stockpile. These activities have been performed at the DOE nuclear weapons industrial facilities (see figure S.1–1).

Since the inception of nuclear weapons in the 1940s, DOE and its predecessor agencies have been responsible for stewardship and management of the Nation's stockpile. In response to the end of the Cold War and changes in the world's political regimes, the emphasis of the U.S. nuclear weapons program has shifted dramatically over the past few years from developing and producing new weapons to dismantlement and maintenance of a smaller enduring stockpile. Accordingly, the nuclear weapons stockpile is being significantly reduced, the United States is no longer manufacturing new nuclear weapons, and DOE has closed or consolidated some of its former weapons industrial facilities. Additionally, in 1992 the United States declared a moratorium on underground nuclear testing, and in 1995 President Clinton extended the moratorium and decided to pursue a "zero yield" Comprehensive Test Ban Treaty. Even with these significant changes, DOE's responsibilities for the nuclear weapons stockpile continue, and the President and Congress have directed DOE to continue to maintain the safety and reliability of the enduring nuclear weapons stockpile.

In response to direction from the President and Congress, DOE has developed its Stockpile Stewardship and Management Program to provide a single, highly integrated technical program for maintaining the continued safety and reliability of the nuclear weapons stockpile. It has evolved from existing predecessor programs that served this mission over previous decades. With no underground nuclear testing, and no new nuclear weapons production, DOE expects existing weapons to remain in the stockpile well into the next century. This means that the weapons will age beyond original expectations, and an alternative to underground nuclear testing must be developed to verify the safety and reliability of weapons. To meet these new challenges, DOE's science-based Stockpile Stewardship and Management Program has been developed to increase understanding of the basic phenomena associated with nuclear weapons, to provide better predictive understanding of the safety and reliability of weapons, and to ensure a strong scientific and technical basis for future U.S. nuclear weapons policy objectives.

The size and composition of the U.S. nuclear weapons stockpile is determined annually by the President. The Department of Defense prepares the Nuclear Weapon Stockpile Plan (NWSP) based on military requirements and coordinates the development of the plan with DOE concerning its ability to support the plan. The NWSP, which is classified, covers the current year and a 5-year planning period. It specifies the types and quantities of weapons required and sets limits on the size and nature of stockpile changes that can be made without additional approval by the President. The Secretaries of Defense and Energy jointly sign the Nuclear Weapon Stockpile Memorandum (NWSM), which includes the NWSP and a long-range planning assessment. As such, the NWSM is the basis for all DOE stockpile support planning.

The *Stockpile Stewardship Management Programmatic Environmental Impact Statement* discusses the relevant factors, such as treaties, that shape the NWSM. Also explained is the fact that potential

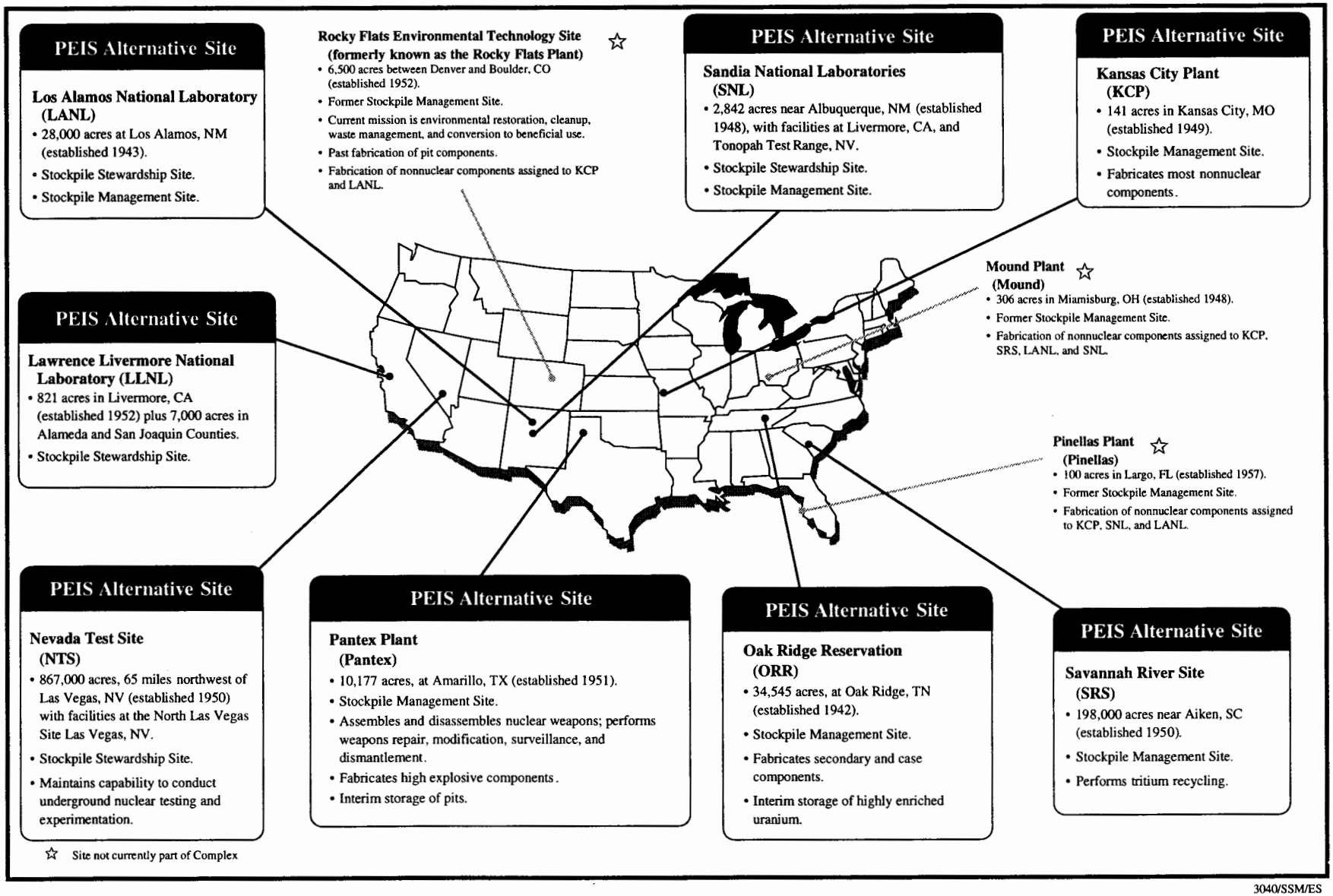

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FIGURE S.1–1.—*Current Stockpile Stewardship and Management Sites (Includes Recent Consolidation of Three Former Sites)*

variances in stockpile size, such as a Strategic Arms Reduction Talks (START) I Treaty versus a START II protocol-sized stockpile, affect only the issue of manufacturing capacity required for the foreseeable future. National security policies in the post-Cold War era require that all the historical capabilities of the weapons laboratories, industrial plants, and NTS be maintained. Capability is the practical ability to perform a basic function or activity. Stockpile stewardship and management capabilities are independent of foreseeable future stockpile sizes. Stockpile management manufacturing capacities are examined in this PEIS, including those required to support a hypothetical low case stockpile size below START II. This was done to examine the sensitivity of potential decisions to transfer manufacturing activities to the weapons laboratories and NTS versus downsizing the industrial plants in place.

S.1.1 Background

A general understanding of nuclear weapons, including the components that make up a weapon and the physical processes involved, helps one understand the scope of the Stockpile Stewardship and Management PEIS and what is to be accomplished by the Stockpile Stewardship and Management Program. Figure S.1.1–1 presents a simplified diagram of a modern nuclear weapon. An actual nuclear weapon produced in the United States is much more complicated, consisting of many thousands of parts.

The nuclear weapon primary is composed of a central core called a pit, which is usually made of plutonium-239 and/or highly enriched uranium. This is surrounded by a layer of high explosives (HE), which when detonated, compresses the pit, initiating a nuclear reaction. This reaction is generally thought of as the nuclear fission "trigger," which activates the secondary assembly component to produce a thermonuclear fusion reaction. The remaining nonnuclear components consist of everything from arming and firing systems to batteries and parachutes. The production and assembly of many of these components is accomplished at dedicated industrial facilities. Assembly and disassembly of nuclear weapons is done only at the weapons Assembly/Disassembly (A/D) facility.

S.1.2 Alternatives Analyzed in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement

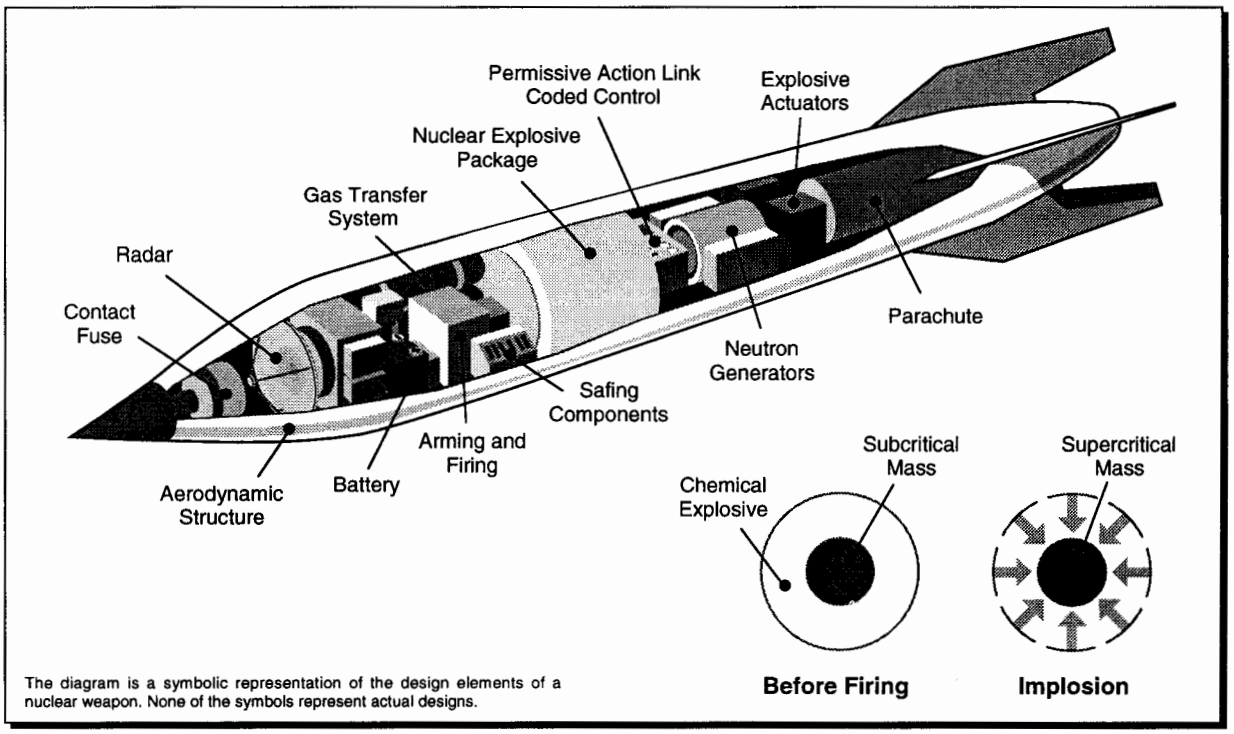
DOE must maintain a Complex with sufficient capability and capacity to meet current and future weapons requirements. For those activities associated with the ongoing stockpile stewardship program, DOE proposes to add enhanced capabilities to existing stockpile stewardship facilities to fulfill requirements. For those activities associated with the ongoing stockpile management program, DOE does not propose to construct any major new weapons industrial facilities. Rather, DOE proposes to "right-size" existing facilities or consolidate them to fulfill expected requirements for manufacture or repair of replacement components for an aging U.S. stockpile.

This *Stockpile Stewardship and Management Programmatic Environmental Impact Statement* addresses potential changes to the future missions of the three weapons laboratories, the four weapons industrial plants, and NTS. A No Action alternative is also described and analyzed. Figure S.1–1 shows the locations of the eight DOE sites comprising the current Complex.

To estimate the potential environmental impacts from modifying/constructing and operating the facilities proposed for stockpile management, DOE assumes that facilities would be sized and operated to support a base case stockpile size consistent with the START II protocol. This PEIS also discusses impacts that would be expected for supporting a larger stockpile based on START I Treaty levels, and a hypothetical stockpile smaller than the START II protocol.

With regard to stockpile management facilities, potential environmental impacts from the base case are analyzed quantitatively in the greatest detail, while impacts from the high and low cases are discussed qualitatively. The facilities proposed for stockpile stewardship are independent of projected stockpile size.

The stockpile stewardship portion of this PEIS evaluates the potential environmental impacts of the proposed actions and the reasonable alternatives for carrying out the stockpile stewardship functions. As described in section S.3.6, the three independently justified proposed facilities: the National Ignition



The diagram is a symbolic representation of the design elements of a nuclear weapon. None of the symbols represent actual designs.

Nuclear explosions are produced by initiating and sustaining nuclear chain reactions in highly compressed material which can undergo both fission and fusion reactions. Modern strategic, and most tactical, nuclear weapons use a nuclear explosive package with two assemblies: the primary assembly, which is used as the initial source of energy, and the secondary assembly, which provides additional explosive energy release. The primary assembly contains a central core, called the "pit", which is surrounded by a layer of high explosive. The "pit" is typically composed of plutonium–239 and/or highly enriched uranium (HEU), and other materials. HEU contains large fractions of the isotope uranium–235.

Primary Detonation

The primary nuclear explosion is initiated by detonating the layer of chemical high explosive that surrounds the "pit" which in turn drives the pit material into a compressed mass at the center of the primary assembly. This implosion process is illustrated in the inset of the diagram.

Boosting

In order to achieve higher explosive yields from primaries with relatively small quantities of pit material, a technique called "boosting" is used. Boosting is accomplished by injecting a mixture of tritium (T) and deuterium (D) gas into the pit. The deuterium and tritium are stored in reservoirs until the gas transfer system is initiated. The implosion of the pit along with the onset of the fissioning process heats the D-T mixture to the point that the D-T atoms undergo fusion. The fusion reaction produces large quantities of very high energy neutrons which flow through the compressed pit material and produce additional fission reactions.

Secondary Activation

The energy released by the primary explosion activates the secondary assembly. The secondary assembly is composed of lithium deuteride and other materials. As the secondary implodes, the lithium, in the isotopic form lithium–6, is converted to tritium by neutron interactions, and the tritium product in turn undergoes fusion with the deuterium to create the thermonuclear explosion.

Nonnuclear Components

Nonnuclear components include contact fuses, radar components, aerodynamic structures, arming and firing systems, gas transfer system, permissive action link coded controls, neutron generators, explosive actuators, safing components, batteries, and parachutes.

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FIGURE S.1.1–1.—*Nuclear Weapons Design.*

Facility (NIF), the Contained Firing Facility (CFF), and the Atlas Facility. Four sites (figure S.1–1) are potentially affected by the stockpile stewardship alternatives: Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), Sandia National Laboratories (SNL), and NTS. This PEIS also assesses the No Action alternative of relying on existing experimental facilities and continuing the missions at these four sites to fulfill the stockpile stewardship mission.

The science-based stockpile stewardship program is expected to continuously evolve as better information becomes available and technological advances occur. Additional experimental facilities, such as the Advanced Hydrotest Facility (AHF), the High Explosives Pulsed Power Facility (HEPPF), the Advanced Radiation Source (ARS [X-1]), and the Jupiter Facility are considered next generation facilities that may be required in the future to support stockpile stewardship objectives. However, these facilities are not proposed actions in this PEIS because they have not reached the stage of development and definition that is necessary for evaluation and decision making.

The stockpile management portion of this PEIS evaluates the potential environmental impacts of the reasonable alternatives for carrying out the stockpile management functions. Alternatives are assessed for nuclear weapons A/D and for fabricating pit, secondary and case, HE, and nonnuclear components. Eight sites (figure S.1–1) are potentially affected: Oak Ridge Reservation (ORR), Savannah River Site (SRS), Kansas City Plant (KCP), Pantex Plant (Pantex), LANL, LLNL, SNL, and NTS. This PEIS also assesses the No Action alternative of relying on existing facilities and continuing the missions at the current sites to fulfill the stockpile management mission.

