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Summary Volume Acronyms and Abbreviations

A/D	assembly/disassembly
AHF	Advanced Hydrotest Facility
ARS (X-1)	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
DOD	Department of Defense
DOE	Department of Energy
DP	DOE Office of the Assistant Secretary for Defense Programs
EIS	environmental impact statement
FXR	Flash X-Ray
HE	high explosives
HEPPF	High Explosive Pulsed Power Facility
HEU	highly enriched uranium
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

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LANL	Los Alamos National Laboratory
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NEPA	*National Environmental Policy Act*
NIF	National Ignition Facility
NLVF	North Las Vegas Facility
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Acronyms and Abbreviations

A/D	assembly/disassembly
AEC	Atomic Energy Commission
AHF	Advanced Hydrotest Facility
AQCR	Air Quality Control Region
ARS	Advanced Radiation Source
BEBA	beyond evaluation basis accident
BEEF	Big Explosives Experimental Facility
BEIR	biological effects of ionizing radiation
CAA	*Clean Air Act*
CEQ	Council on Environmental Quality
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CFF	Contained Firing Facility
CFR	Code of Federal Regulations
Complex	Nuclear Weapons Complex
CTBT	Comprehensive Test Ban Treaty
CWA	*Clean Water Act*
DARHT	Dual Axis Radiographic Hydrodynamic Test (Facility)
D&D	decontamination and decommissioning
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DP	DOE Office of the Assistant Secretary for Defense Programs
EA	environmental assessment
EBA	evaluation basis accident
EIS	environmental impact statement
EM	DOE Office of the Assistant Secretary for Environmental Management
EPA	Environmental Protection Agency
ES&H	environment, safety, and health
FONSI	Finding of No Significant Impact
FXR	Flash X-Ray (Facility)

HAP	hazardous air pollutants
HE	high explosives
HEPA	high efficiency particulate air (filter)
HEPPF	High Explosive Pulsed Power Facility
HEU	highly enriched uranium
HI	hazard index
HLW	high-level waste
HQ	hazard quotient
ICRP	International Commission on Radiological Protection
INEL	Idaho National Engineering Laboratory
IP	implementation plan
ISCST	Industrial Source Complex Short-Term (model)
K-25	K-25 site, Oak Ridge Reservation
KCP	Kansas City Plant
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
LLW	low-level waste
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NIF	National Ignition Facility
NLVF	North Las Vegas Facility
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPR	Nuclear Posture Review
NPT	Nuclear Nonproliferation Treaty
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NTS	Nevada Test Site
NWSM	Nuclear Weapon Stockpile Memorandum
NWSP	Nuclear Weapon Stockpile Plan
ORNL	Oak Ridge National Laboratory

ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
Pantex	Pantex Plant
PBFA II	Particle Beam Fusion Accelerator
PDD	Presidential Decision Directive
PEIS	programmatic environmental impact statement
PHERMEX	Pulsed High Energy Radiation Machine Emitting X-Rays (Facility)
PL	Public Law
R&D	research and development
RCRA	Resource Conservation and Recovery Act
RD&T	research, development, and testing
RIMS	Regional Input-Output Modeling System
ROD	Record of Decision
ROI	region of influence
SAR	Safety Analysis Report
SARA	Superfund Amendments and Reauthorization Act
SDWA	*Safe Drinking Water Act*
SHPO	State Historic Preservation Officer
SNL	Sandia National Laboratories/New Mexico
SRS	Savannah River Site
START	Strategic Arms Reduction Talks
TA	technical area
TLV-TWA	threshold limit value-time weighted average
TRU	transuranic
TSCA	*Toxic Substances Control Act*
TSP	total suspended particulates
USFWS	U.S. Fish and Wildlife Service
VOCs	volatile organic compounds
Y-12	Y-12 Plant, Oak Ridge Reservation
WIPP	Waste Isolation Pilot Plant

Volume II Acronyms and Abbreviations

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AHF	Advanced Hydrotest Facility
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ARS	Advanced Radiation Source
BEBA	beyond evaluation basis accident
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PHERMEX	Pulsed High Energy Radiation Machine Emitting X-Rays (Facility)
PL	Public Law
R&D	research and development
RCRA	*Resource Conservation and Recovery Act*
RD&T	research, development, and testing
RIMS	Regional Input-Output Modeling System
ROD	Record of Decision
ROI	region of influence
SAR	Safety Analysis Report
SARA	Superfund Amendments and Reauthorization Act

SDWA	*Safe Drinking Water Act*
SMR	standardized mortality ratio
SHPO	State Historic Preservation Officer
SNL	Sandia National Laboratories/New Mexico
SRS	Savannah River Site
START	Strategic Arms Reduction Talks
TA	technical area
TLV-TWA	threshold limit value-time weighted average
TRU	transuranic
TSCA	*Toxic Substances Control Act*
TSP	total suspended particulates
USFWS	U.S. Fish and Wildlife Service
VOCs	volatile organic compounds
Y-12	Y-12 Plant, Oak Ridge Reservation
WIPP	Waste Isolation Pilot Plant

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 assesument 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 nucWar 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-design 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 lear 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 "zero-yield" Comprehensive Test Ban Treaty (CTBT). 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 predecessor programs that served this mission over previous decades. With no underground nuclear testing, and no new-design 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 (DOD) 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 assesument. As such, the NWSM is the basis for all DOE stockpile support planning.

The Stockpile Stewardship and Management PEIS discusses the relevant factors, such as treaties, that shape the NWSM. Also explained is the fact that potential variances in stockpile size, such as a Strategic Arms Reduction Talks (START) I Treaty-sized stockpile 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 (HEU). 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 (A/D) of nuclear weapons is done only at Pantex.

S.1.2 Alternatives Analyzed in this *Programmatic Environmental Impact Statement for Stockpile Stewardship and Management*

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 "rightsize" existing facilities or consolidate them to fulfill expected requirements for manufacture of repair or replacement components for an aging U.S. stockpile.

This PEIS 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. Tables S.3.2-1 and S.3.4-1 show the alternatives analyzed.

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.2.4, the three independently justified proposed facilities include the National Ignition 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 (includes NLVF). 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 to be 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 decisionmaking.

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) of 1969, 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 Records 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 alternative sites. Each proposed facility's project-specific analysis can be found in Volume III of 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 *Programmatic Environmental Impact Statement 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 (DOE/EIS-0161) was issued in March 1995 and was followed by public hearings in April 1995. A Final PEIS was issued in October 1995, followed by the ROD published in the *Federal Register* (60 FR 63878) on December 12, 1995.

The DARHT *Facility 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 was about 34 percent complete when construction was halted under a U.S. District Court preliminary injunction issued on January 27, 1995, pending completion of the DARHT Facility EIS and issuance of the ROD. The DARHT Facility 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 Facility Draft EIS (DOE/EIS-0228) 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 the ROD published in the *Federal Register* (60 FR 53588) on October 16, 1995.

In the ROD, DOE announced that it will complete and operate the DARHT Facility at LANL while implementing a program to conduct most tests inside steel vessels, with containment to be phased in over 10 years. Following the ROD, DOE filed a motion for dissolution of the injunction. On April 16, 1996, the U.S. District Court concluded that the purpose of the injunction had been satisfied, and therefore lifted the injunction and dismissed the case.

DOE will rely on hydrodynamic testing in the absence of underground nuclear testing to ensure the stockpile's safety and reliability. Under any course of action analyzed in this PEIS, DOE will still need to continue hydrodynamic testing and acquire near-term enhanced radiographic capability such as that provided by the DARHT Facility. DOE determined that implementing the DARHT Facility ROD will not prejudice any decisions in the Stockpile Stewardship and Management Program. The impacts of the DARHT Facility for each resource area are addressed in the No Action impact discussions for LANL in Volume I, section 4.6.3.

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 PEIS and included in the analysis. This PEIS describes and includes in its analysis the ongoing alternatives being developed by the *Waste Management Programmatic Draft Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* ; the *Storage and Disposition of Weapons-Usable Fissile Materials Draft Programmatic Environmental Impact Statement* ; the *Site-Wide Draft Environmental Impact Statement 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 decisionmaking 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 NEPA 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 PEIS 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 so long as the RODs of both the PEISs 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.

S.1.6 Public Participation

Public participation for this PEIS consisted of two primary activities: the scoping process and the public comment process. CEQ regulations require "an early and open process for determining the scope of issues to be addressed and for identifying the significant issues to be addressed and for identifying the significant issues related to a proposed action (40 CFR 1501.7)." This is usually called the public scoping process. Section 4.1 of the *Implementation Plan Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (DOE/E1S-0236IP, December 1995) describes the scoping process. The following sections describe the public comment process on the Draft EIS.

S.1.6.1 *Public Comment Process on the Draft Programmatic Environmental Impact Statement*

In February 1996, DOE published the Stockpile Stewardship and Management Draft PEIS that evaluated the siting, construction, and operation of the proposed stockpile stewardship facilities and the modification/construction and operation of facilities proposed for stockpile management at eight alternative sites within the Complex. The 60-day public comment period for the Draft PEIS began on March 8, 1996, and ended on May 7, 1996. However, late comments were accepted to the extent practicable.

During the comment period, public hearings were held in Los Alamos, NM; Albuquerque, NM; Las Vegas, NV; Oak Ridge, TN; Kansas City, MO; Livermore, CA; Washington, DC; Amarillo, TX; Santa Fe, NM; and North Augusta, SC. Five of the public hearings were joint meetings to obtain comments on both the Stockpile Stewardship and Management PEIS and the Storage and Disposition PEIS. Two of the joint meetings (Pantex and SRS) also included the Pantex Site-Wide EIS. In addition, the public was encouraged to provide comments via mail, fax, electronic bulletin board (Internet), and telephone (toll-free 800 number). Figure S.1.6.1-1 shows the dates and locations of the hearings.

The public hearings held for the Draft PEIS were conducted using an interactive workshop-type format. The format chosen allowed for a two-way interaction between DOE and the public and encouraged informed public input and comments on the document. Neutral facilitators were present at the hearings to direct and clarify discussions and comments. Court reporters were also present to provide a verbatim transcript of the proceedings and record any formal comments.

All public hearing comment summaries were combined with comments received by mail, fax, Internet, or telephone during the public comment period. Volume IV of this PEIS, the *Comment Response Document* , describes the public comment process in detail, presents comment summaries and responses, and provides copies of all comments received.

S.1.6.2 *Major Comments Received on the Draft Programmatic Environmental Impact Statement*

A large number of the comments received on the Draft PEIS related to concerns that the analysis of particular alternatives and/or alternative sites did not adequately consider such factors as cost and technical feasibility. Although these concerns made up the majority of the comments, many other comments related to the resources analyzed, NEPA and regulatory issues, and DOE and Federal policies as they related to the PEIS. The major issues identified by commentors include the following:

- The potential conflict between the Stockpile Stewardship and Management Program and the Nuclear Nonproliferation Treaty (NPT) goals, and the pursuit of a CTBT
- Using the funds allocated for the Stockpile Stewardship and Management Program for social programs and on research of alternative sources of energy
- The generation, storage, and disposal of radioactive and hazardous wastes and the associated risks
- The impacts of the alternatives on human health (both from radiation and hazardous chemicals) and how these risks were determined and evaluated
- The relationship of this PEIS to other DOE documents and programs, particularly the Pantex and NTS Site-Wide EISs, the Waste Management and the Storage and Disposition PEISs, and the need to make decisions based on all associated programs and activities concurrently
- The need for decisions to be based on many different factors, including environmental, cost, and safety concerns
- The need for DOE to consider a zero-level stockpile, remanufacturing, and denuclearization as alternatives
- Maintaining deterrence with surveillance, curatorship, and remanufacturing without the need for the proposed facilities
- The need for DOE to adequately consider the ongoing stewardship programs
- The need for DOE to perform detailed analysis of future stockpile stewardship facilities.