S.1.3 *National Environmental Policy Act* Strategy for Stockpile Stewardship and Management

This PEIS has been prepared in accordance with Section 102(2)(c) of the *National Environmental Policy Act* (NEPA), as amended (42 U.S.C. 4321 et seq.), and implemented by regulations promulgated by the Council on Environmental Quality (CEQ) (40 CFR 1500-1508) and DOE regulations (10 CFR 1021). Under NEPA, Federal agencies, such as DOE, that propose major actions that could significantly affect the quality of the human environment are required to prepare an environmental impact statement (EIS) to ensure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. For broad actions, such as the Stockpile Stewardship and Management Program, a PEIS is prepared.

DOE's NEPA compliance strategy for the Stockpile Stewardship and Management Program consists of two phases. The first phase includes the Stockpile Stewardship and Management PEIS and subsequent Record of Decision (ROD). Decisions will be based on relevant factors including economic and technical considerations, DOE statutory mission requirements, policy considerations, and environmental impacts. In addition to the analyses in this PEIS, engineering studies, cost, schedule, and technical feasibility analyses will be considered in the ROD. The ROD is expected to identify the effects of U.S. national security policy changes on Stockpile Stewardship and Management Program missions and determine the configuration (facility locations) necessary to accomplish the Program missions.

During the second phase of the NEPA strategy, which would follow the PEIS ROD, DOE would prepare any necessary project-specific NEPA documents to implement any programmatic decision. However, as explained below, this PEIS also includes project-specific environmental analyses for the experimental facilities proposed for stockpile stewardship.

For the three facilities in the proposed action for stockpile stewardship—NIF, CFF, and the Atlas Facility—the Stockpile Stewardship and Management PEIS is intended to include sufficient project-specific analyses to complete NEPA requirements for siting, construction, and operation, and thus, satisfy both phases of the NEPA compliance strategy. This PEIS supports the programmatic decisions on whether to proceed with the facility and, if so, where to site the facility. The project-specific analysis describes the detailed construction and operational impacts for each facility at the alternate sites. Each proposed facility's project-specific analysis can be found in Volume III, as an appendix to this PEIS.

S.1.4 Related Recently Completed *National Environmental Policy Act* Actions

Two other actions that DOE has already evaluated in separate EISs, in accordance with CEQ regulations for interim actions (40 CFR 1506.1), are within the scope of the Stockpile Stewardship and Management PEIS. These are the PEIS for Tritium Supply and Recycling and the *Dual-Axis Radiographic Hydrodynamic Test* (DARHT) *Facility Environmental Impact Statement.*

The Tritium Supply and Recycling PEIS evaluated the potential environmental impacts associated with alternatives for siting, constructing, and operating tritium supply and recycling facilities. The purpose of the Tritium Supply and Recycling Program is to provide long-term, assured tritium supply and recycling to support the Nation's nuclear weapons stockpile. The Tritium Supply and Recycling Draft PEIS was issued in March 1995 and was followed by public hearings in April 1995. A Final PEIS was issued in October 1995, followed by an ROD in December 1995.

The DARHT EIS analyzed the environmental consequences of alternative ways to accomplish enhanced high-resolution radiography for the purposes of performing hydrodynamic tests and dynamic experiments. These tests are used to obtain diagnostic information on the behavior of nuclear weapons primaries and to evaluate the effects of aging on nuclear weapons. The DARHT Facility's construction is about 34 percent complete. Construction was halted under a U.S. District Court preliminary injunction issued on January 27, 1995, pending completion of the DARHT EIS and issuance of the ROD. The DARHT EIS evaluated the potential environmental impacts of six alternatives; the preferred approach entailed completing and operating the proposed DARHT Facility at LANL and implementing a phased enhanced containment strategy for testing at the DARHT Facility, so that most tests would be conducted inside steel vessels. The DARHT Draft EIS was issued in May 1995 and was followed by public hearings in May and June 1995. A Final PEIS was issued in August 1995, followed by an ROD in October 1995.

S.1.5 Other Department of Energy Ongoing *National Environmental Policy Act* Reviews

In addition to the two completed actions identified above, DOE is currently preparing other programmatic, project-specific, and site-wide NEPA documents. The following major documents have been determined to have potential cumulative effects for the sites being analyzed by this Stockpile Stewardship and Management PEIS, and are described in this Stockpile Stewardship and Management PEIS and included in the analysis. This Stockpile Stewardship and Management PEIS describes and includes in its analysis the ongoing alternatives being developed by: the Waste Management PEIS, the Storage and Disposition of Weapons-Usable Fissile Material PEIS, the Site-Wide EIS for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components, the Site-Wide EIS for the Los Alamos National Laboratory, and the Site-Wide EIS for the Nevada Test Site.

In May 1994, when DOE announced its intention to prepare the Pantex Site-Wide EIS, DOE believed that the Pantex Site-Wide EIS ROD would precede decision making on the long-term storage of pits by at least several years. Accordingly, the Draft Pantex Site-Wide EIS was scoped to address alternative locations for interim pit storage (i.e., until the long-term decisions were made and implemented).

Since May 1994, DOE has initiated two additional *National Environmental Policy Act* documents that address the storage of pits. This Stockpile Stewardship and Management PEIS will support decisions on the long-term storage of pits that will be needed for national security requirements (strategic reserve pits). The Storage and Disposition of Weapons-Usable Fissile Materials Programmatic EIS will support decisions on the long-term storage of all pits (strategic reserve and surplus) and the approach for dispositioning pits that are surplus to national security requirements.

Both of these PEISs have progressed to the point where they are scheduled to have their RODs issued

by the fall of 1996, at or about the same time as the ROD for the Pantex Site-Wide EIS, which is scheduled for November 1996. Therefore, DOE is proposing that as long as the RODs of both the PEISs and the Pantex EIS occur within a short period of time, there will be no need to make a decision on the interim storage of pits. Instead, decisions on the long-term storage of pits would be made in the RODs of the PEISs.

However, if there is a significant delay in the RODs for either of the PEISs, or if DOE does not make a decision on the long-term storage of pits in those RODs, then there would still be a need to make a decision on the interim storage of pits. In either of those events, the final Pantex Site-Wide EIS would be completed with the analysis of interim storage alternatives, including addressing the issues and comments received from the public on the Draft Pantex Site-Wide EIS, and that EIS would be the basis for decisions on the interim storage of pits.

S.2 PURPOSE OF AND NEED FOR THE STOCKPILE STEWARDSHIP AND MANAGEMENT ACTION

The Stockpile Stewardship and Management Program is broad in scope and technically complex. The Program currently involves the integrated activities of three national laboratories, four industrial plants, and a nuclear test site. Further, the Program must be consistent with, and supportive of, U.S. national security policies, which have changed considerably since the end of the Cold War. Therefore, to better understand the *Stockpile Stewardship and Management Programmatic Environmental Impact Statement* purpose, need, proposed action, and alternatives, it is useful to view the Program from two different perspectives. One perspective (see section S.2.1) is from the top level of national security policies for nuclear deterrence, arms control, and nonproliferation. These policies include ongoing responsibilities, strategies, and directives. The other perspective (see section S.2.2) focuses on the relevant technical efforts to maintain a safe and reliable U.S. nuclear weapons stockpile. Flow diagrams representing the logic of each perspective are included in figures S.2–1 and S.2–2.

S.2.1 National Security Policy Considerations

There are four principal national security policy overlays and four related treaties that define Program conditions for the reasonably foreseeable future. They are:

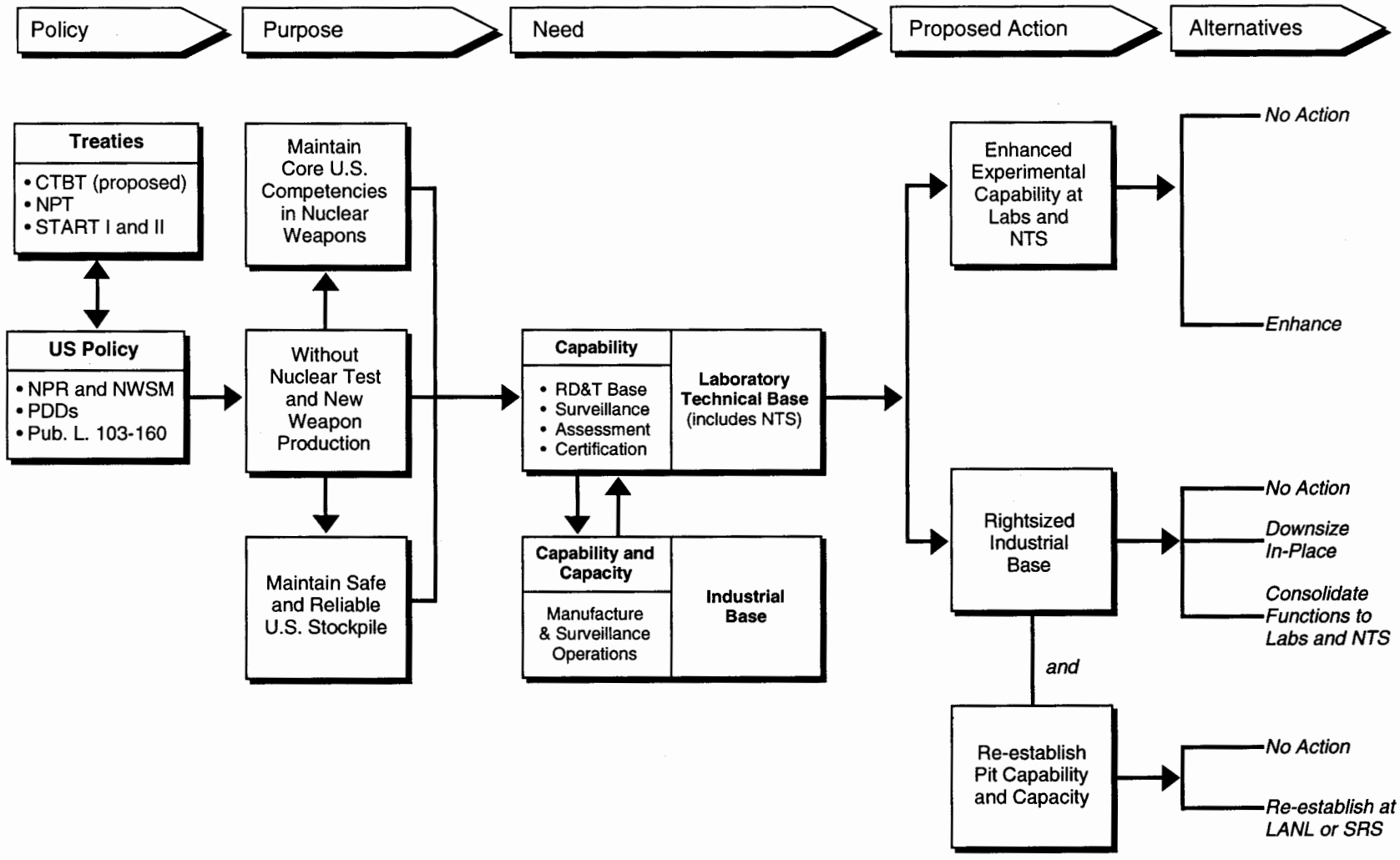
- Presidential Decision Directives (PDD)
- *National Defense Authorization Act*, 1994 (Pub. L. 103-160)
- The Department of Defense (DOD) Nuclear Posture Review (NPR)
- Nuclear Weapon Stockpile Memorandum (NWSM)
- Proposed Comprehensive Test Ban Treaty (CTBT)
- Nuclear Nonproliferation Treaty (NPT)
- Strategic Arms Reduction Talks I Treaty
- START II protocol

Of the above, the START II protocol is the most useful in helping define a specific time period to bound the reasonably foreseeable future.

Nuclear Posture Review

Beginning in 1991, several Presidential policy decisions, some unilateral and some made in conjunction with international treaties, resulted in DOD conducting the comprehensive NPR, which was approved by the President in 1994. The NPR defines and integrates past and present U.S. policies for nuclear deterrence, arms control, and nonproliferation objectives. The unclassified NPR strategies that pertain to the Stockpile Stewardship and Management Program were presented at the eight public scoping meetings conducted in the summer of 1995. There was general public interest in understanding this complex issue, especially as it relates to treaties, policies, and stockpile size. A summary of how the post-Cold War treaties relate to the NPR strategies and the stockpile follows.

Strategic Arms Reduction Talks. The NPR assumes that the START I Treaty and START II protocol will be fully implemented. However, since the START I Treaty is not yet fully implemented and the START II protocol is not scheduled to be fully implemented until 2003, the NPR strategy protects the U.S. option to reconstitute the stockpile to START I levels should unfavorable events occur in the former Soviet Union. The treaties only control the number of strategic



Note: RD&T–research, design, development, and testing.

3065/SSM/ES

FIGURE S.2–1.—*Policy Perspective of the Stockpile Stewardship and Management Program.*

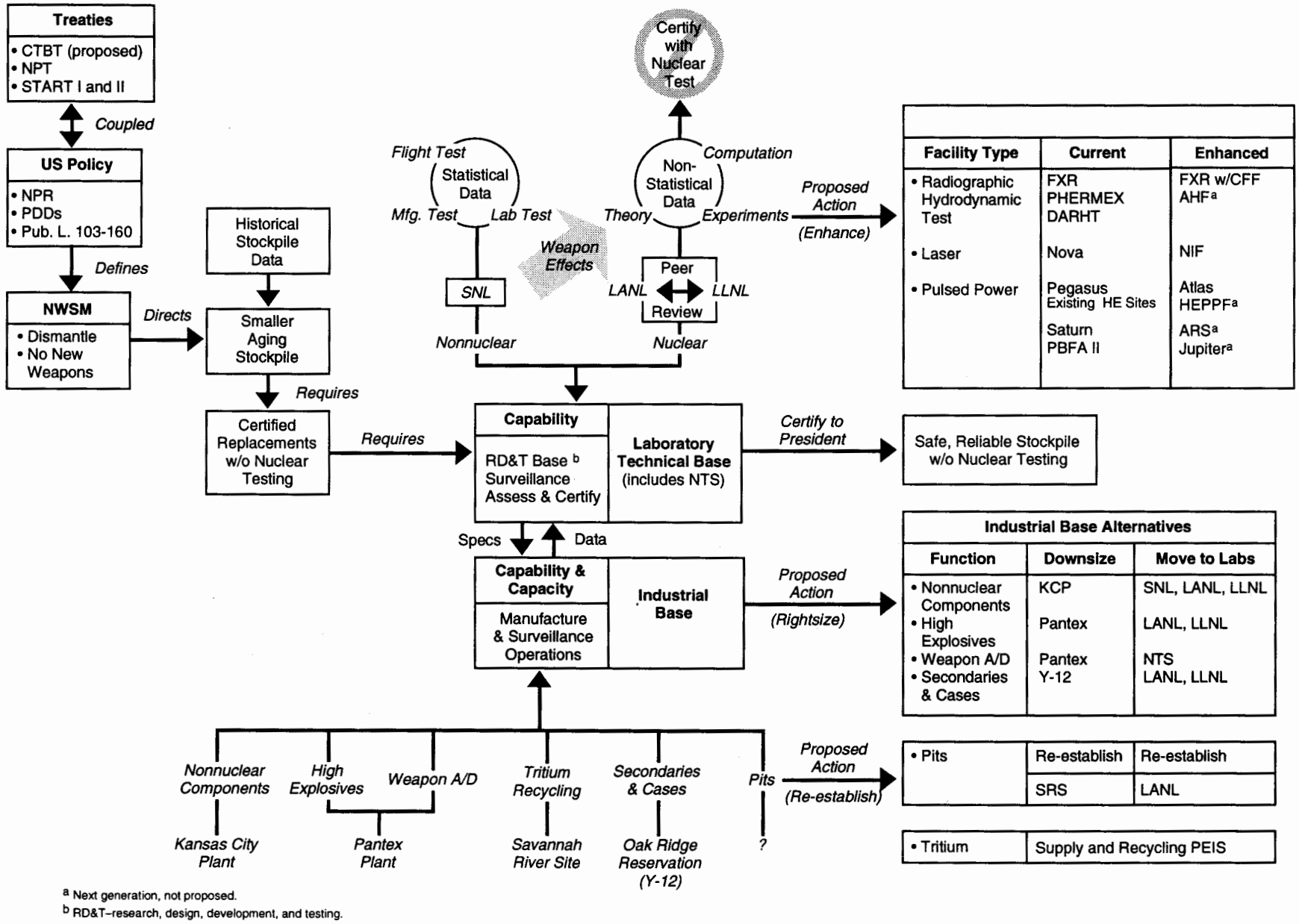


FIGURE S.2–2.—*Stockpile Perspective of the Stockpile Stewardship and Management Program.*

nuclear weapons that can be loaded on treaty-specified and -verified strategic missiles and bombers. These nuclear weapons are limited to 6,000 by the START I Treaty and 3,500 by the START II protocol. The treaties do not control the total stockpile size or the composition of strategic and nonstrategic nuclear weapons of either side. The U.S. stockpile will be larger than 6,000 under START I and 3,500 under START II since the stockpile also includes retaining weapons for nonstrategic nuclear forces, DOD operational spares, and spares to replace weapons attrited by DOE surveillance testing. In the START II case, the stockpile may also include retaining weapons to reconstitute to the START I level. However, the terms "START I-sized stockpile" and "START II-sized stockpile" are relevant to the Stockpile Stewardship and Management PEIS as explained in section 2.2.2 and chapter 3.

Comprehensive Test Ban Treaty. It is the declared policy of the United States to seek ratification of a "zero yield" CTBT as soon as possible. The United States has been observing a moratorium on nuclear testing since 1992. The NPR strategy reflects this policy and the strategy has a significant effect on shaping the Stockpile Stewardship and Management Program. As explained in section S.2.2, it is anticipated that repairs or replacements to an aging U.S. stockpile will be needed. Assessment and certification of the safety and reliability of stockpile repairs or replacements without nuclear testing is a significant challenge to the Stockpile Stewardship and Management Program. In declaring the policy to seek a CTBT, the President also declared that the continued safety and reliability of the U.S. nuclear stockpile is a "supreme national interest" of the United States.

Nuclear Nonproliferation Treaty. Article VI of the NPT obligates the parties "to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control." However, the NPT does not provide any time period for achieving this goal. Even relatively simple bilateral treaties, such as START I and START II, require more than 10 years to implement, not counting the years of negotiations. In the words of Ambassador Thomas Graham, "Regrettably, none of us is clairvoyant, and so it is unwise to predict with any degree of precision the future international reality and consequently, the complete arms control agenda."[1] For the Stockpile Stewardship and Management PEIS, speculation on the terms and conditions of a "zero level" U.S. stockpile with international verification, as some have suggested during the scoping meetings, goes beyond the bounds of a reasonably foreseeable future. For the same reason, DOE has not chosen to speculate on a return of the nuclear arms race requiring a stockpile larger than START I-size. However, in keeping with the NPT goals, the NPR strategy does express the U.S. intent to pursue further reductions in nuclear forces beyond START II. Therefore, the implications of further reductions below the START II-sized stockpile are discussed in the Stockpile Stewardship and Management PEIS where they are relevant.

Nuclear Weapon Stockpile Memorandum

Although the NWSM is a classified document, its effect in shaping the Stockpile Stewardship and Management PEIS can be explained in an unclassified context. Without access to the classified NWSM, one might assume that the exact details of the projected stockpile size and composition under START I and START II could have a significant effect on the Stockpile Stewardship and Management PEIS. This is not the case for the following reasons:

- The stockpile composition (i.e., the number of different weapon types), does not vary significantly in either a START I- or START II-sized stockpile. All weapon types are tritium-boosted, thermonuclear weapons that could be affected by the same types of safety and reliability problems requiring repair, replacement, and certification in the absence of nuclear verification. The basic weapons laboratory and industrial capabilities required for the foreseeable future do not vary significantly from planned differences in size or composition of either a START I- or START II-sized stockpile.

[1] From a January 1995 speech by Ambassador Graham, Special Representative of the President for Arms Control Non-Proliferation and Disarmament.

- Industrial capacity is only indirectly affected by projected variances in stockpile size and composition. Stockpile size must be linked with historical stockpile data to arrive at estimates of average annual industrial capacity needed to produce components for repair or replacement. Even without the limitations on the use of historical stockpile data described in section S.2.2, this cannot be done with mathematical precision and therefore reasonable technical judgment must be applied. The result is to forecast a need for a smaller industrial base with capacities on a scale of hundreds of weapons per year versus the thousands of weapons per year that existed prior to the end of the Cold War. A range of annual requirements is considered for impact analysis in the Stockpile Stewardship and Management PEIS that bounds potential variances in the NWSM under the START II protocol. In addition, a qualitative sensitivity analysis is performed on the hypothetical low case that is well below the START II-sized stockpile projection and the high case associated with a START I-sized stockpile.

Presidential Decision Directives and Public Law

Over the past few years, there have been several publicly announced PDDs that have shaped the Stockpile Stewardship and Management Program. In the *National Defense Authorization Act*, 1994 (Pub. L. 103-160), Congress acted to reinforce many of the same points. A summary of their effect in shaping the Stockpile Stewardship and Management PEIS follows:

- The continued maintenance of a safe and reliable nuclear weapons stockpile will remain a cornerstone of the U.S. nuclear deterrent for the foreseeable future.

- The core intellectual and technical competencies of the United States in nuclear weapons will be maintained. This includes competencies in research, design, development, and testing (including nuclear testing); reliability assessment; certification; manufacturing; and surveillance capabilities.

- The United States will develop new ways to maintain a high level of confidence in the safety, reliability, and performance of the U.S. nuclear weapons stockpile in the absence of nuclear testing. The strategy for this action will be structured around the use of past nuclear test data in combination with enhanced computational modeling, experimental facilities, and simulators to further comprehensive understanding of the behavior of nuclear weapons and the effects of radiation on military systems.[2]

- The continued vitality of all three DOE nuclear weapons laboratories will be essential in addressing the challenges of maintaining a safe and reliable nuclear weapons stockpile without nuclear testing and without the production of new design weapons.

S.2.2 Safety and Reliability of the United States Stockpile

This section focuses on the technical effects of national security policy decisions on shaping the purpose, need, proposed actions, and alternatives of the Stockpile Stewardship and Management Program. The stockpile is currently judged to be safe and reliable by DOE. National security policy changes will significantly change the characteristics of the future nuclear weapons stockpile and the manner in which it will need to be certified safe and reliable.

Stockpile History

Since the beginning of the Cold War, the United States has maintained a nuclear deterrent force as safe and reliable as the evolution of military requirements and technology development would permit. A safe and reliable U.S. nuclear weapons stockpile has been a cornerstone of maintaining a credible nuclear

[2] The effects of radiation on nuclear weapons and military systems are referred to as "weapons effects" throughout this document.

deterrent. The size of the U.S. nuclear weapons stockpile peaked in the 1960s. In the 1970s, it was significantly reduced due to the easing of Cold War tensions with the former Soviet Union. In the late 1970s and through most of the 1980s, Cold War tensions with the former Soviet Union significantly increased and the U.S. nuclear deterrent force was modernized in response. However, the size of the U.S. nuclear weapons stockpile remained stable during the 1980s with the production of new design weapons replacing dismantled weapons nearly one for one.

The beginning of the 1990s brought the collapse of the Warsaw Pact and the former Soviet Union and a significant effort to end the Cold War. During the first half of the 1990s, many changes occurred in U.S. policy and planning for its nuclear deterrent force. Much has already been accomplished, including the dismantlement, without replacement, of more than 8,000 U.S. nuclear weapons since the end of the Cold War; however, much more will need to be accomplished with the former Soviet Union over the next 10 years to stay the course. Large uncertainties remain concerning the nuclear weapons stockpile of the former Soviet Union, and it is the policy of the United States to protect its national security options for its nuclear deterrent, including the reconstitution of its nuclear forces. The following excerpt is from the President's national security strategy statement in July 1994:

> Even with the Cold War over, our Nation must maintain military forces that are sufficient to deter diverse threats. . . . We will retain strategic nuclear forces sufficient to deter any future hostile foreign leadership with access to strategic nuclear forces from acting against our vital interests and to convince it that seeking a nuclear advantage would be futile. Therefore we will continue to maintain nuclear forces of sufficient size and capability to hold at risk a broad range of assets valued by such political and military leaders.

Smaller, Aging Stockpile

Until recently there has been no reason to expect that weapons would remain in the stockpile longer than they have in the past. Continuous modernization to improve safety and reliability kept the stockpile young as new weapon types replaced old ones. Now, with no new weapons being produced, the United States will have a steadily aging stockpile. The average age of the stockpile has never approached the typical lifetime specified in the weapon requirements (approximately 20 years for the most modern U.S. nuclear weapons). The average age of the stockpile is currently about 13 years. The NWSM forecasts the average age will now climb roughly 1 year per year and will reach the 20 year mark by 2005, at which time the oldest weapons will be about 35 years old.

Historical Stockpile Data

The following paragraphs describe the effects of historical stockpile data in shaping the Stockpile Stewardship and Management Program. This information was extracted from an unclassified report, *Stockpile Surveillance: Past and Future* (tri-laboratory report requested by DOE and issued as Sandia Laboratory Report, SAND 95-2751, September 1995), which was co-authored by the three weapons laboratories and is available to the public. The past role of nuclear testing is emphasized because such testing can no longer be relied on to provide unambiguous high confidence in the future safety and reliability of an aging stockpile.

Stockpile Evaluation Program.[3] Continuous evaluation of the safety and reliability of the stockpile has always been a major part of the U.S. nuclear weapons program. Since the introduction of sealed-pit weapons more than 35 years ago, a formal surveillance program of nonnuclear laboratory and flight testing has been in existence. More than 13,800 weapons have been evaluated in this program. The Stockpile Evaluation Program, with its reliance on functional testing, has provided information that can be used in the statistical analysis of nonnuclear component and subsystem reliability. This program has detected about 75 percent of all problems ultimately detected, and it has been the principal mechanism for discovering defects and initiating subsequent repairs and replacements. However, not all aspects of a nuclear weapon can be statistically assessed this way. Weapons research and develop-

[3] Other than in specific discussions, the word surveillance is used generically throughout this document in place of the Stockpile Evaluation Program.

ment (R&D) at the three weapons laboratories and nuclear testing have played an important part in assessing the stockpile and in making corrective changes when needed.

Past Role of Nuclear Testing. Nuclear tests have been a critical part of the nuclear weapons program. They have contributed to a broad range of activities from development of new weapons to stockpile confidence tests to tests that either identified a concern or showed that remedial actions were not needed. However, the United States has not conducted a sufficient number of nuclear tests for any one weapon type to provide a statistical basis of reliability assessment for the nuclear explosive package. This is why the word "performance" instead of "reliability" is used when discussing a nuclear explosive package.

Although nuclear tests were never a part of the formal Stockpile Evaluation Program, they played an important role in maintaining the safety and performance of the weapons in the stockpile. Every advantage was taken of developmental nuclear tests to eliminate potential nuclear explosive problems. In some cases, nuclear testing during development of one weapon type uncovered a problem that was pertinent to a previous design already in the stockpile, which then had to be corrected. Nuclear tests identified certain classes of stockpile problems not observable in the surveillance program. Nuclear tests have been used to resolve issues raised by the Stockpile Evaluation Program, such as whether a particular corrosion problem affected the nuclear yield of a weapon. Nuclear tests have also been used to verify the efficacy of design changes. For example, the adequacy of certain mechanical safing techniques was determined through nuclear testing. In the case of a catastrophic defect, tests have been used to certify totally new designs to replace an existing design. Finally, in some cases, nuclear testing proved that a potential problem did not exist.

Beginning in the late 1970s, DOD and DOE agreed to a formal series of underground nuclear tests of weapons withdrawn from the stockpile. These tests were referred to as Stockpile Confidence Tests. They differed from developmental nuclear tests because the weapons were from actual production, had experienced stockpile conditions, and had minimal changes made to either nuclear or nonnuclear components prior to the test. There have been 17 such confidence tests since 1972, including 4 tests in the early 1970s that were not officially designated as Stockpile Confidence Tests. Confidence tests have been conducted for each of the weapon types expected to remain in the stockpile well into the next century.

In addition to the 17 confidence tests, at least 51 additional underground nuclear tests have been conducted since 1972 involving nuclear components from the stockpile, components from the actual weapon production line, or components built according to stockpile design specifications and tested after system deployment. The objectives of these tests included weapon effects, weapons R&D, confirmation of a fix, or investigation of safety or performance concerns. Three of these tests (in addition to one confidence test) revealed or confirmed a problem that required corrective action. Four tests (in addition to three confidence tests) confirmed a fix to an identified problem. Additionally, five tests were performed to investigate safety concerns affecting three different weapon types. These five tests verified that a problem did not exist.

The confidence in the performance of the nuclear explosive package has been based on underground nuclear test data, aboveground experiments, computer simulations, surveillance data, and technical judgment. The directors of the three weapons laboratories must certify the nuclear performance of the weapons designed by their laboratory. In a future without additional nuclear testing, the core capabilities of the weapons laboratories that were developed to eliminate potential problems in new weapon designs must now be employed to assess stockpile problems. However, in the absence of nuclear testing, the ability to assess nuclear components is more difficult; new methods of assessment, discussed later, will have to be developed to help compensate for this loss.

Stockpile Data Summary. The historical stockpile database includes more than 2,400 findings from about 45 weapon types. Findings are any abnormal conditions pertaining to stockpile weapons, such as out-of-specification data. Findings are then investigated and assessed as to whether or not they are a problem. Excluding multiple occurrences of the same anomalous condition, table S.2.2–1 provides a summary of the distinct findings and actionable findings since 1958. Actionable findings are those that require some form of corrective action. All major components and subsystems have had

problems that required corrective actions. The number of findings for nonnuclear components is much larger than that for nuclear components largely because there are so many more nonnuclear components in a nuclear weapon that require testing more frequently. However, the ratio of actionable findings to distinct findings is much greater for the nuclear components. Thus, when a finding has occurred for a nuclear component, it has generally been a serious one requiring corrective action. Often these corrective actions to nuclear components have required changes to all of the weapons comprising the weapon type affected.

For the nuclear explosive package, there were approximately 110 findings on 39 weapon types requiring some remediation either to the entire build of that design or to all weapons produced after the particular finding. In addition to rebuilds and changes in production procedures, other actions included imposing restrictions on the weapon, accepting a performance decrement, and in several cases, conducting a nuclear test to determine that the finding did not require any physical change. There have been other instances not counted as actionable where a material was chemically changing and the weapon was closely monitored to see if further action was necessary or whether it was determined to be an isolated case that did not require remediation.

Certified Repairs or Replacements Will Be Needed

Based on the age of the planned stockpile over the next 10 years, historical data would project an average of one to two actionable findings per year in the planned stockpile and an average of one to two change proposals approved per year, with one of these resulting in a major change. Even with a START II-sized stockpile, one change can affect thousands of weapons. These projections are most likely minimum numbers. The stockpile they were derived from was, on average, younger than the planned stockpile will be in future years, and the number of components in the weapon types was less than the number of components in weapon types of the planned stockpile. Furthermore, the planned stockpile contains different materials than the stockpile of the past, and the aging characteristics of some of these materials are not well understood.

The previous paragraphs describe how problems were identified in stockpile weapons during the period when nuclear testing and active weapons development were being conducted along with the Stockpile Evaluation Program. At the present time, with no anticipated new weapons and no nuclear testing, new approaches are needed to assess weapons for potential problems and anticipate aging concerns, especially in the nuclear explosive package. This is important because the smaller, less diverse U.S. stockpile will be more vulnerable to single-component and common-cause failures (i.e., failures or defects compromising the safety or reliability of, respectively, a single weapon system or several systems sharing a common design feature).

DOE will continue to rely on well-established methods while the weapons laboratories develop new methods of measurement and evaluation to address aging, safety, reliability, and performance issues. As the new methods mature for either nuclear or nonnuclear components, they will be incorporated into the Stockpile Evaluation Program. In the future, for example, DOE will rely on improved experimental capabilities, coupled with an improved computational capability, to address issues associated with the nuclear explosive package. These experimental capabilities, along with enhanced surveillance methods, are now crucial to help assess and predict the state of the stockpile and to provide long lead time information about incipient problems.

TABLE S.2.2–1.—*Distinct and Actionable Findings Summary Since 1958*

		Actionable Findings	
Type of Components	**Distinct Findings**	**Findings**	**Weapon Types**
Nuclear	145	110	39
Nonnuclear	703	306	38

Source: SAND 95-2751.

S.2.3 Purpose and Need

Broadly stated, changes to U.S. national security policies for nuclear deterrence now place two significant constraints on the way in which DOE has traditionally accomplished its statutory nuclear weapons mission:

- The United States has declared a moratorium on nuclear testing and will seek ratification of a "zero yield" CTBT.
- The United States has stopped the development and production of new design nuclear weapons.

With these constraints, U.S. national security policy directs DOE to:

- Maintain the core intellectual and technical competencies of the United States in nuclear weapons including:
  - Research, design, development, testing, reliability assessment, certification, manufacturing, and surveillance.
  - All three nuclear weapons laboratories and the capability to resume nuclear testing if needed.
- Maintain a safe and reliable U.S. nuclear weapons stockpile.