All of the issues identified above are summarized and responded to in detail in chapter 3 of Volume IV. Substantial revisions to this PEIS resulting from public comments are discussed below.

Revisions in the Final PEIS include additional discussion and analysis in the following areas: alternatives considered but eliminated (section 3.1.2); the No Action alternative (appendix A "Stockpile Stewardship and Management Facilities," sections A.1.5, A.1.6, A.1.7, and A.1.8); socioeconomics at ORR, Pantex, and KCP; accident impacts at Pantex; normal operation impacts for radiological and chemical sections; cumulative impacts (section 4.13); and minor changes to LANL water resources section (4.6.2.4). A new section was also added to appendix F (section F.4, Secondary Impacts of Accidents). Each of these areas is discussed in more detail in the following section.

S.1.6.3 *Changes from the Draft Programmatic Environmental Impact Statement*

As a result of comments received on the Draft PEIS, several changes were incorporated into this PEIS. A brief discussion of the more significant changes is provided in the following paragraphs.

Alternatives Considered but Eliminated from Detailed Study and Related Issues. In response to public comments expressing a concern that DOE had not analyzed a reasonable range of alternatives, section 3.1.2 was expanded. The changes were in response to specific questions concerning compliance with treaties, stockpile size, maintenance and remanufacturing options, and the stockpile stewardship alternatives including No Action. The discussions in section 3.1.2 provide greater detail and more clarification on why alternatives were eliminated from detailed study in this PEIS. Together, chapter 2 and section 3.1.2 explain the framework and the constraints of national security policy that have shaped the proposed actions and reasonable alternatives for this PEIS.

No Action Alternative. Several commentors did not think that the No Action alternative was clearly explained in the Draft PEIS. More specifically, they were not sure which existing facilities at LANL, LLNL, SNL, and NTS were part of the ongoing stockpile stewardship program. As a result, the description of No Action was modified in appendix A to include a listing of major DOE Office of Defense Programs (DP) facilities at LANL, LLNL, SNL, and NTS. Additionally, the discussion of impacts of No Action at LANL (section 4.6.3) was revised as appropriate to include the effects of the DARHT Facility.

Socioeconomics at Oak Ridge Reservation, Kansas City Plant, and Pantex Plant. Based on public comments and revised workforce size estimates, the socioeconomic impact sections for the downsizing alternatives at ORR (section 4.2.3.8), KCP (section 4.4.3.8), and Pantex (section 4.5.3.8) have been revised. The analyses were also expanded to cover the base case single-shift options in greater detail. At these three sites, downsizing of existing facilities is the preferred alternative. For such downsizing, the base case single-shift scenario represents the bounding analysis for the workforce. The change in worker estimates did not cause any of the major indicators in the socioeconomic analysis to change in any significant manner.

Accident Impacts at Pantex Plant. The analyses of impacts due to an aircraft impact and the resulting release of plutonium by a fire or an explosion were modified to include more updated data on probability and source terms developed for the Pantex Site-Wide EIS. Section 4.5.3.9 and appendix sections F.2.1.1 and F.2.1.2 were revised to incorporate the new analytical results. Based on the updated data, the potential impacts and risks to the public from the composite accident presented in this PEIS would be less than previously reported in the Draft PEIS. This change was not significant.

Normal Operation Radiological/Chemical Impacts. The discussion of the normal operation radiological affected environment for LANL, section 4.6.2.9, has been updated to include the latest data from *Environmental Surveillance at Los Alamos* During 1993 (LA-12973-ENV, October 1995). The normal operation radiological impact sections 4.2.3.9, 4.3.3.9, and 4.6.3.9 have also been revised to include the contribution of recent facilities at ORR, SRS, and the new environmental surveillance data for LANL. The chemical health effects, section 4.6.3.9 for LANL and section 4.7.3.9 for LLNL, were revised based on new analyses using updated dispersion rates. Tables in appendix section E.3.4

supporting these sections were also updated. The majority of these changes affected the No Action alternative analyses. None of the changes to these sections significantly changed the analysis of impacts for the "action" alternatives.

Cumulative Impacts. The cumulative impact section 4.13 has been modified to incorporate a discussion of normal operation radiological impacts and other changes based on more recent data from NEPA documents and RODs. The changes to this section did not have a meaningful effect on the analysis/comparative evaluation of alternatives.

Los Alamos National Laboratory Water Resources. Changes were incorporated in section 4.6.2.4 (Water Resources) for LANL based on more recent water use and water quality data. The Draft PEIS had erroneously stated that the LANL water allotment would be fully used by about the year 2000. The Final PEIS correctly reports that this allotment would be fully used by about the year 2052. This change did not have a meaningful effect on the analysis/comparative evaluation of alternatives. Minor revisions reflecting the baseline changes, were also made to the LANL water resources impact section 4.6.3.4.

Health Effects Studies. Appendix section E.4, which outlines epidemiological studies at the alternative sites, was rewritten to provide more detail and incorporate more recent and other applicable studies. Although these epidemiology sections do not affect the environmental analysis of future stockpile stewardship and management missions, they do provide relevant information regarding potential health effects from past actions. These changes did not have a meaningful effect on the analysis/comparative evaluation of alternatives.