The NPR, PDDs, and Pub. L. 103-160 all address the need to maintain the core competencies of the United States in nuclear weapons without nuclear testing. The NPR strategy adds the expectation of no new- design weapon production; therefore, the NWSM does not currently direct or forecast such a requirement.

The Stockpile Stewardship and Management Program must accomplish these fundamental purposes in a safe, efficient, and environmentally responsible manner. National security policies do not eliminate any of the current or historical core competencies and capabilities of the DOE weapons laboratories, industrial plants, or NTS. They are basic needs that must be maintained for the foreseeable future. These needs are summarized in a focused discussion of their relationship to the development of the PEIS proposed actions and alternatives.

Stockpile Stewardship—The Laboratories and Nevada Test Site

The three weapons laboratories possess most of the core intellectual and technical competencies of the United States in nuclear weapons. These competencies embody more than 50 years of weapons knowledge and experience that cannot be found anywhere else in the United States. Since the end of the Cold War, laboratory staffing in the weapons program has declined significantly due to the effects of policy changes on program and budget. Further significant reductions or consolidations of the weapons laboratories would counter efforts to maintain core competencies and to develop the new technologies necessary to ensure continued high confidence in a safe and reliable stockpile. Current stockpile activities in this regard, such as ongoing retrofits of enduring stockpile weapons and safe dismantlement of weapons no longer required, would also be hampered. For the foreseeable future it would be unreasonable to pursue an alternative course for the weapons laboratories. In addition, because there can be no absolute guarantee of complete success in the development of enhanced experimental and computational capabilities, the United States will maintain the capability to conduct nuclear tests under a "supreme national interest" provision in the anticipated CTBT. DOE will need to maintain the capability for nuclear testing and experimentation at NTS and the necessary technical capabilities at the weapons laboratories to design and conduct such tests.

The science and engineering technology base at the three weapons laboratories controls all technical requirements for a U.S. nuclear weapon. The laboratories perform the basic research, design, system engineering, development testing, reliability assessment, and certification of nuclear performance. In addition, they provide or control all technical specifications that are used by the industrial base for manufacturing and surveillance operations and for maintenance operations conducted by DOD. Data from these operations are provided to the weapons laboratories for assessment and technical resolution of problems.

When stockpile problems develop, all of the core laboratory capabilities may come into play. The cause of the problem is identified and an assessment made of its impact on safety, reliability, or performance. If the problem is to be fixed, alternative solutions are developed. These can range from simple repair of a defective feature to complete redesign of the weapon component or subsystem.

The focus is always on the acquisition of relevant test data to make these judgments. Once a fix is determined, it must be designed, prototyped, and development tested by the laboratories before the design is released for manufacture. This generally includes weapon system-level laboratory and flight tests for nonnuclear features and, in the past, nuclear tests if the changes could affect the weapon's nuclear performance. If the fix is to be manufactured, the laboratories provide the quality assurance test specifications. For nonnuclear components, a significant amount of functional test data is acquired during manufacture and is used to begin building a statistical estimate of component reliability. Subsequent laboratory and flight testing in the surveillance program accumulates additional data that include the effects of aging and exposure to stockpile environments. Thus, over time, high confidence in the safety and statistical reliability of nonnuclear components and subsystems can be established.

The situation is not the same for nuclear components and the assessment of nuclear performance. Nuclear components cannot be functionally tested during manufacture or surveillance. The data acquired during manufacture only show that the component was manufactured as designed. Surveillance data indicate whether the component is changing as a result of aging or exposure to stockpile environments. Manufacturing and surveillance data can identify concerns, but these data do not provide all of the necessary information to assess nuclear performance. Assessment and certification of nuclear performance is a nonstatistical, technical judgment by the weapons laboratories based on scientific theory, experimental data, and computational modeling. The scientific practice of "peer review" has been fundamental to these judgments. Experts from the two nuclear design laboratories review each other's data and conclusions on important issues, thereby providing an independent check and balance.

In the past, nuclear testing filled the gaps in basic understanding of the complex physics phenomena; it provided high confidence in the certification of nuclear safety and performance. Without nuclear testing, science-based stockpile stewardship will focus on obtaining the more accurate scientific and experimental data that will be needed for more accurate computer simulations of nuclear performance. The new experimental data must also be validated against past nuclear test data. Assessment of stockpile problems and certification of repairs or replacements of nuclear components will have to rely on improvements to these tools. The existing tools were used in conjunction with nuclear testing and are inadequate if used alone.

From a broader national security perspective, the core intellectual and technical competencies of the weapons laboratories provide the technical basis for the pursuit of U.S. arms control and nuclear nonproliferation objectives. Their extensive core competencies have provided most of the nuclear weapons arms control technologies developed and employed by the United States. The weapons laboratories will have to continue to provide this essential service in the future. For the same reasons, the weapons laboratories also provide significant technical support for U.S. efforts on nuclear weapons nonproliferation and counter-proliferation programs.

Stockpile Management—The Industrial Base

None of the manufacturing and surveillance capabilities of the current industrial base can be eliminated on the basis of the post Cold War changes in national security policies. The industrial base also possesses core competencies, such as manufacturing product, process, and quality control know-how. However, with a smaller stockpile and no new weapons production, industrial capacity can be reduced to meet anticipated manufacturing requirements for stockpile repair and replacement activities. A summary discussion of each of the major functions needed is provided in this section. A more detailed discussion can be found in section 3.4.

Broadly stated, there are six major manufacturing and surveillance functional areas in the weapons industrial base:

- Weapon A/D
- Pit components
- Secondary and case components
- HE components
- Nonnuclear components
- Tritium supply and recycling

As explained in section S.1.4, tritium supply and recycling was evaluated in a separate PEIS.

Weapon Assembly/Disassembly. The Pantex Plant (Pantex) is the only DOE site currently authorized to assemble or disassemble stockpile weapons. Special facilities built to explosives safety criteria are required; in addition, some facilities are designed to limit nuclear material dispersal in case of an HE accident. These facilities exist in large numbers at Pantex, and because they are relatively discrete structures, downsizing-in-place is a viable alternative. NTS has a much smaller set of these special structures that were constructed for use in assembling nuclear test devices. However, NTS has few of the support facilities required for volume assembly or disassembly of stockpile weapons. A major programmatic consideration is the cost of re-creating facilities that already exist at Pantex. Due to ongoing weapon dismantlement requirements, the alternative to transfer this function to NTS would be slow but achievable within a 10-year period.

Pit Components. These components are designed by LANL and LLNL and were formerly produced at the Rocky Flats Plant, which is no longer available for this function. The LLNL facility is not large enough to accommodate both stewardship and management activities; therefore, only LANL is considered to be a reasonable alternative if this function is reestablished at a weapons laboratory. Also, LANL has the more extensive and complete plutonium facility infrastructure. Savannah River Site is also considered a viable alternative for reestablishing this function because it has a plutonium processing infrastructure, although it does not have a precision component manufacturing capability. Other than the synergism with maintaining core competencies at the weapons laboratories, a major program consideration would be the scale of manufacturing capacity required for the foreseeable future.

The preceding discussion applies to new pit fabrication as well as both intrusive and nonintrusive modification pit reuse manufacturing capability and capacity. Intrusive modification pit reuse requires handling and processing of the plutonium internal to the pit. Nonintrusive modification pit reuse involves the external features of the pit and does not require an extensive plutonium infrastructure; the risk of contamination and the generation of radioactive waste is very low for nonintrusive modification activities. Therefore, the weapons A/D facility is also an alternative for nonintrusive modification pit reuse.

Secondary and Case Components. The Y-12 Plant (Y-12) at the Oak Ridge Reservation produces the secondary and case components. These components are designed by LANL and LLNL; therefore, each of those facilities would be reasonable alternative sites if this function is transferred to the weapons laboratories. Both of these laboratories have a uranium technology base and facility infrastructure, although they have only a very limited R&D manufacturing capability. Other than the synergism with maintaining core competencies at the weapons laboratories, a major program consideration would be the cost of transferring product technologies and the re-creation of capital facilities that already exist at Y-12. Due to the complicated nature of nuclear facilities and plans for retrofit of an enduring stockpile weapon involving these components, a transition to either LANL or LLNL would be slow but achievable within a 10-year period. Downsizing Y-12 is considered to be a reasonable alternative.

High Explosive Components. Pantex currently manufactures HE components in special facilities built to explosives safety criteria. Downsizing the facilities at Pantex is a reasonable alternative. Comparable facilities also exist at both LLNL and LANL, and either laboratory has sufficient capacity to meet estimated future manufacturing requirements. Costs for this function are relatively low in any case. If a decision is made to transfer this function to the weapons laboratories, it could be done more quickly than the transfer of other functions. However, Pantex would have to retain disposition and disposal capability for the HE inventories currently on site and those expected from near-term weapon dismantle-

ment. A major program consideration would be the synergism of this function in maintaining the core competencies of the weapons laboratories.

Nonnuclear Components. KCP currently manufactures the majority of the nonnuclear components. The KCP facilities are not unique in structural design and are amenable to downsizing in place. The manufacturing technologies are complex and varied due to the large number of component types and high reliability requirements. SNL designs most of the components that KCP manufactures; therefore, SNL would become the major nonnuclear component supplier if a decision is made to transfer this function to the weapons laboratories. Other than potential synergism with maintaining core competencies at the weapons laboratories, a major program consideration would be the cost of transferring product technologies and re-creating facilities that already exist at KCP. Requirements for ongoing support of the enduring stockpile would make this a slow transition, but it would be achievable within a 10-year period.

S.2.4 Proposed Action and Alternatives

All of the existing basic capabilities of the laboratory and industrial base continue to be needed even though there have been changes in national security policy since the end of the Cold War. These changes do not affect the standards for stockpile safety and reliability. Therefore, the proposed action concentrates on three major issues that result from the national security policies and constraints placed on the program. The three program elements of the proposed action are:

- Providing enhanced experimental capability
- Rightsizing the industrial base
- Re-establishing manufacturing capability and capacity for pit components

Reasonable alternatives for the proposed action are briefly discussed below. Chapter 3 describes these alternatives in more detail.

Enhanced Experimental Capability

Understanding nuclear weapon performance requires knowledge of the performance of the individual elements: the primary (pit and HE), the secondary, and the functional interaction between the primary and the secondary inside the case. Computer model-based validation and certification will be the key to DOE's ability to determine, with confidence, many of the future safety and performance characteristics of the stockpile in the absence of nuclear testing. This requires two principal elements: advanced computational models; and facilities to provide experimental data that can be used to adjust (normalize) the computational models in conjunction with past nuclear test data. DOE is proposing three facilities to complement the existing capabilities to provide these data. Two are new facilities and one is the upgrade of an existing facility.

NIF and the Atlas Facility are proposed new facilities. The Atlas Facility would be collocated with the existing Pegasus II Facility at LANL, and the two facilities would use common infrastructures and support facilities. The Confined Firing Facility is a proposed environmental and diagnostic upgrade to the existing Flash X-Ray Facility at LLNL. As described in section 3.3, these three new facilities would perform separate functions and provide different types of experimental data. Thus, they are complementary in nature and are not alternatives to one another. In each case, the alternative to constructing and operating the facility is No Action, (i.e., relying on existing facilities to provide data). In addition, site alternatives are evaluated for the NIF, since it is not associated with an existing facility. Volume III of this PEIS contains project-specific analyses for each of these facilities.

The stockpile stewardship program is expected to continuously evolve as better information becomes available and technological advancements occur. DOE is in the early planning stages for a number of what can be described as "next generation" stewardship facilities. These facilities are discussed in section 3.3.4. They will build on the knowledge gained from existing and proposed new facilities. Since these facilities are in the conceptual planning stages, they are not sufficiently well defined to be analyzed in this PEIS. When those technologies reach the appropriate level of development so that a meaningful analysis can be presented, DOE will complete NEPA documentation for them.

Rightsizing the Industrial Base

One of the primary goals of stockpile management is to rightsize functions to provide an effective and efficient manufacturing capability for a smaller stockpile. Such rightsizing must be accomplished in a manner that preserves core competencies in manufacturing and surveillance. This PEIS analyzes two alternative approaches to rightsizing the stockpile management functions described in section S.2.3. These are: (1) transfer of manufacturing and surveillance activities from the industrial sites to the weapons laboratories and NTS; and (2) downsize the industrial plants in place. Relocation alternatives were selected on the basis of existing technical and facility infrastructure at the laboratories and NTS. Section 3.4 discussed these alternatives in detail.

Reestablishing Manufacturing Capability and Capacity for Pit Components

Plutonium pit manufacturing is a special case among those stockpile management functions discussed in section S.2.3. In 1992, DOE ceased plutonium pit manufacturing operations at the Rocky Flats Plant due to concerns about the safety of the plant and national security policy decisions to cease the production of new nuclear weapons. Reestablishing pit manufacturing capability and capacity was to be part of the Reconfiguration PEIS previously discussed. This function is now part of the proposed action in this Stockpile Stewardship and Management PEIS.

Pit manufacturing capability and capacity, like that of all other major weapons components and subsystems, is essential for protecting national security options with regard to the nuclear deterrent. In addition, repair or replacement pits for existing stockpile weapons may be required in the future. Reasonable alternative sites for reestablishing this function were selected from sites that already possess some measure of the appropriate technical or facility infrastructure.

S.2.5 Nonproliferation

On August 11, 1995, the President announced his commitment to seek a "zero yield" CTBT. He also established several safeguards that condition the U.S. entry into a CTBT. One of these safeguards is the conduct of science-based stewardship, including the conduct of experimental programs. This safeguard will enable the United States to enter into such a treaty while maintaining a safe and reliable nuclear weapons stockpile consistent with U.S. national security policies.

One benefit of science-based stockpile stewardship is to demonstrate the U.S. commitment to NPT goals; however, the U.S. nuclear posture is not the only factor that might affect whether or not other nations might develop nuclear weapons of their own. Some nations that are not declared nuclear states have the ability to develop nuclear weapons. Many of these nations rely on the U.S. nuclear deterrent for security assurance. The loss of confidence in the safety or reliability of the weapons in the U.S. stockpile could result in a corresponding loss of credibility of the U.S. nuclear deterrent and could provide an incentive to other nations to develop their own nuclear weapons programs.

The United States has halted the development and production of new design nuclear weapons. The experimental testing program will be used to assess the safety and reliability of the nuclear weapons in the remaining stockpile. Much of this testing is classified and could not lead to proliferation without a breach of security. Use of classified data from past U.S. nuclear tests is also a vital part of the overall process for validation of new experimental data. Most of the component technology used for the proposed enhanced experimental capability is unclassified and is available in open literature, and many other nations have developed a considerable capability.

Proliferation drivers for other states, such as international competition or the desire to deter conventional armed forces, would remain unchanged regardless of whether DOE implemented the proposed action analyzed in this PEIS. In the NPT, the parties agree not to transfer nuclear weapons or other devices, or control over them, and not to assist, encourage, or induce nonnuclear states to acquire nuclear weapons. However, the treaty does not mandate stockpile reductions by nuclear states, and it does not address actions of nuclear states in maintaining their stockpiles.

S.3 ALTERNATIVES

S.3.1 Development of Stockpile Stewardship and Management Program Alternatives

This PEIS evaluates the direct, indirect, and cumulative impacts associated with the Stockpile Stewardship and Management Program alternatives which are summarized in figure S.3.1–1. For the various alternatives, this includes evaluating the applicable impacts of new facility construction or existing facility modification. Also assessed are the operational impacts of long-term stewardship and management activities in support of the base case nuclear weapons stockpile, including transportation of materials and components between sites. This PEIS also provides a sensitivity analysis of differences, if any, from the base case alternatives for the high and low case stockpile. However, since it is expected that the annual workload may vary above and below the base case capacity assumptions, the base case is analyzed in the greatest detail.

Planning Assumptions and Basis for Analysis

In the Stockpile Stewardship and Management Program and in this PEIS, DOE will:

- Emphasize compliance with applicable laws and regulations and accepted practices regarding industrial and weapons safety, safeguarding the health of workers and the general public, protecting the environment, and ensuring the security of nuclear material, weapons, and weapons components

- Analyze alternatives that are consistent with, and supportive of, national security policies

- Maximize efficiency and minimize cost and waste consistent with programmatic needs

- Minimize the use of hazardous materials and the number and volume of waste streams consistent with programmatic needs through active pollution prevention programs and measures

The Department is currently preparing site-wide EISs covering continued operations for some of the alternative sites evaluated in the Stockpile Stewardship and Management PEIS. Some of the existing activities covered by these site-specific, site-wide EISs are similar to those of the No Action alternative of the Stockpile Stewardship and Management PEIS. Although the near-term analytical periods for these site-wide EIS analyses are different from that of the Stockpile Stewardship and Management PEIS, which is focused on long-term activities, the preparation of these documents has been closely reviewed and coordinated. As work on these site-wide EISs proceeds, their analyses will continue to be reviewed to ensure consistency. To the extent that the site-wide EIS analyses provide better information, such information will be incorporated, as appropriate, in the preparation of the Stockpile Stewardship and Management Final PEIS.