New Section. A new section has also been added to the Final PEIS (appendix section F.4, Secondary Impacts of Accidents). This section evaluates the secondary impacts of accidents that affect elements of the environment other than humans (e.g., farmland). The section was added because of public comments. The results of this analysis show that secondary impacts from accidents would generally not extend beyond site boundaries, except at Pantex and LLNL, where it is possible that some surface contamination could occur. This new analysis did not have a meaningful effect on the analysis/comparative evaluation of alternatives.

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 PEIS 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 of 1994 (Pub. L. 103-160)
- DOD Nuclear Posture Review (NPR)
- NWSM
- Proposed CTBT
- NPT
- START 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 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 the discussion of the NWSM.

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. Assesument 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 this 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 testing. 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.

- 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 *of 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 assesument; 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 its 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 as 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 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-design weapon types replaced old ones. Now, with no new-design 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 development (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 assesument 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 assesument, 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 more than 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 it was an isolated case that did not require remediation.

Table S.2.2-1. ***Summary of Distinct and Actionable Findings Since 1958***

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

Source: SNL 1996a.

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 aging characteristics of some of the materials used in the weapon types remaining in the stockpile 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.

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 assesument, 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. A classified appendix has also been prepared to support the PEIS.

Stockpile Stewardship--The Weapons 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 DOE technical requirements for a U.S. nuclear weapon. The laboratories perform the basic research, design, system engineering, development testing, reliability assesument, 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 assesument 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 assesument 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 assesument 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. Assesument 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. Assesument 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-design 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.

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. 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. SRS 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 ORR 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 LANL and LLNL, 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 onsite and those expected from near-term weapon dismantlement. 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
- Reestablishing manufacturing capability and capacity for pit components

Reasonable alternatives for the proposed action are briefly discussed below. Section S.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 in TA-35 with the existing Pegasus II Facility at LANL, and the two facilities would use common infrastructures and support facilities. CFF is a proposed environmental and diagnostic upgrade to the existing Flash X-Ray (FXR) Facility at LLNL. As described in section S.3.2, 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 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 S.3.2. 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 defined to be analyzed in this PEIS. When these technologies reach the appropriate level so as to be ripe for decisionmaking, DOE would 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: (1) transfer 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 S.3.4 discusses these alternatives in more 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-design nuclear weapons. Reestablishing pit manufacturing capability and capacity was to be part of the Reconfiguration PEIS. 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 of 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, when applicable, 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 industrial and weapons safety practices that safeguard the health of workers and the general public, protect the environment, and ensure the security of nuclear material and weapons
- 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

DOE 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 has been incorporated. In the preparation of the Stockpile Stewardship and Management Final PEIS, any updated information relating to the sites' affected environment was reviewed and appropriate changes were made if new information could potentially change results of the impact analyses.

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

No Action Alternative Assumptions

- The No Action alternative for this PEIS is defined in a way that takes into account the fact that DOE for decades has had in place a program for the stewardship and management of the nuclear weapons stockpile. Consistent with CEQ guidance, the No Action alternative consists of those facilities necessary to maintain the status quo in terms of DOE's current program direction. These consist primarily of existing facilities where DOE currently conducts weapons activities, including modifications to those facilities necessary to maintain their current mission capabilities. However, the No Action alternative also includes a small number of minor new facilities that will also be needed simply to maintain current mission capabilities at individual sites. Finally, the No Action alternative includes two major new facilities which are proceeding independent of this PEIS, and for which DOE has prepared separate EISs under the interim action provisions of the CEQ regulations. These EISs are the PEIS for Tritium Supply and Recycling (DOE/EIS-0161) and the EIS for the DARHT Facility (DOE/EIS-0228).

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 2005. A 25-year lifetime was evaluated for operations.
- For plutonium, strategic reserve storage is evaluated at Pantex and NTS. For HEU, strategic reserve storage is evaluated at ORR, Pantex, and NTS. (For purposes of this PEIS, DOE does not intend to move the strategic reserves of HEU to Pantex or NTS if ORR is chosen as the secondary and case fabrication site).
- This PEIS contains an analysis of low-consequence/high-probability accidents (evaluation basis) and high-consequence/low-probability accidents (beyond evaluation 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 an 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 are the same as described under stockpile management.

S.3.1.1 *Alternative Sites*

Eight locations (ORR, SRS, KCP, Pantex, LANL, LLNL, SNL, and NTS) are being considered as alternative sites for stockpile stewardship and management missions. All of these sites are currently performing DP activities.

Site Selection

One important strategy of the Stockpile Stewardship and Management Program is to maximize the use of existing infrastructure and facilities as the Complex transitions to be smaller and more efficient in the 21st century. Consequently, only those sites with existing infrastructure or facilities capable of supporting a given stockpile stewardship or stockpile management mission are considered reasonable site alternatives for detailed study in this PEIS. Sites without a technical infrastructure or facilities for a given mission would require significant new construction that would be costly and impractical compared to sites with existing infrastructure and facilities.

For stockpile stewardship, the three existing weapons laboratories (LANL, LLNL, and SNL) and NTS are being considered for new or upgraded stockpile stewardship facilities. This is because the weapons testing mission and stockpile stewardship have always been primary responsibilities of the weapons laboratories and NTS, and existing facilities and capabilities can be built upon to meet the stewardship mission.

Oak Ridge Reservation

ORR, located in Oak Ridge, TN, contains the Oak Ridge National Laboratory, Y-12, and the K-25 Site. DP assignments at ORR are performed at Y-12 and include maintaining the capability to produce secondaries and cases for nuclear weapons, storing and processing uranium and lithium materials and parts, dismantling nuclear weapon secondaries returned from the stockpile, and providing special production support to the DOE weapons laboratories and to other DOE programs.

Savannah River Site

SRS, located near Aiken, SC, contains fuel and target fabrication facilities, nuclear material production reactors, chemical separation plants used for recovery of plutonium and uranium isotopes, a uranium fuel processing area, and the Savannah River Technology Center. SRS is now conducting tritium-recycling operations in support of stockpile requirements using dismantled weapons as the tritium supply source.

Kansas City Plant

KCP, situated on the Bannister Federal Complex in Kansas City, MO, produces and procures nonnuclear electrical, electronic, electromechanical, mechanical, plastic, and nonfissionable metal components for the nuclear weapons program. KCP is currently the principal nonnuclear fabrication facility within the Complex.

Pantex Plant

Pantex, located northeast of Amarillo, TX, fabricates chemical HE for nuclear weapons, assembles and performs maintenance and surveillance of nuclear weapons in the stockpile, disassembles nuclear weapons being retired from the stockpile, and provides interim storage of plutonium components from dismantled weapons.

Los Alamos National Laboratory

LANL, located at Los Alamos, NM, is a multidisciplinary research facility engaged in a variety of programs for DOE and other Government agencies. Its primary mission is the nuclear weapons Stockpile Stewardship and Management Program and related emergency response, arms control, and nonproliferation and environmental activities. It conducts R&D activities including the basic sciences, mathematics and computing with applications to these mission areas and to a broad range of programs including: nonnuclear defense; nuclear and nonnuclear energy; atmospheric, space, and geosciences; bioscience and biotechnology; and the environment.

In regard to nuclear weapons, LANL is responsible for the design of the nuclear explosive package in certain U.S. weapons. In addition, since the end of the Cold War, LANL now conducts the pit surveillance program and some manufacturing of nonnuclear components due to termination of the nuclear weapons missions at the Mound, Pinellas, and Rocky Flats Plants.

Lawrence Livermore National Laboratory

LLNL, located at Livermore, CA, is a multidisciplinary research facility engaged in a variety of programs for DOE and other Government agencies. Its primary mission is the nuclear weapons stewardship program and related emergency response, arms control, and nonproliferation activities. It conducts R&D activities in the basic sciences, mathematics, and computing with applications to these mission areas and to a broad range of programs including: nonnuclear defense; nuclear and nonnuclear energy; atmospheric, space, and geosciences; bioscience and biotechnology; and the environment. In regard to nuclear weapons, LLNL is responsible for the design of the nuclear explosive package in certain U.S. weapons.

Sandia National Laboratories

SNL maintains facilities in three locations in the United States: Albuquerque, NM; Livermore, CA; and Tonopah, NV. The facilities discussed in this document refer only to the Albuquerque location which is located adjacent to the city of Albuquerque, NM. SNL is a multidisciplinary research and engineering facility engaged in a variety of programs for DOE and other Government agencies. Its primary mission is the nuclear weapons Stockpile Stewardship and Management Program and related emergency response, arms control, and nonproliferation activities. In addition, it conducts R&D activities in advanced manufacturing, electronics, information, pulsed power, energy, environment, transportation, and biomedical technologies.

In regard to nuclear weapons, SNL is responsible for the design of nonnuclear components and related system engineering. In addition, since the end of the Cold War, SNL now performs some nonnuclear manufacturing functions due to termination of the nuclear weapons mission at the Mound and Pinellas Plants.

Nevada Test Site

NTS occupies approximately 351,000 hectares (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 . The North Las Vegas Facility (NLVF), located in the city of North Las Vegas, NV, supports DOE Nevada Operations Office and LANL, LLNL, and SNL weapons test programs, and is considered an adjunct to NTS.

S.3.2 Stockpile Stewardship

Historically, nuclear testing has provided unambiguous high confidence in the safety and reliability of weapons in the stockpile. Without additional underground nuclear testing, DOE 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, DOE 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, DOE 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. Each of these categories are described below, as well as alternatives that are assessed in this PEIS. Table S.3.2-1 depicts the proposed alternatives and facilities under consideration for stockpile stewardship.

Table S.3.2-1. ***Stockpile Stewardship Enhanced Experimental Capability Alternatives***

Capability	LANL	LLNL	SNL	NTS
Physics of Nuclear Weapons Primaries				
No Action	X	X		X
Contained Firing Facility [4]		X		
Physics of Nuclear Weapons Secondaries [5]				
No Action	X	X		
National Ignition Facility[4]	X	X	X	X
Atlas Facility [4]	X			
Weapons Effects				
No Action[6]			X	

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 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 will consist of a new accelerator building with two accelerator halls to provide two perpendicular lines-of-sight which will enable two radiographic images to be captured simultaneously or sequentially and will provide a capability to perform three dimensional diagnostics of a simulated nuclear weapon primary. For the purposes of this PEIS, DOE includes the DARHT Facility in No Action 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 a science-based stockpile stewardship program. In this regard, both laboratories will continue to utilize and improve radiographic hydrodynamic testing capability. The proposed CFF would augment and be collocated with the existing FXR Facility at LLNL Site 300. The containment enclosure would provide for containment of hydrodynamic tests and reduce the environmental, safety, and 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 nuclear performance 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. 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.

Weapons 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 the Saturn Facility or the Particle Beam Fusion Accelerator Facility, 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 have not been defined to the degree necessary for decisionmaking. 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 that would provide enhanced experimental capabilities in the areas of weapons physics and weapons effects.

S.3.2.1 ***Stockpile Stewardship Comparison of Alternatives***

To aid the reader in understanding the differences in environmental impacts among the various PEIS stewardship alternatives, this section presents comparisons of the alternatives, concentrating on the major resources assessed in this PEIS.