DOE has developed several planning assumptions as the basis of analyses presented in this PEIS. These considerations are summarized below.

Stockpile Management Assumptions

- Base case stockpile size for the PEIS analysis is consistent with the START II protocol but larger than 3,500 weapons. This PEIS also analyzes a high and a low case stockpile size. The high case consists of maintaining the stockpile at a level consistent with the START I Treaty but larger than 6,000 weapons. The hypothetical low case is a stockpile of approximately 1,000 weapons.

- Impacts from construction, including modifying existing structures, and operation are evaluated. The period of construction or downsizing for each alternative varies; however, for analytical purposes, this PEIS assumes that operations would begin in the year 2005.

- For plutonium, strategic reserve storage is evaluated at Pantex and NTS. For highly enriched uranium (HEU), strategic reserve storage is evaluated at ORR, Pantex, and NTS (DOE does not propose to store the strategic reserves of HEU at

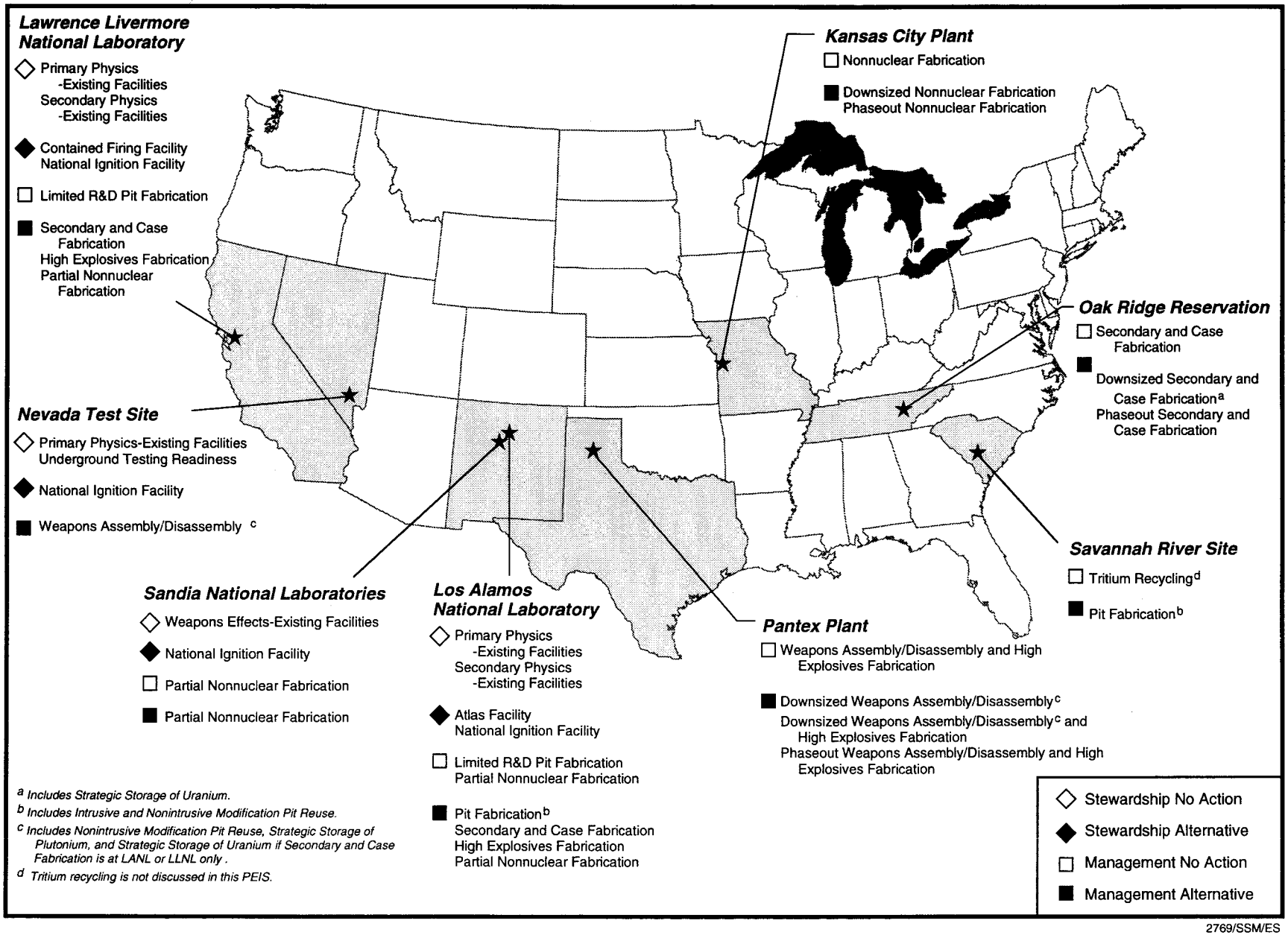


FIGURE S.3.1–1.—*Nuclear Weapons Complex Sites and Stockpile Stewardship and Management Alternatives.*

Pantex or NTS if ORR is closed as the secondary and case fabrication site).

- The No Action alternative includes all existing site facilities plus all facilities for which Congressional budget "line item" construction was started by the end of fiscal year 1995 (September 30, 1995).

- This PEIS contains an analysis of low-consequence/high-probability accidents (design basis) and high-consequence/low-probability accidents (beyond design basis). A spectrum of both types of accidents is analyzed. For radiological accidents, impacts are evaluated for both the general population residing within an 80-kilometer (km) (50-mile [mi]) radius (including the maximally exposed individual) and for noninvolved workers in collocated facilities. The accident analyses in this PEIS are based upon facility conditions that are expected to exist in 2005. In some cases, facility conditions in 2005 may differ from current facility conditions due to design upgrades.

- Plutonium or uranium would not be introduced into a site that does not currently have a plutonium or uranium infrastructure because of the high cost of new facilities and the complexity of introducing plutonium or uranium operations to sites without current capabilities.

Stockpile Stewardship Assumptions

- The range of stockpile sizes used for analysis of manufacturing capacity-related issues for stockpile management functions is not applicable to stockpile stewardship functions. Capabilities are independent of stockpile size. Stockpile stewardship functions are basic capabilities.

- National security policy requires a safe and reliable stockpile without further nuclear testing and with aggressive pursuit of enhanced experimental capabilities. Three stockpile stewardship facilities are proposed in this PEIS: NIF, CFF, and the Atlas Facility. These facilities are analyzed as supplements to the facilities and capabilities that currently exist for carrying out the stockpile stewardship mission. Each proposed facility is an independent component of the overall stockpile stewardship program, each has unique value, and, therefore, these proposed facilities are not competing alternatives.

- Assumptions regarding accident analysis and the No Action alternative for existing site facilities and construction started before the end of fiscal year 1995 are the same as described under stockpile management.

S.3.2 Alternatives Considered but Eliminated from Detailed Study

The following alternatives were considered for the Stockpile Stewardship and Management Program but eliminated from detailed study for the reasons discussed.

Locating Stockpile Stewardship Functions at Manufacturing Facilities

The majority of the U.S. core competencies and capabilities in nuclear weapons reside at the weapons laboratories. Proposing to locate stewardship facilities at sites without the knowledge base and infrastructure would be counterproductive to the development of science-based stockpile stewardship.

Dismantling the Nuclear Weapons Complex

Even in the post-Cold War period, international dangers remain, and nuclear deterrence will continue to be a cornerstone of U.S. national security policy for the foreseeable future. Thus, DOE's responsibilities for ensuring the safety and reliability of the U.S. nuclear weapons stockpile will also continue for the foreseeable future.

Two Laboratory Alternative

With no new production of nuclear weapons, DOE has considered whether or not it would be advisable to consolidate the weapons laboratories through the transfer of nuclear weapons-related responsibilities

from LLNL to LANL. *The Galvin Report*, issued in February 1995, recommended the elimination of duplicative programs at the weapons laboratories over a 5-year period.

The President's desire to seek a "zero yield" CTBT, combined with assurances that DOE's weapons laboratories could meet the challenge of maintaining the Nation's nuclear deterrent in the absence of nuclear testing, led DOE to reexamine the consolidation of activities at the three weapons laboratories. On September 25, 1995, DOE was directed by the President to maintain nuclear weapons responsibilities and capabilities at the three weapons laboratories sufficient to ensure continued confidence in the safety and reliability of the nuclear weapons stockpile in the absence of nuclear testing.

Nonscience-Based Stockpile Stewardship

Nonscience-based approaches were considered as alternatives for stockpile stewardship in this PEIS, but eliminated from detailed study. These eliminated alternatives can be grouped into four categories: (1) denuclearization, (2) remanufacturing, (3) maintenance, and (4) restoration. Brief explanations of each approach, and the reasons for eliminating each approach from detailed study, follow.

Denuclearization. Under this approach, nuclear weapons would be eliminated worldwide. During the transition to a nuclear-free world, the United States would conduct only those stockpile stewardship missions required to ensure the safety of the stockpile until it reached zero. This alternative would not enable DOE to meet national security policy objectives explained in section S.2 and is not considered to be within the bounds of a reasonably foreseeable future as explained in section S.2.1.

Remanufacturing. Under this approach, the safety and reliability of the nuclear weapons stockpile would be ensured by monitoring weapons and remanufacturing them to original specifications when defects arose. This approach would also produce weapons at a low rate on an ongoing basis to forestall defects, to exercise the manufacturing base, and to enable orderly planning for remanufacture.

Remanufacturing weapon components to their original specification, or maintaining these weapons to their original design specifications, would superficially appear to be a straightforward, low cost approach to maintaining the safety and reliability of the stockpile in the absence of underground nuclear testing. However, precise replication is often not possible. Subtle changes in materials, processing, and fabrication techniques are an ever-present problem. In some cases, specialty materials and components become unavailable for commercial or environmental reasons. Remanufacturing to original specifications has to be determined on a case-by-case basis and cannot be relied on as a generic strategy. Science-based stockpile stewardship strategies focus on basic materials science and the enhanced experimental and computational tools necessary to make these judgments. Emphasis is on nuclear components which can no longer be functionally evaluated by nuclear tests.

Maintenance. Under this approach, weapons maintenance would be the focus of stockpile stewardship. This approach would rely on enhanced surveillance and dual revalidation, whereby the weapons laboratories would conduct independent technical examinations of weapons to validate their safety and reliability. Any problems that arose would be solved through either remanufacture or "fixes" proposed by the laboratories. No significant new aboveground experimental facilities would be proposed.

While a maintenance approach might work in the short term, DOE does not believe that such an approach would maintain confidence in the safety and reliability of the nuclear weapons stockpile over the long term. The current experimental capabilities are judged to be inadequate to provide the data necessary to make the technical judgments required on remanufacturing or "fixes" in areas where nuclear testing played a significant role.

Restoration. Under this approach, the United States would resume design and production of new types of nuclear weapons, and would resume underground nuclear testing to certify that enduring and new weapons would be safe and reliable. Clearly this alternative works, because it is the approach that has been used to provide the current safe and reliable stockpile. However, this alternative is completely counter to post-Cold War national security policies on nuclear deterrence, arms control, and nonproliferation issues.

Nevada Test Site

NTS occupies approximately 351,000 ha (867,000 acres) in the southeastern part of Nye County in southern Nevada. NTS, located about 104 km (65 mi) northwest of Las Vegas, is a remote, secure facility that maintains the capability for conducting underground testing of nuclear weapons and evaluating the effects of nuclear weapons on military communications systems, electronics, satellites, sensors, and other materials.

North Las Vegas Facility. NLVF, located in the city of North Las Vegas, NV, supports DOE Nevada Operations Office and LLNL, LANL, and SNL weapons test programs, and is considered an adjunct to NTS.

S.3.6 Stockpile Stewardship Enhanced Experimental Capability

Historically, nuclear testing has provided unambiguous high confidence in the safety and reliability of weapons in the stockpile. Without additional underground nuclear testing, the Department must rely on experimental and computational capabilities, especially in weapons physics, to predict the consequences of the complex problems that are likely to occur in an aging stockpile. Without these enhanced capabilities, the Department will lack the ability to evaluate some safety and reliability issues, which could significantly affect the stockpile. It is also possible that, without these enhanced capabilities, the Department could not certify the acceptability of weapons components repaired or modified to address future safety or reliability issues. The nuclear weapons phenomena involved in enhanced experimental capability can be broadly grouped into three categories: physics of nuclear weapons primaries, physics of nuclear weapons secondaries, and weapons effects. Table S.3.6–1 depicts the proposed alternatives and facilities under consideration for stockpile stewardship.

Physics of Nuclear Weapons Primaries

With respect to the physics phenomena from the implosion of the primary, the experimental facilities provide physics validation, material behavior information, improved understanding of the implosion and the ability to assess age related defects. Proposed new facilities and site alternatives under consideration, along with the existing facilities which are part of the No Action alternative, are discussed below.

No Action. The principal diagnostic tools DOE currently uses to study nuclear weapons primaries are hydrodynamic tests and dynamic experiments. Under the No Action alternative, DOE would continue to use the hydrodynamic testing facilities

TABLE S.3.6–1.—*Stockpile Stewardship Enhanced Experimental Capability Alternatives*

Capability	LANL	LLNL	NTS	SNL
Physics of Nuclear Weapons				
Primaries				
No Action	X	X	X	
Contained Firing Facility[a]		X		
Physics of Nuclear Weapons				
Secondaries[b]				
No Action	X	X		
National Ignition Facility[a]	X	X	X	X
Atlas Facility[a]	X			
Weapons Effects				
No Action[c]				X

[a] Proposed facilities. Stockpile Stewardship and Management PEIS includes both a programmatic assessment and a project-specific analysis of these potential experimental facilities.

[b] Facilities used to investigate the physics of nuclear weapons secondaries may also be used to investigate some physics phenomena related to nuclear weapons primaries.

[c] No new facilities to investigate weapons effects phenomena are being proposed at this time.

currently available at LANL, LLNL, and NTS, and a new facility planned for LANL. The FXR Facility at LLNL Site 300 uses linear induction accelerator technology for high-speed radiography. The Pulsed High-Energy Radiation Machine Emitting X-Rays Facility has been in continuous operation at LANL since 1963, and uses a radio-frequency accelerator designed for high-speed radiography.

The DARHT Facility at LANL would consist of a new accelerator building with two accelerator halls to provide two perpendicular lines-of-sight which would enable two radiographic images to be captured simultaneously or sequentially and would provide a capability to perform three dimensional diagnostics of a simulated nuclear weapon primary. For the purposes of this PEIS, DOE includes DARHT as an existing facility at LANL because DOE has reached an independent decision to construct and operate the facility.

Besides LANL and LLNL, NTS has some hydrodynamic testing facilities in place (e.g., Big Explosive Experimental Facility [BEEF]). BEEF is used to study hydrodynamic motion associated with HE detonations.

Proposed Contained Firing Facility. Both LANL and LLNL are considered necessary for the continued development of the Stockpile Stewardship Program. In this regard, both laboratories will continue to utilize and improve radiographic hydrodynamic test capability. The proposed CFF would augment and be collocated with the existing Flash X-Ray (FXR) Facility at LLNL Site 300. The containment enclosure would provide for containment of hydrodynamic tests and reduce the Environmental, Safety & Health impacts of current outdoor testing. The enclosure will also improve the quality of diagnostics data derived from testing by better controlling experimental conditions.

Physics of Nuclear Weapons Secondaries

The energy released by the fission of the nuclear weapons primary activates the secondary assembly, creating a thermonuclear (fusion) explosion. With respect to the phenomena of the physics from the thermonuclear explosion of the secondary, the experimental facilities provide improved understanding of thermonuclear ignition, secondary physics validation, and material behavior information. The proposed physics facilities and site alternatives under consideration are discussed below. Some of the facilities may also be useful for investigating physics phenomena related to nuclear weapons primaries and weapon effects. The capabilities that would be provided by the proposed NIF and the Atlas Facility are independent components needed to improve the understanding of the physics of nuclear weapons secondaries. Each proposed facility responds to a different diagnostic need related to nuclear weapons secondaries and they are not competing alternatives.

No Action. Few methods are currently available to study the physics of nuclear weapons secondaries. The principal facilities currently available are the Nova Facility at LLNL and the Pegasus II Facility at LANL. Without improvements to these capabilities, as proposed by the NIF and the Atlas Facility, DOE would lack the ability to evaluate some significant reliability issues, which could adversely affect confidence in the Nation's nuclear deterrent.

Proposed National Ignition Facility. The proposed NIF would make it possible to study radiation physics in the laboratory close to the conditions which would approach that of a thermonuclear detonation. The NIF would achieve higher temperatures and pressures, albeit in a very small volume, than any other existing or proposed stockpile stewardship facility. This facility could be located at either LANL, LLNL, SNL, or NTS.

Proposed Atlas Facility. The proposed Atlas Facility at LANL would be used for experiments that would contribute to the development of predictive capabilities related to the aging and performance of secondaries. This facility would build on existing special equipment at LANL.

Weapon Effects

One of the reasons for past underground nuclear testing has been to determine the effects of nuclear weapon radiation outputs of x rays, gamma rays, and neutrons on nuclear weapon subsystems and components. Existing facilities at SNL, such as SATURN and PBFA, provide a limited capability to investigate these effects, and would continue to operate under No Action. No alternatives for new facilities designed principally for weapons effects testing are being proposed in this PEIS.

Next Generation Stockpile Stewardship Facilities

The science-based stockpile stewardship program will build upon existing information and capabilities. Thus, the program is expected to continuously evolve as better information becomes available and technological advancements occur. In fact, evolution is expected to be an integral part of the science-based stockpile stewardship program. While the proposed NIF, CFF, and Atlas Facility would provide improvements over existing capabilities, and are expected to be important components of science-based stewardship, they do not represent the entire science-based stewardship program that is envisioned for all time.

The next generation of stockpile stewardship facilities cannot be defined to the degree necessary to perform detailed environmental analysis. These anticipated facilities are AHF, HEPPF, ARS (X-1), and the Jupiter Facility. AHF would be a next generation radiographic hydrodynamic test facility featuring multiple pulse and multiple view diagnostic capability. HEPPF would provide experimental capabilities for studying secondary physics at shock pressures and velocities approaching those of actual weapons conditions. ARS (X-1) and Jupiter Facilities would be advanced pulsed-power x-ray sources to provide enhanced experimental capabilities in the areas of weapons physics and effects.

S.3.7 Stockpile Management

Stockpile management activities include dismantlement, maintenance, surveillance, and repair or replacement of weapons and weapons components in the existing stockpile. The individual stockpile management functions can be grouped into five major categories: weapons A/D, nonnuclear components fabrication, pit fabrication, secondary and case fabrication, and HE fabrication. Specific alternatives that would enable DOE to maintain its stockpile management responsibilities are shown in table S.3.7–1 and are discussed below.

TABLE S.3.7–1.—*Stockpile Management Alternatives*

Capability[a]	KCP	Pantex	SRS	Y-12	LANL	LLNL	NTS	SNL
Weapons Assembly/Disassembly[b]								
No Action		X						
Downsize existing capability		X						
Relocate capability							X	
Nonnuclear Fabrication								
No Action	X				X			X
Downsize existing capability	X							
Relocate capability					X[c]	X[c]		X[c]
Pit Fabrication and Intrusive Modification Pit Reuse[d]								
No Action[e]					X	X		
Reestablish capability			X		X			
Secondary and Case Fabrication[d]								
No Action				X				
Downsize existing capability				X				
Relocate capability					X	X		
High Explosives Fabrication								
No Action		X						
Downsize existing capability		X						
Relocate capability					X	X		

[a] Surveillance is included in all capabilities.
[b] Includes nonintrusive modification pit reuse and the option of strategic reserve storage.
[c] KCP functions would be distributed among all three laboratories.
[d] Staging and storage of working inventories of nuclear materials and components are included.
[e] Research and development capability only.

Weapons Assembly/Disassembly Alternatives

Weapons A/D provides the capability to dismantle retired weapons; assemble nuclear components and nonnuclear components into nuclear weapons; and perform weapons surveillance. In addition, the capability to conduct nonintrusive modification pit reuse would be a mission of the weapons A/D facility. This alternative also includes an option to store strategic reserves of nuclear components (pits and secondaries).

The alternatives for A/D are: 1) to continue in current facilities at Pantex with only those changes that are currently scheduled and budgeted (No Action), 2) to downsize and consolidate facilities and operations at Pantex, or 3) to relocate operations to NTS.

No Action. The No Action alternative for these activities, except nonintrusive modification pit reuse, is presently located at Pantex. Current plutonium R&D facilities at LANL and LLNL have limited capability and capacity to perform nonintrusive modification pit reuse.

Downsize at Pantex Plant. This alternative would downsize and consolidate facilities and operations including strategic reserve storage at Pantex. Downsizing of the A/D operation at Pantex could consist of an in situ decrease in footprint and relocation into modern, existing facilities, all within Zone 12. No new construction would be required at Pantex; however, relocation and reinstallation of equipment would be required.

Relocate to Nevada Test Site. This alternative is based on the use of the current Device Assembly Facility and balance of plant infrastructure available and required to maintain the capability for underground nuclear testing. Additional new construction would be required and would be designed and sized to meet the specific needs of the reduced program and enhanced safety and environmental objectives.

Nonnuclear Fabrication

Nonnuclear fabrication provides the following services:

- Fabrication of electrical, electronic, electro-mechanical, and mechanical components (plastics, metals, composites); assembly of arming, fusing, and firing systems
- Surveillance inspection and testing of nonnuclear components

The alternatives considered for nonnuclear fabrication include the No Action alternative of continuing in current facilities, downsizing and consolidating existing facilities at KCP, or closing KCP and sharing nonnuclear fabrication functions among SNL, LANL, and/or LLNL.

No Action. The No Action alternative for these activities is presently located at KCP, SNL, and LANL. KCP manufactures nonnuclear weapons components and conducts surveillance testing on and makes repairs to nonnuclear weapons components. SNL conducts system engineering of nuclear weapons, designs and develops nonnuclear components, conducts field and laboratory nonnuclear testing, manufactures some nonnuclear weapons components, and provides safety and reliability assessments of the stockpile. LANL also manufactures a few nonnuclear weapons components and conducts surveillance on certain nonnuclear weapons components.

Downsize at Kansas City Plant. The downsized nonnuclear fabrication alternative consists of three major factories designed around electronics, mechanical, and engineered materials product lines, procuring some components from outside sources, and reducing the KCP footprint for DP activities about 45 percent. This alternative consists of downsizing and consolidating existing facilities and would require facility modification but no new construction.

Relocate to Los Alamos National Laboratory. The basis for this alternative would be to use the existing expertise, capability, and infrastructure at LANL to provide for production requirements of the Complex. Nonnuclear fabrication missions considered for transfer to LANL include: plastics, which might also be transferred to LLNL; detonator inert components and pilot plant; and reservoirs and valves, which might also be transferred to SNL.

Relocate to Lawrence Livermore National Laboratory. This alternative calls for LLNL to provide support for nuclear system plastic components that

might also go to LANL. This alternative would build on LLNL's established plastics fabrication mission with no new facility construction required.

Relocate to Sandia National Laboratories. This alternative would transfer the majority of current KCP missions to the Albuquerque, NM facility of SNL, except for nuclear system plastic components which would go to either LANL or LLNL and high energy detonator inert components, which would go to LANL. In addition, there is the option of moving the reservoir mission to either SNL or LANL. This alternative would require construction of a new stand-alone production site at SNL, directly east of Technical Area I consists of six new buildings and renovation/minor modifications to some existing buildings.

Pit Fabrication and Intrusive Modification Pit Reuse Alternatives

This capability, hereafter referred to as pit fabrication, includes all activities necessary to fabricate new pits, to modify the internal features of existing pits (intrusive modification), and to recertify or requalify pits. There are two alternative sites for pit fabrication: SRS and LANL. Nonintrusive modification pit reuse, which is an inherent capability of the pit fabrication facility, includes the processes and systems necessary to make modifications to the external features of a pit, if necessary, and to recertify the pit for reuse in a weapon.

No Action. Under the No Action alternative, DOE would continue to use existing R&D capabilities at LANL and LLNL. LANL maintains a limited capability to fabricate plutonium components using its plutonium R&D facility and provides safety and reliability assessments of the stockpile. In addition, less extensive capabilities would continue at LLNL to support material and process technology development.

Reestablish at Los Alamos National Laboratory. This alternative would reconfigure the plutonium facility at LANL to fulfill the pit fabrication mission and the intrusive modification pit reuse mission. This alternative would locate pit manufacturing in existing facilities within five technical areas. Existing equipment would be retained as much as possible, but some equipment would be upgraded.

Reestablish at Savannah River Site. This alternative would establish a pit fabrication and reuse facility at SRS within existing hardened facilities, but with new equipment and systems. Facilities are available at the SRS separations areas, F-Area, and H-Area, which could house, in hardened structures, all the process functions required for the manufacture of plutonium pits. Pit fabrication would be located in Building 232-H and plutonium processing would be located in the F-Canyon facilities. New equipment and systems would be required for the pit fabrication facility.

Secondary and Case Fabrication

The secondary and case fabrication mission includes all activities to support fabrication, surveillance, inspection, and testing of secondaries and components. Functional capabilities for these services include operations to physically and chemically process, machine, inspect, assemble, and disassemble secondary and case materials. Materials include depleted uranium, enriched uranium, uranium alloys, isotopically enriched lithium hydride and lithium deuteride, and other materials. Alternative sites considered for stockpile management secondary activities are ORR, LANL, and LLNL.

No Action. Under No Action, ORR would continue secondary and case fabrication. Y-12 maintains the capability to produce and assemble secondaries, cases, and related nonnuclear weapons components.

Downsize at Oak Ridge Reservation. This alternative would be based on downsizing the existing secondary and case fabrication facilities at Y-12 on ORR. The downsized facilities would only require approximately 10 percent of the existing Y-12 floor space and there would be no new facility construction at Y-12 to support the secondary and case fabrication mission. Modifications to the existing buildings would be required for implementation of the alternate secondary and case fabrication mission and to upgrade the buildings to meet natural phenomena requirements.

Relocate to Los Alamos National Laboratory. This alternative would establish a secondary and case fabrication capability using the processes proven at Y-12 and would use facilities in 11 existing buildings. Modifications to the LANL facilities to perform the stockpile management secondary and case fabrication mission would be required.

Relocate to Lawrence Livermore National Laboratory. This alternative would establish a secondary and case fabrication capability using the processes proven at Y-12, and would use facilities in existing buildings. The secondary and case fabrication facilities at LLNL would principally involve minor modifications to six buildings at the Livermore Site.

High Explosives Fabrication

The HE fabrication mission is described in two functional areas: HE main charge fabrication and small HE component fabrication. The HE fabrication mission includes activities needed to provide HE, binders, main charge formulations, initiation HE, and mock HE formulations.

The HE fabrication mission supports the production aspect of stockpile management and also supports HE surveillance and some stockpile stewardship activities.

No Action. Under No Action, Pantex would continue fabrication and surveillance of HE components for nuclear weapons. LANL and LLNL would continue to perform weapons HE R&D, surveillance, and HE safety studies.

Downsize at Pantex Plant. The Pantex HE fabrication alternative would downsize and consolidate current HE operations and facilities. Only minor modifications to existing facilities within Zones 11 and 12 would be required. This alternative would be considered only in conjunction with maintaining the weapons A/D mission at Pantex.

Relocate to Los Alamos National Laboratory. This alternative would transfer HE operations to LANL from Pantex. This alternative would use existing LANL R&D facilities, which have sufficient capacity for stockpile management requirements. There would be no new building construction and no significant modifications required.

Relocate to Lawrence Livermore National Laboratory. The LLNL HE fabrication alternative would transition HE fabrication activities from Pantex. The LLNL HE fabrication alternative would require construction of one new facility for storage of HE and would use 23 existing buildings, 66 existing magazines, and various utilities and services at Site 300.

S.4 COMPARISON OF ALTERNATIVES

To aid the reader in understanding the differences in environmental impacts among the various PEIS alternatives, this section presents comparisons of the alternatives, concentrating on the major resources assessed in this PEIS. In section S.4.1, alternatives for each stockpile management mission (e.g., A/D, plutonium fabrication, secondary and case fabrication, nonnuclear fabrication, and HE fabrication) are compared with one another and the No Action alternative. Section S.4.1 also contains a top-level comparison of the entire stockpile management program. That comparison assesses the major differences in environmental impacts between a Complex that is rightsized in-place and a Complex that is consolidated to the maximum extent practicable. In section S.4.2 the three proposed Stockpile Stewardship facilities are compared with the No Action alternative.

S.4.1 Stockpile Management

Assembly/Disassembly. In addition to the No Action alternative, there are two alternatives being considered that would meet the needs of the Program: a downsizing of the existing A/D facilities at Pantex; and transferring the A/D mission to NTS by expanding the Device Assembly Facility at NTS.

Under No Action, the A/D mission would remain at Pantex. No downsizing or modifications of facilities would occur, and there would be no construction impacts. Due to the reduced workload expected in the future, impacts from operations are expected to be less than current impacts. Air quality would remain within regulatory limits, water requirements would be met without increased aquifer drawdowns, and generated wastes would be adequately managed with existing waste management facilities. Because of the reduced workload, the most significant change occurring at Pantex would involve the number of workers associated with the A/D mission, which would be expected to decrease from the approximately 2,365 current workers to approximately 915 workers. The average radiological dose to workers would not be expected to change, although the total worker dose would change due to the reduced number of workers associated with a reduction in workload. Potential impacts from accidents, which are essentially independent of a given operating tempo, would not be expected to change.

For the two alternatives other than No Action, the following impacts would be expected. Transferring the A/D mission to NTS would entail upgrading and expanding the Device Assembly Facility, with associated increases in land disturbance and short-term, beneficial socioeconomic impacts due to construction activities. An estimated 2.3 hectares (5.7 acres) of additional land would be disturbed, which is less than 1 percent of the land available at NTS for development. This land disturbance would increase the potential to impact cultural and biotic resources, however the impact to cultural resources is not expected to be significant because the proposed A/D site has been previously disturbed during construction activities associated with the Device Assembly Facility. Impacts to biotic resources are expected to be minor; however, the presence of the desert tortoise at NTS would require a site survey to determine any impacts. With mitigation measures already in place at NTS to minimize impacts to the Federal-listed desert tortoise, significant impacts due to the proposed project are not expected. Socioeconomic impacts associated with a peak construction workforce of 662 would produce small positive economic benefits. The 662 direct workers would also spawn approximately 620 indirect jobs. The 1,282 total new jobs during peak construction would cause the regional economic area unemployment rate to decease from 6.1 percent to 5.9 percent. Housing rental vacancies and public finance expenditures/revenues would change by less than 1 percent.

Because both alternatives would utilize similar facilities, procedures, resources, and numbers of workers during operation, both alternatives would produce similar operational environmental impacts for most resource areas. Impacts to air quality were modeled, and results indicate minimal impacts for both alternatives. Water use for the NTS alternative is projected to be less than for the Pantex alternative because continued operations at Pantex would rely on existing, older site-wide infrastructure. At both sites, water requirements could be adequately met without substantial aquifer drawdown. At Pantex, downsizing would reduce groundwater withdrawals by 16 percent compared to No Action. At NTS, water requirements to support the A/D mission would be approximately 4 percent more than projected usage. Groundwater withdrawals at NTS would be less than the recharge rates for the aquifer.

As stated above, because of the reduced workload expected in the future, under No Action, the number of workers associated with the A/D mission at Pantex would be expected to decrease from the current number of approximately 2,365 workers to approximately 915 workers. During operations, the downsized Pantex facility would operate more efficiently than the No Action Pantex facility. The downsized Pantex facility would require approximately 765 workers for one-shift operations. This is 150 workers less than the one-shift No Action projection of 915 workers. To perform operations in the downsized Pantex facility in a three-shift mode, which is the bounding-case analysis for this PEIS, approximately 1,249 workers would be required. This is approximately 334 workers more than the No Action one-shift number of workers.

If the A/D mission were transferred to NTS, approximately 1,093 direct jobs (based on three-shift operation) would be created at that site, along with approximately 1,160 indirect jobs. The 2,253 total new jobs would cause the regional economic area unemployment rate to decrease by approximately 0.1 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent. If the A/D mission were transferred to NTS, there would be socioeconomic impacts associated with phasing out the A/D mission at Pantex. Approximately 1,644 direct jobs would be lost at the Pantex site, and another 1,905 indirect jobs would be lost in the regional economic area. The loss of approximately 3,549 total jobs would cause the regional economic area unemployment rate to increase from 4.8 percent to 6.2 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent.