Proposed National Ignition Facility

The following comparisons have been summarized from the more-detailed comparisons for the NIF alternatives found in Volume III, appendix section I.3.5. The NIF project-specific analysis addresses the impacts of constructing and operating NIF at four alternative sites: LLNL (preferred), LANL, SNL, and NTS (includes NLVF). A No Action alternative is also assessed.

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.

For the action alternative, the analysis indicates that there would be few significant differences in environmental impacts at the candidate sites. The maximum 24-hour concentration of particulate matter 10 microns or smaller (PM *10*) in the air during site clearing would exceed applicable standards at LLNL and NLVF. However, the ambient air quality impacts would be localized and of short duration. Uncommitted land requirements would be greatest at NTS ha acres]), although this acreage is less than 1 percent of the uncommitted land at NTS. Conversely, the least amount of uncommitted land that would be required for NIF would be 3.2 ha (7.9 acres) at NLVF. However, this acreage represents the largest percentage of uncommitted land at a candidate site (56 percent). Of greater significance would be the quality of the habitat of the uncommitted land that would be affected by NIF construction. The highest-quality habitats that would be affected would be forest (4.0 ha [9.9 acres]) at LANL or desert ha acres]) at NTS. At the other candidate sites, habitat disturbance would occur to grassland (LLNL and SNL) or to an area of sparse vegetation (NLVF). No significant biotic or cultural impacts are expected at any of the NIF alternative sites.

At each NIF alternative site, beneficial socioeconomic impacts associated with construction and operation would occur. During construction, 270 to 470 direct new jobs would be created in the peak year of activity. These direct jobs would create indirect jobs such that the total jobs during the peak year would be: 2,870 at LLNL; 1,130 at LANL; 1,640 at NTS; and 1,770 at SNL. Once operations begin, NIF would employ 330 direct workers. The total number of jobs (direct plus indirect) during operation would be 890 at LLNL, 600 at LANL, 620 at NTS, and 670 at SNL.

Over the 30-year operational life of NIF, the public would be exposed to a very small dose of radiation. No cancer fatalities would be expected to occur from exposures associated with routine NIF operations under either the Conceptual Design or Enhanced options. A radiological accident at NIF would not cause any cancer fatalities to the public except possibly at NLVF and SNL. Under postulated accident conditions, radiological impacts to the public and workers would be minor. The highest calculated radiation dose is 4,900 person-rem. At most, two cancer fatalities could occur if an accidental release occurred. Because of the extremely low accidental release frequency (2x10 *-8* /yr), the risk of radiation-caused cancer fatalities from the postulated accident at any site is essentially zero. The cancer fatality risk associated with radiological exposure from an accident involving the transport of NIF tritium targets would range from 1x10 *-8* to 8x10 *-10* fatalities per year, whereas the nonradiological fatality risks associated with vehicular emissions and accidents would be in the range of 10-3 to 10-4 fatalities per year.

Although each candidate site would implement waste minimization practices, the generation of additional wastes would be unavoidable. All candidate sites have current or planned capacity to handle wastes associated with construction and operation of NIF; however, this would entail offsite shipment of some of the wastes for all sites except LANL.

NIF would comply with all applicable Federal, state, and local environmental regulatory requirements, including the *California Environmental Quality Act* if NIF is sited in the state of California. Such compliance functions as a general form of mitigation. The candidate sites have also established several mitigative measures for construction actions that would also be applicable to NIF construction. While each of these mitigative measures may be minor, in combination they could significantly reduce impacts to the environmental resources of the selected site.

With regard to unavoidable impacts, land clearing and construction activities for NIF would eliminate habitat and destroy or displace wildlife. Construction of new facilities could result in short-term disturbances of previously undisturbed biological habitats. These disturbances could cause long-term reductions in the biological productivity of an area. Construction of NIF would replace natural habitat with areas of pavement and buildings. Depending upon the candidate site selected, this conversion could extend the influence of urbanized/industrial habitats into natural areas, increase fragmentation of natural habitat, and cause minor loss of habitat used by rare species. However, no critical habitat for Federal threatened or endangered species would be affected.

Radiological doses to the general public from NIF operation would be no more than percent of the dose from all other candidate site operations and no more than one-millionth of the dose to the population from normal background radiation. NIF would be considered a low-hazard, radiological facility. Such a facility uses radionuclides (for nonreactor purposes) and has other hazards (such as chemicals needed at the facility). Low hazard implies that there are minor onsite and negligible offsite consequences.

Cumulative impacts would result from the addition of the incremental effects of the construction and operation of NIF to the effects of other past, present, and reasonably foreseeable future actions at the selected site. Fugitive dust emissions from construction of NIF would be an incremental addition to the already existing environmental impact of dust emissions to the atmosphere. Minor changes in stormwater runoff are expected due to removal of grass cover during NIF construction and increased runoff from pavement during facility operation.

Proposed Contained Firing Facility

The following comparisons have been summarized from the more-detailed information for CFF found in Volume III, 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 primaries. 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 operation 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 operation 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 Volume III, appendix K.

Under No Action, DOE would rely on existing aboveground experimental facilities, predominantly the Pegasus Facility at TA-35 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 facilities within TA-35, 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.3.3 Underground Nuclear Testing

One of the primary purposes of the Stockpile Stewardship and Management PEIS is to evaluate ways of maintaining a continued safe and reliable nuclear deterrent in the absence of nuclear testing. Thus, the proposal described in this PEIS does not include nuclear testing. However, because it is possible--although not probable--that the United States might one day exercise its "supreme national interests" rights and conduct underground nuclear testing to certify the safety and reliability of its nuclear weapons, this PEIS and the NTS Site-Wide EIS include an analysis of the environmental impacts of underground nuclear testing at NTS.