Worker exposure to radiation is expected to be about equal for both alternatives and well within regulatory limits. At either Pantex or NTS, the average worker dose from this mission would be approximately 10 mrem/year. Because of the difference in the workforce for this mission at the two sites, this would result in a total worker dose of 3.0 person-rem/year at Pantex and 2.6 person-rem/year at NTS. Statistically, this would equate to approximately one fatal cancer every 833 years at Pantex, and approximately one fatal cancer every 961 years at NTS, from operation of the A/D facility. Radiation exposure to the public from normal operation would be well within regulatory limits at both sites. At Pantex, the

incremental dose to the population within 80 km (50 mi) would be 4.0×10^{-4} person-rem/year. The probability of a member of the public dying from cancer would be 2.0×10^{-7}/year. Statistically, this would equate to one fatal cancer every 5 million years at Pantex from operation of the A/D facility. At NTS, the incremental dose to the public within 80 km (50 mi) resulting from operation of the A/D facility would be 3.1×10^{-6} person-rem/year. The probability of a member of the public dying from cancer would be 3.9×10^{-8}/year. Statistically, this would equate to one fatal cancer every 645 million years at NTS from operation of the A/D facility.

Potential impacts from accidents were determined using computer modeling. For the composite accident, less than one fatal cancer would be expected for the surrounding 80-km (50-mi) population at both Pantex and NTS. Based on a weighted averaging of the postulated accidents, at Pantex there would be a statistical risk that one fatal cancer to a member of the public would result every 43,478 years from accidents. At NTS, there would be a statistical risk that one fatal cancer to a member of the public would result every 500,000 years from accidents.

Both sites have adequate waste management facilities to treat, store, and/or dispose of wastes from the A/D mission, although LLW at Pantex would continue to be shipped offsite to NTS. The impacts of transporting LLW are similar to the impacts of transporting nonradiological materials, which are small. Transferring the A/D mission to NTS would eliminate the need to ship LLW from Pantex to NTS. Transferring the A/D mission to NTS by expanding the Device Assembly Facility would also increase the overall amount of eventual D&D activities and wastes.

The A/D mission also includes an option to store strategic reserves of plutonium and/or uranium. At Pantex, which presently stores both strategic reserves and surplus quantities of plutonium, no additional facilities would be needed, and no significant new environmental impacts or risks would result. Storing the strategic reserve would not produce any additional air emissions, require any additional water withdrawals, generate any wastes, or require additional workers. At NTS, however, the Device Assembly Facility would be further expanded to accomplish the strategic reserve storage. The additional construction would have smaller impacts (less than 10 percent) than the construction associated with the Device Assembly Facility upgrade for the A/D mission.

As with the A/D mission itself, due to the remoteness of NTS and the proximity of Pantex to a population center, there is a greater potential for a higher radiation exposure to the public in the event of an accident.

Pit Fabrication. For pit fabrication, a capability that no longer exists due to the closure of the Rocky Flats Plant, two alternatives are being considered that would reestablish this mission and meet the needs of the Program: upgrading the existing plutonium R&D fabrication capability at LANL, and upgrading existing H-Area and F-Canyon facilities at SRS. Under the No Action alternative, DOE would not reestablish this mission, but would rely on the existing R&D capabilities at LANL and LLNL.

For the two alternatives that would reestablish the pit fabrication capability, both alternatives involve relatively minor upgrades to existing facilities. Therefore, impacts during construction activities are expected to be small. Construction activities would involve internal modifications to existing facilities, no land would be disturbed, and thus, no impacts to cultural and biotic resources would result. Because the SRS alternative has less of an infrastructure in place for plutonium fabrication, the SRS alternative would require more direct workers (288 versus 138) during construction. At both sites, however, the socioeconomic impacts during construction would not cause any socioeconomic indicator to change by more than 1 percent.

Because both alternatives would utilize similar facilities, procedures, resources, and numbers of workers during operation, both alternatives would result in similar operational environmental impacts for most resource areas. Impacts to air quality were modeled, and results indicate minimal impacts to air quality for both alternatives. Water requirements at SRS would be provided from surface water, which is plentiful, and no adverse impacts would be expected. At LANL, groundwater would be used. Water requirements for this mission, which would be less than 1 percent of projected No Action uses, could be adequately met without exceeding the groundwater allotment at LANL.

During operation, both alternatives would have small positive socioeconomic impacts. Based on the socioeconomic modeling, impacts would be higher at SRS because of the indirect jobs that would be created for this industry. Modeling results indicate no indirect jobs for this industry at LANL. At SRS, approximately 810 direct jobs would be created, along with approximately 1,590 indirect jobs. These 2,400 total new jobs would cause the regional economic area unemployment rate to decrease from 6.7 percent to 6.0 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent. At LANL, approximately 260 new direct jobs would be created, but no indirect jobs would be created. The 260 total new jobs would cause the regional economic area unemployment rate to decrease from 6.2 percent to 6.0 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent.

Worker exposure to radiation is expected to be about equal for both alternatives and well within regulatory limits. At either SRS or LANL, the average workforce dose from this mission would be approximately 380 mrem/year. Because of a difference in workforce for this mission at the two sites, this would result in a total worker dose of 156 person-rem/year at SRS and 55 person-rem/year at LANL. Statistically, this would equate to one fatal cancer every 16.0 years at SRS, and every 45.4 years at LANL, from operation of the plutonium fabrication facility. Radiation exposure to the public from normal operation would be well within regulatory limits at both sites. At SRS and LANL, the incremental dose to the public within 80 km (50 mi) would be 5.9×10^{-4} person-rem/year and 8.6×10^{-5} person-rem/year, respectively. Statistically, this would equate to one fatal cancer every 3.4 million years at SRS, and one fatal cancer every 23.2 million years at LANL from operation of the plutonium fabrication facility.

Potential impacts from accidents were determined using computer modeling. For the composite accident, less than one fatal cancer would be expected for the surrounding 80-km (50-mi) population at both SRS and LANL. Based on a weighted averaging of the postulated accidents, at SRS there would be a statistical risk that one fatal cancer to a member of the public would result every 357,142 years from accidents. At LANL, there would be a statistical risk that one fatal cancer to a member of the public would result every 161,290 years from accidents.

Both site alternatives have adequate existing waste management facilities to treat, store, and/or dispose of wastes that would be generated by this mission.

Secondary and Case Fabrication. In addition to the No Action alternative, there are three alternatives being considered that would meet the needs of the Program: (1) a downsizing of the facilities that presently perform this mission at ORR, (2) transferring the secondary and case fabrication mission to LANL by upgrading the existing R&D secondary and case fabrication capabilities of LANL, and (3) transferring the secondary and case fabrication mission to LLNL by upgrading the existing R&D secondary and case fabrication capabilities of LLNL.

Under No Action, the secondary and case fabrication mission would remain at the Y-12 facility at ORR. No downsizing or modification of facilities would occur, and there would be no construction impacts. Impacts from operations are expected to be similar to current impacts. Air quality would remain within regulatory limits, water requirements would be adequately met by surface water withdrawals, and generated wastes would be adequately managed with existing waste management facilities. Under No Action, the most significant change occurring at Y-12 would involve the number of workers, which, due to reduced future workloads, would decrease from the approximately 2,350 current workers to approximately 2,235 workers. The average radiological dose to workers would not be expected to change, although the total worker dose would change due to the reduced number of workers. Potential impacts from accidents, which are essentially independent of workload, would not be expected to change.

For the three "action" alternatives, no previously disturbed land would be disturbed, and thus, no impacts to biotic resources would result. Minimal impacts to cultural resources may result from building modifications to National Register of Historic Places eligible facilities. During construction activities, socioeconomic impacts would result, but would be small. The number of peak workers would be 15 at ORR, 55 at LANL, and 130 at LLNL, which has the least extensive existing infrastructure for secondary and case fabrication. At all three sites, the socioeconomic impacts during construction would not cause any socioeconomic indicator to change by more than 1 percent.

Because each of the alternatives would utilize similar facilities, procedures, resources, and numbers of workers during operation, each of the alternatives would produce similar operational environmental impacts for most resource areas. Impacts to air quality were modeled for each alternative and results indicate minimal impacts to air quality for each of the alternatives. Water requirements at ORR would be met from surface water, which is plentiful, and no adverse impacts would be expected. At LANL, groundwater would be used. Groundwater withdrawals would increase by less than 1 percent over projected No Action water requirements, and LANL's groundwater allotment would not be exceeded. At LLNL, public water supply would be used, and usage would be approximately 4-percent higher than projected No Action water requirements. No adverse impacts to water resources are expected.

As stated above, because of the reduced workload expected in the future, under No Action, the number of workers associated with the secondary and case fabrication mission at Y-12 would be expected to decrease from 2,350 current workers to approximately 2,235 workers. The downsized Y-12 facility would operate more efficiently than the No Action Y-12 facility, and would require approximately 455 workers for one-shift operation. This is approximately 1,780 workers less than the one-shift No Action projection of 2,235 workers. To perform operations in the downsized Y-12 facility in a three-shift mode, which is the bounding-case analysis for this PEIS, approximately 870 workers would be required. This is approximately 1,365 workers less than the No Action one-shift number of workers. A reduction of 1,365 direct jobs represents approximately 9 percent of the projected No Action workforce at the entire ORR site, and less than 1 percent of the regional economic area. Approximately 3,490 indirect jobs would also be lost. Mitigating the workforce reductions would be the fact that downsizing would generate approximately 1,318 new jobs associated with Decontamination and Decommissioning (D&D) activities. Approximately 1,830 indirect jobs would be created by these D&D jobs. The net effect for the three-shift mode of operation would be a loss of a total of approximately 47 direct jobs at Y-12, which would represent less than 1 percent of the projected No Action workforce at ORR. Approximately 1,645 indirect jobs would be lost, which would represent less than 1 percent of the regional economic area.

Transferring the secondary and case fabrication mission to either LANL or LLNL would have small positive socioeconomic impacts at those sites, and negative socioeconomic impacts at ORR due to the phase out of this mission. At LANL, approximately 321 direct jobs (based on three-shift operation) would be created, but no indirect jobs would be created for this industry. The 321 new jobs would cause the regional economic area unemployment rate to decrease from 6.2 percent to 6.0 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent. At LLNL, approximately 290 new direct jobs (based on three-shift operation) would be created, along with 722 indirect jobs. The 1,012 new jobs would cause the regional economic area unemployment rate to decrease by less than 1 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent. Transferring the secondary and case fabrication mission from ORR to either LANL or LLNL would result in the loss of approximately 2,235 direct jobs projected for this mission under No Action at Y-12, and the closure and D&D of the Y-12 facilities previously involved in this mission. Approximately 5,710 indirect jobs could also be lost. It is expected that approximately 2,160 new jobs would be created by a direct transfer of responsibilities from DP to the DOE Office of the Assistant Secretary for Environmental Management. Additionally, because the D&D of facilities at ORR would be a relatively long-term process, any initial negative socioeconomic impacts resulting from the transfer of the secondary and case fabrication mission to LANL or LLNL would be minimized by the additional workforce associated with D&D activities at ORR. These 2,160 new D&D jobs would also create approximately 3,010 new indirect jobs. The net effect would be a loss of a total of approximately 2,775 total jobs (direct plus indirect) in the ORR regional economic area. This would cause the regional economic area unemployment rate to increase from 4.9 percent to 5.4 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than one percent.

Worker exposure to radiation is expected to be about equal for all three alternatives and well within regulatory limits. At each of the three sites, the average workforce dose from this mission would be approximately 2.2 mrem/year. Because of a difference in workforce for this mission at the sites, this would result in a total worker dose of 0.38 person-rem/year at ORR,

0.33 person-rem/year at LANL, and 0.55 person-rem/year at LLNL. Statistically, this would equate to one fatal cancer every 6,579 years at ORR, 7,576 years at LANL, and 4,545 years at LLNL from operation of the secondary and case fabrication facility. Radiation exposure to the public from normal operation would be well within regulatory limits at both sites. At ORR, the incremental dose to the population within 80 km (50 mi) would be 0.6 person rem/year. The probability of a member of the public dying from cancer would be $3x10^{-4}$/year. Statistically, this would equate to one fatal cancer every 3,333 years at ORR from operation of this facility. At LANL, the incremental dose to the population within 80 km (50 mi) would be 0.5 person-rem/year. The probability of a member of the public dying from cancer would be $2.5x10^{-4}$/year. Statistically, this would equate to one fatal cancer every 4,000 years at LANL from operation of this facility. At LLNL, the incremental dose to the population within 80 km (50 mi) would be 0.84 person-rem/year. The probability of a member of the public dying from cancer would be $4.2x10^{-4}$/year. Statistically, this would equate to one fatal cancer every 2,381 years at LLNL from operation of this facility.

Potential impacts from accidents were determined using computer modeling. For all postulated accidents, less than one fatal cancer would be expected for the surrounding 80-km (50-mi) population at each of the sites. Based on a weighted averaging of the postulated accidents, at ORR and LANL there would be a statistical risk that one fatal cancer to a member of the public would result every 833,333 years from accidents. At LLNL, there would be a statistical risk that one fatal cancer to a member of the public would result every 263,157 years from accidents. All three site alternatives have adequate existing waste management facilities to treat, store, and/or dispose of wastes that would be generated by this mission.

Lastly, if the secondary and case fabrication mission were transferred from ORR, storage of the strategic reserves of HEU would be transferred to the A/D facility (or a consolidated storage facility being assessed in the Storage and Disposition PEIS). The potential impacts associated with the one-time transfer of the strategic reserves of highly enriched uranium to the A/D facility are expected to be minor, even in the event of an accident, due to the robust shipping containers.

High Explosives Fabrication. In addition to the No Action alternative, there are three alternatives being considered that would meet the needs of the program: (1) a downsizing of the facilities that presently perform this mission at Pantex; (2) transferring the HE fabrication mission to LANL by upgrading the existing R&D HE fabrication capabilities of LANL; and/or (3) transferring the HE fabrication mission to LLNL by upgrading the existing R&D HE fabrication capabilities of LLNL. Transferring the HE fabrication from Pantex to LANL and/or LLNL would result in the closure and D&D of Pantex facilities previously involved in this activity.

Under No Action, the HE fabrication mission would remain at Pantex. No downsizing or modifications of facilities would occur, and there would be no construction impacts. Impacts from operations are expected to be similar to current impacts, although the direct number of workers associated with HE fabrication would decrease from 365 to approximately 105.

For the three "action" alternatives, construction impacts are expected to be minor and would involve internal modifications to existing facilities. No land would be disturbed at Pantex or LANL, and thus, no impacts to cultural or biotic resources would result. At LLNL, a small area of land (<1 ha) would be disturbed to construct an HE and parts storage building, but impacts to biotic and cultural resources are not expected. During construction activities, socioeconomic impacts would result, but they would be small. The number of peak workers would be 29 at Pantex, 46 at LANL, and 19 at LLNL. At all three sites, the socioeconomic impacts during construction would not cause any socioeconomic indicator to change by more than 1 percent.

Because each of the alternatives would utilize similar facilities, procedures, resources, and numbers of workers during operation, each of the alternatives would result in similar operational environmental impacts for most resource areas. Impacts to air quality were modeled for each alternative, and results indicate minimal impacts to air quality for each of the alternatives. At all sites, water requirements would be met from groundwater. At Pantex, groundwater withdrawals would be reduced by 21 percent compared to No Action. At LANL, groundwater withdrawals would increase by less than 1 percent over projected No Action water requirements, and LANL's groundwater allotment would not be

exceeded. At LLNL, groundwater and/or public water supply could be used to support the HE fabrication mission. If public water were used, it would require approximately 21 percent of the design capacity of the public water tap line. If groundwater were used, withdrawals would increase by approximately 65 percent from No Action, but they would not have any adverse impacts to aquifer levels.