S.3.4 Stockpile Management

Stockpile management comprises operations associated with producing, maintaining, refurbishing, surveilling, and dismantling the nuclear weapons 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.3.4-1 and are discussed below.

Table S.3.4-1. ***Stockpile Management Alternatives***

Capability[7]	**Y-12**	**SRS**	**KCP**	**Pantex**	**LANL**	**LLNL**	**SNL**	**NTS**
Weapons Assembly/Disassembly[8]								
No Action				X				
Downsize existing capability				X				
Relocate capability								X
Nonnuclear Fabrication								
No Action			X		X		X	
Downsize existing capability			X					
Relocate capability					X [9]	X [9]	X [9]	
Pit Fabrication and Intrusive Modification Pit Reuse [10]								
No Action [11]					X	X		
Reestablish capability		X			X			
Secondary and Case Fabrication[10]								
No Action	X [12]							
Downsize existing capability	X[12]							
Relocate capability					X	X		
High Explosives Fabrication								
No Action				X				
Downsize existing capability				X				
Relocate capability					X	X		

Weapons Assembly/Disassembly Alternatives

Weapons A/D provides the capability to dismantle retired weapons, assemble nuclear 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-place decrease in facility footprint and relocation into modern, existing facilities, mostly 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.

Nonnuclear Fabrication

Nonnuclear fabrication consists of the following general functions:

- Fabrication of electrical, electronic, electro-mechanical, and mechanical components (plastics, metals, and composites) and assembly of arming, fuzing, 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 LANL, SNL, and/or LLNL.

No Action. The No Action alternative for these activities is presently located at KCP, SNL, and LANL. KCP manufactures nonnuclear weapon 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 assesuments 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 factory segments 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 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 LANL or SNL. This alternative would require construction of a new stand-alone production site at SNL, directly east of Technical Area I consisting of six new buildings and renovations or 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 performs surveillance operations on plutonium components returned from 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 separation areas, F- and H-Area, which could house 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 weapon 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 14 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 alternative 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 would be required to perform the stockpile management secondary and case fabrication mission.

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 from Pantex to LANL. 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 1 new facility for storage of HE and would use 23 existing buildings, 66 existing magazines, and various utilities and services at Site 300.

Relocate to both Los Alamos National Laboratory and Lawrence Livermore National Laboratory. This option would involve splitting the mission between the two laboratories. Since its impact is bounded by the previous two options, this option is not analyzed further.

S.3.4.1 *Stockpile Management Comparison of Alternatives*

To aid the reader in understanding the differences in environmental impacts among the various PEIS management alternatives, this section presents comparisons of the alternatives, concentrating on the major resources assessed in this PEIS.

Assembly/Disassembly

In addition to the No Action alternative, two alternatives are being considered that would meet the needs of the Program: (1) downsizing the existing A/D facilities at Pantex and (2) transferring the A/D mission to NTS by expanding the Device Assembly Facility. Under No Action, the A/D mission would remain at Pantex. No downsizing or modification of facilities would occur, and there would be no construction impacts. Downsizing existing facilities at Pantex would involve internal modifications to the existing facility. Transferring the A/D mission to NTS would entail upgrading and expanding the Device Assembly Facility.

Socioeconomic Impacts. Because of the reduced workload associated with completing the weapon dismantlement backlog, significant employment reductions will occur at Pantex for all alternatives. There would be a decrease from the current total of 3,437 workers to about 1,644 workers. Of the current workforce, 3,002 are associated with A/D operations. Under No Action only 915 A/D workers would be required. The downsized Pantex facility would be optimally configured for the reduced future workload, and would operate more efficiently than the No Action Pantex facility. The downsized Pantex facility would require 800 workers for single-shift operation. To perform operations in the downsized Pantex facility in a three-shift mode, 1,266 workers would be required.

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

Socioeconomic impacts at NTS associated with a peak construction workforce of 662 would produce small positive economic benefits. The 662 direct workers would also generate 622 indirect jobs. The 1,284 total new jobs during peak construction would cause no change in the regional economic area unemployment rate. Housing rental vacancies and public finance expenditures/revenues would change by less than 1 percent.

Resource Impacts. Due to the reduced workload expected in the future at Pantex, impacts from operations are expected to be less than current impacts. Air quality would remain within regulatory limits, and water requirements would be met without increased aquifer drawdowns. In addition, downsizing existing facilities at Pantex would involve internal modifications to the existing facility. No land would be disturbed.

Transferring the A/D mission to NTS would entail upgrading and expanding the Device Assembly Facility, with associated increases in land disturbance. An estimated 7.5 ha (18.5 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.

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 21 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.

Radiation and Waste Management Impacts. The average radiological dose to workers at Pantex 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. Worker exposure to radiation is expected to be about equal (approximately 10 mrem/year) for both alternatives and well within regulatory limits. Because of the small 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. The added risk to the workforce due to these levels of radiation exposure is extremely small.

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 4.0x10-4 person-rem/year. At NTS, the incremental dose to the public within 80 km (50 mi) resulting from operation of the A/D Facility would be 3.1x10-6 person-rem/year. The added risk to the public due to these levels of radiation exposure is extremely small.

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 decontamination and decommissioning (D&D) activities and wastes.

Accident Impacts. Potential impacts from accidents would not be expected to change significantly due to reduced workload. Accident impacts 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 either Pantex or 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 approximately every 43,000 years from accidents. At NTS, there would be a statistical risk that one fatal cancer to a member of the public would result approximately every 500,000 years from accidents.

Other. 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. Radiation exposure to the public in the event of an accident would be significantly less than for the A/D mission for either alternative.