During operation, socioeconomic impacts at Pantex would be similar to the No Action projections, although the downsizing of the HE fabrication mission would reduce the number of direct workers associated with this mission to approximately 51, compared to 105 for No Action. Transferring the HE fabrication mission to either LANL or LLNL would create small positive socioeconomic impacts at either of those sites, and small negative socioeconomic impacts at Pantex, due to the phaseout of this mission. At LANL, approximately 65 new direct jobs would be created, but no indirect jobs would be created by this industry. The 65 new jobs would cause the regional economic area unemployment rate to decrease from 6.2 percent to 6.1 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent. At LLNL, approximately 100 new direct jobs would be created, along with 150 indirect jobs. The 250 total new jobs would cause the regional economic area unemployment rate to decrease by less than 1 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent. Phasing out the HE fabrication mission at Pantex would cause the loss of approximately 105 direct jobs, which would be approximately 3 percent of the projected No Action workforce at Pantex. The direct plus indirect jobs lost would cause no observable change to the Pantex regional economic area unemployment rate, housing/rental vacancies, and public finance expenditures/revenues.

There are no radiological risks to workers or the public associated with the HE fabrication mission, and no adverse impacts associated with normal operation. Potential impacts from chemical accidents or explosions were determined using modeling. Impacts from these types of accidents could include death and other bodily damage. Due to proximity, workers would be most susceptible to any potential impacts. For all postulated accidents, impacts to the public were much less than to workers. In the event of an accident involving HE fabrication, due to the higher population surrounding LLNL, public impacts could be higher at LLNL compared to LANL and Pantex.

All three site alternatives have adequate existing waste management facilities to treat, store, and/or dispose of wastes that would be generated by this mission. Lastly, transferring the HE fabrication mission from Pantex to LANL and/or LLNL would require HE components to be shipped from the fabrication site to the A/D facility. HE is a nonradioactive, hazardous material. There are no impacts associated with the incident-free transportation of HE. In the event of an accident, HE transportation impacts would be no greater than those encountered by the public from industry's transportation of similar explosives. Potential accidents could include both explosive and nonexplosive roadway accidents, with potential impacts of death, lesser bodily injury, and property damage.

Nonnuclear Fabrication. In addition to the No Action alternative, there are two alternatives being considered that would meet the needs of the program: a downsizing of the facilities that presently perform this mission at KCP, and transferring the KCP nonnuclear fabrication mission to LANL, LLNL, and SNL by upgrading existing nonnuclear fabrication capabilities at LANL and LLNL, and constructing new nonnuclear fabrication facilities at SNL.

Under No Action, the nonnuclear fabrication mission would remain at current locations, which is primarily at KCP and a small workload at SNL and LANL. No downsizing or modification of facilities would occur, and there would be no construction impacts. At KCP, workforce downsizing consistent with a reduced workload has already taken place; therefore, the projected No Action workforce (2,612 workers) is equal to the current workforce. Due to the reduced workload expected in the future, impacts from operations are expected to be less than current impacts. Air quality would remain within regulatory limits at each of the sites, water requirements would be adequately met, generated wastes would be adequately managed with existing waste management facilities, and employment would be the same as current.

For the alternative that would downsize KCP, the construction activities would involve internal modifications to the existing facility. No land would be disturbed. For the alternative that would transfer the KCP mission to the laboratories, construction

impacts would involve internal facility modifications at LANL and LLNL. At SNL, approximately 9 ha (22 acres) of land would be disturbed to construct a new facility. This represents approximately 6 percent of the undisturbed land at SNL. Potential impacts to cultural and biotic resources would exist, but they would be mitigated to the extent practicable during follow-on, site-specific studies. During construction activities, socioeconomic impacts would result, but would be small. At KCP, approximately 187 direct jobs would be created during downsizing activities, plus another 262 indirect jobs. The 449 total jobs created during construction at KCP would represent less than a 1-percent increase in the regional economic area, and would cause no observable change to the regional economic area unemployment rate, housing/rental vacancies and public finance expenditures/revenues. If the nonnuclear fabrication mission is transferred to the three laboratories, no observable socioeconomic impacts would occur at LANL or LLNL. At SNL, approximately 379 direct jobs would be created during construction activities, plus another 421 indirect jobs. The 800 total jobs during construction at SNL would represent less than a 1-percent increase in the regional economic area, and would not cause any socioeconomic indicator to change by more than one percent.

Because each of the alternatives would utilize similar facilities, procedures, resources, and numbers of workers during operation, each of the alternatives would result in similar operational environmental impacts for most resource areas. Impacts to air quality were modeled for each alternative. Modeling results indicate minimal impacts to air quality for each of the alternatives. Water requirements for nonnuclear fabrication are relatively minor at each of the sites. At KCP, water requirements, which are publicly provided, would be reduced by approximately 31 percent compared to No Action. At LANL, groundwater withdrawals would increase by less than 1 percent over projected No Action water requirements, and LANL's groundwater allotment would not be exceeded. At LLNL, there would also be a less than 1-percent increase in water requirements to support nonnuclear fabrication. At SNL, groundwater would be used. Groundwater withdrawals would increase by approximately 64 percent over projected No Action withdrawals, but would still represent only 24 percent of the Kirtland Air Force Base groundwater rights. Thus, no adverse impacts are expected.

During operation, small negative socioeconomic impacts would be expected at KCP due to the downsizing. The downsized KCP facility would operate more efficiently than the No Action KCP facility, and would require approximately 1,669 workers for one-shift operations. This is approximately 943 workers less than the one-shift No Action projection of 2,612 workers. To perform operations in the downsized KCP facility in a three-shift mode, which is the bounding-case analysis for this PEIS, approximately 2,257 workers would be required. This is approximately 350 workers less than the No Action one-shift number of workers. The loss of 352 direct jobs during downsizing represents approximately 11 percent of the projected No Action workforce at KCP, but less than 1 percent of the regional economic area. Approximately 628 indirect jobs would also be lost. The loss of a total of 980 jobs (direct plus indirect jobs) would not cause the regional economic area unemployment rate to change.

Transferring the nonnuclear fabrication mission to the laboratories would create small positive socioeconomic impacts at both LANL and LLNL, with 391 and 249 total (direct plus indirect) jobs, respectively. At each of these sites, socioeconomic indicators would change by less than 1 percent. At SNL, approximately 1,160 direct jobs would be created, along with 1,350 indirect jobs. The 2,510 new jobs would cause the regional economic area unemployment rate to decrease from 5.7 percent to 5.2 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent. Phasing out the nonnuclear fabrication mission from KCP would cause the loss of approximately 3,283 direct jobs, and the loss of approximately 5,792 indirect jobs in the regional economic area. The loss of approximately 9,075 total jobs from KCP would cause the regional economic area unemployment rate to increase from 4.9 percent to 5.6 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent. Some socioeconomic impacts could be mitigated by employing personnel for D&D of the KCP facility, although that is not expected to last more than 5 years.

There are no radiological risks to workers or the public associated with the nonnuclear fabrication mission, and there are no adverse impacts associated with normal operation. Accident profiles at the sites would not change as a result of downsizing KCP or

transferring the nonnuclear fabrication mission to the laboratories. Phaseout of the nonnuclear mission from KCP would eliminate any potential accidents at that site. Lastly, all three site alternatives have adequate existing waste management facilities to treat, store, and/or dispose of wastes that would be generated by this mission.

Stockpile Management Top-Level Comparison. Based upon the reasonable alternatives for the five major missions that make up the stockpile management program, one could construct a matrix with hundreds of discrete alternatives for the entire Complex. Analyzing such a large number of alternatives is neither practical nor useful. What is useful, however, is to look at the two extreme configurations for the entire Complex in order to compare environmental impacts for a bounding-case analysis. Based on the alternatives that are reasonable for the individual missions, the bounding configurations and environmental impacts for the Complex would be: a relatively unconsolidated Complex that is downsized in place, and a relatively consolidated Complex that is rightsized by upsizing the laboratories.

For the first configuration (referred to as Downsize/Rightsize-in-Place), the Complex would consist of: A/D at Pantex, HE fabrication at Pantex, plutonium fabrication at LANL (or SRS), secondary and case fabrication at ORR, and nonnuclear fabrication at KCP. For the second configuration (referred to as "Maximum Consolidation"), the Complex would consist of: A/D at NTS, HE fabrication at LANL, plutonium fabrication at LANL, secondary and case fabrication at LANL (or LLNL), and nonnuclear fabrication at SNL, LANL, and LLNL. Major differences in environmental impacts between these two configurations are presented below.

Construction impacts associated with the Downsize/Rightsize-in-Place configuration would be minimal. All construction activities would be modifications to existing facilities, with no new construction. Consequently, no significant land disturbance at any sites would result, and no potential impacts to biota or cultural resources would occur. Socioeconomic impacts from construction for the Downsize/Rightsize-in-Place configuration would also be minimal.

Construction impacts associated with the Maximum Consolidation configuration would be small overall; only the Device Assembly Facility upgrade at NTS and the nonnuclear facility at SNL involve any land disturbance greater than 1 ha. Most construction activities would be modifications to existing facilities, with no significant land disturbance, and no potential impacts to biota or cultural resources. Overall, socioeconomic impacts from construction for the Maximum Consolidation configuration would be minimal, except at NTS and SNL.

During operation, because each of the two configurations would utilize similar facilities, procedures, resources, and numbers of workers, each would result in similar operational environmental impacts for most resource areas. It is worthy to note that some of the reductions in workforce at the various stockpile management facilities are associated with reduced workloads expected in the future, while additional reductions in workforce could occur due to the physical downsizing of facilities. For the A/D mission at Pantex, under No Action, the workforce would be reduced from the current level of approximately 2,365 workers to approximately 915 workers for one-shift operations. The physical downsizing of the facility would also improve efficiency such that the workforce could be reduced even further, to approximately 765 workers for one-shift operations. Three-shift operation of the downsized Pantex facility would require approximately 1,250 workers.

For the secondary and case fabrication mission at ORR, under No Action, the workforce would be reduced from the current level of approximately 2,350 workers to approximately 2,235 workers for one-shift operations. The physical downsizing of the Y-12 facility (essentially a 90-percent reduction in facility size) would also improve efficiency such that the workforce could be reduced even further, to approximately 460 workers for one-shift operations. Three-shift operation of the downsized Y-12 facility would require approximately 870 workers. The adverse socioeconomic impacts associated with the Y-12 downsizing would be mitigated by the creation of approximately 1,318 new jobs for the D&D of the facilities no longer needed.

At KCP, workforce reductions consistent with a reduced workload has already taken place; therefore, the projected No Action workforce (2,610 workers) is equal to the current workforce. Downsizing the KCP facility would improve efficiency such that the workforce could be reduced to approximately 1,670 workers for one-shift operations. Three-shift

operation of the downsized KCP facility would require approximately 2,260 workers.

For the Maximum Consolidation configuration, the greatest potential for any significant environmental impacts would occur at LANL, which would be the site for plutonium fabrication, secondary and case fabrication, HE fabrication, and a portion of non-nuclear fabrication. For each of the resources evaluated in the PEIS, no significant impacts are expected from such consolidation. Modeling results for air quality indicate minimal impacts to air quality. Water requirements would increase at LANL by 13 percent, but would still be less than the LANL allotment. Cumulative doses to the population from normal operations would be less than regulatory limits. Because impacts from accidents are independent of other missions (e.g., accident risks are additive not multiplicative), no additional accident risk results from the consolidation at LANL. Lastly, LANL would have adequate existing waste management facilities to treat, store, and/or dispose of wastes that would be generated by these missions. A major difference in the operation of the Downsize/Rightsize-in-Place configuration and the Maximum Consolidation configuration would involve the transportation of nuclear and hazardous materials. The Downsize/Rightsize-in Place configuration would result in transporting plutonium components between LANL (or SRS) and Pantex, and transporting secondary and case components between ORR and Pantex. Incident-free impacts associated with this transportation are small, while accident impacts are minor due to robust shipping containers. The Maximum Consolidation configuration would also result in transporting plutonium components and secondary and case components. Transportation would occur between LANL and NTS. Relative to the Downsize/Rightsize-in-Place configuration, any transportation impacts would be less due to shorter distances and less populated roadways. The Maximum Consolidation configuration would also result in transporting HE components between LANL and NTS, but no significant impacts are expected.

S.4.2 Stockpile Stewardship

Proposed National Ignition Facility. The following comparisons have been summarized from the more-detailed comparisons for the NIF alternatives found in appendix section I.3.5.

Under No Action, DOE would rely on existing aboveground experimental facilities, predominantly the NOVA Facility at LLNL, to study the physics of nuclear weapons secondaries. No construction impacts are associated with the No Action alternative and the operational impacts of the NOVA Facility have been accounted for in the overall environmental baseline presented for LLNL. The quantity of land disturbed by construction of the proposed NIF varies from site to site, from a high of 18.2 ha (45 acres) at NTS to a low of 3.2 ha (7.9 acres) at NLVF. While NIF construction at NTS would disturb the most land, because of the size of NTS, NIF at NTS would also disturb the least percentage of undeveloped land. The highest percentage of available land disturbance would occur at NLVF. At SNL, LANL, and LLNL, the percentage of disturbed land compared to available land would be relatively small. No significant biotic or cultural impacts are expected at any of the NIF site alternatives; however, the presence of the Mexican spotted owl at LANL and the desert tortoise at NTS would require a site survey to determine whether any impacts would occur.

At each NIF alternative site, beneficial socioeconomic impacts associated with construction and operation would occur. While these changes would not cause any major changes to the regional economic area employment, housing, or public finance, the changes would produce small positive economic benefits.

Impacts to human health from NIF operations are expected to be small and within regulatory limits at each site alternative. The NLVF alternative would have the greatest potential to affect human health because of its proximity to a large population; however, even these potential impacts are extremely small. Each of the site alternatives has adequate existing waste management facilities or processes to treat, store, and/or dispose of wastes that would be generated by NIF.

Proposed Contained Firing Facility. The following comparisons have been summarized from the more-detailed information for CFF found in appendix J.

Under No Action, DOE would rely on existing aboveground experimental facilities, predominantly the existing hydrotest facilities at LLNL, LANL, and NTS to study the physics of nuclear weapons prima-

ries. No construction impacts are associated with those existing facilities, and the operational impacts of those facilities have been accounted for in the overall environmental baseline presented for LLNL, LANL, and NTS.

Because the proposal for CFF involves modification to the existing FXR Facility, construction impacts are expected to be small. Very little land would be disturbed and the construction activities would largely involve internal modifications to the existing facility. Wastes and socioeconomic impacts from construction would be negligible.

Impacts associated with operations would also be negligible. CFF would not utilize any significant quantities of resources, would not cause any significant socioeconomic changes at LLNL, and would not generate large quantities of hazardous or low-level wastes. LLNL has adequate existing waste management facilities to treat, store, and/or dispose of wastes that would be generated by CFF. Impacts to human health from CFF operations are expected to be extremely small and within regulatory limits.

Proposed Atlas Facility. The following comparisons have been summarized from the more-detailed information for the Atlas Facility found in appendix K.

Under No Action, DOE would rely on existing aboveground experimental facilities, predominantly the Pegasus Facility at LANL, to study the physics of nuclear weapon secondaries. No construction impacts are associated with that facility, and the operational impacts from Pegasus have been accounted for in the overall environmental baseline presented for LANL.

Because the proposal for the Atlas Facility involves modification to the existing Pegasus Facility, construction impacts are expected to be small. Very little land would be disturbed and the construction activities would largely involve internal modifications to the existing facility. Wastes and socioeconomic impacts from modification activities would be negligible.

Impacts associated with operations would also be negligible. The Atlas Facility would not utilize any significant quantities of resources, would not cause any significant socioeconomic changes at LANL, and would not generate large quantities of hazardous or low-level wastes. LANL has adequate existing waste management facilities to treat, store, and/or dispose of wastes that would be generated by the Atlas Facility. Impacts to human health from Atlas Facility operations are expected to be small and within regulatory limits.

S.5 PREFERRED ALTERNATIVE

Regulations require that an agency identify its preferred alternative, if one or more exists, in the Draft EIS (40 CFR 1502.14[e]). The preferred alternative is the alternative that the agency believes would most fulfill its statutory mission, giving consideration to environmental, economic, technical, and other factors. Consequently, to identify a preferred alternative, the Department is developing information on potential environmental impacts, costs, technical risks, and schedule risks for the alternative under consideration. This Draft PEIS provides information on the environmental impacts. Cost, schedule, and technical analyses are also being prepared, and will be considered in the identification of a preferred alternative.

As of February 9, 1996, the date when this PEIS was sent to the printer, DOE had identified only one preferred alternative: to construct and operate NIF at LLNL. Other preferred alternatives will be announced, as appropriate, when they are identified.

The preferred PEIS alternatives do not represent decisions by DOE. Rather, they reflect DOE's current preferences based on existing information. Comments on the preferred alternatives are encouraged. The Final PEIS will identify all preferred alternatives. The ROD will describe DOE's decisions for the Stockpile Stewardship and Management PEIS proposed actions.