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: (1) upgrading the existing plutonium R&D fabrication capability at LANL and (2) upgrading existing H-Area and F-Canyon facilities at SRS. Both alternatives involve relatively minor (though costly) upgrades to existing facilities. Under the No Action alternative, DOE would not reestablish this mission, but would rely on the existing R&D capabilities at LANL and LLNL.

Socioeconomic Impacts. 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 due to this mission. Modeling results indicate no indirect jobs for this mission at LANL. At SRS, up to 813 direct jobs would be created for surge operations, along with 1,594 indirect jobs. These 2,407 total new jobs would cause the regional economic area unemployment rate to decrease from 6.7 to 6.0 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent. At LANL, up to 260 new direct jobs would be created for surge operations, 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 to 6.0 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent. 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.

Resource Impacts. 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 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.

Radiation and Waste Management Impacts. 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 years at SRS, and every 45 years at LANL, from operation of the Pit 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 5.9x10-4 person-rem/year and 8.6x10-5 person-rem/year, respectively. The added risk to the public due to these levels of radiation exposure is extremely small. Both site alternatives have adequate existing waste management facilities to treat, store, and/or dispose of wastes that would be generated by this mission.

Accident Impacts. 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 approximately every 360,000 years from accidents. At LANL, there would be a statistical risk that one fatal cancer to a member of the public would result approximately every 160,000 years from accidents.

Secondary and Case Fabrication

In addition to the No Action alternative, three alternatives being considered would meet the needs of the Program: (1) downsizing 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 Y-12 at ORR, and no downsizing or modification of facilities would occur.

Socioeconomic Impacts. Under No Action, there would be a decrease in the number of workers at Y-12 from the current total of 5,152 workers to 4,721 workers. Of the 5,152 workers, 3,126 workers are currently associated with the core stockpile management mission. Under No Action, only 2,741 core stockpile management workers would be required. The downsized Y-12 would be optimally configured for the reduced future workload, operate more efficiently, and require 784 workers for single-shift operation, a reduction of 1,957 workers. To perform operations in the downsized Y-12 in a three-shift mode, 1,376 core stockpile management workers would be required, a reduction of 1,365 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. Another 3,490 indirect jobs would also be lost.

Mitigating the workforce reductions would be the fact that downsizing would require 1,152 new jobs associated with landlord activities in preparation for D&D activities. Another 1,600 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 213 direct jobs at Y-12, which would represent less than 1 percent of the projected No Action workforce at ORR.

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 phaseout of this mission. At LANL, 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 to 6.0 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent. At LLNL, 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 3,336 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. Another 10,134 indirect jobs could also be lost. It is expected that 1,385 new jobs would be created by a direct transfer of responsibilities from DP to the DOE Office of 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 1,385 new D&D jobs would also create 1,937 new indirect jobs. The net effect would be a loss of a total of 13,470 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 to 7.4 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent.

During construction activities, socioeconomic impacts would result, but would be small. The number of peak workers would be 14 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.

Resource Impacts. Impacts from continued operation at Y-12 are expected to be similar to current impacts. Air quality would remain within regulatory limits and water requirements would be adequately met by surface water withdrawals. For the three "action" alternatives, no previously undisturbed land would be disturbed, and thus, no impacts to biotic resources would result. Minimal impacts to cultural resources may result from building modifications to facilities eligible for the National Register of Historic Places. 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 20-percent higher than projected No Action water requirements. No adverse impacts to water resources are expected.

Radiation and Waste Management Impacts. Radiation 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 differences in projected workforces, 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. The added risk to the workforce due to these levels of radiation exposure is extremely small. Radiation exposure to the public from normal operation would be well within regulatory limits at these 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. 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. 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. The added risk to the public due to these levels of radiation exposure is extremely small. 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.

Accident Impacts. 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 approximately every 830,000 years from accidents. At LLNL, there would be a statistical risk that one fatal cancer to a member of the public would result approximately every 260,000 years from accidents.

Other. 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 HEU 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, three alternatives are being considered that would meet the needs of the Program: (1) downsizing 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 modification of facilities would occur.

Socioeconomic Impacts. Downsizing the HE fabrication mission at Pantex would reduce the number of direct workers associated with this mission to 37, 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. For surge operations at LANL, 67 new direct jobs would be created, but no indirect jobs would be created by this industry. The 67 new jobs would cause the regional economic area unemployment rate to decrease from 6.2 to 6.1 percent. Housing/rental vacancies and public finance expenditures/revenues would change by less than 1 percent. For surge operations at LLNL, 100 new direct jobs would be created, along with 155 indirect jobs. The 255 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 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.

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.

Resource Impacts. 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 (less than 1 ha) would be disturbed to construct an HE and parts storage building, but impacts to biotic and cultural resources are not expected.

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, this alternative applies only in conjunction with the downsize A/D alternative at Pantex discussed earlier. Downsizing both missions would reduce groundwater withdrawals by 16 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 the 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.

Radiation and Waste Management Impacts. There are no radiological risks to workers or the public associated with the HE fabrication mission and no adverse impacts associated with normal operation. 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.

Accident Impacts. Potential impacts from chemical accidents or explosions were determined using modeling. Impacts from these types of accidents could include death or 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. 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, two alternatives are being considered that would meet the needs of the Program: (1) downsizing the facilities that presently perform this mission at KCP and (2) 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; primarily at KCP, with small workloads at LANL and SNL.

Socioeconomic Impacts. At KCP, workforce downsizing consistent with a reduced workload has already taken place; therefore, the projected No Action workforce (3,179 workers) is equal to the current workforce. Of these 3,179 workers, 2,508 workers perform core stockpile management missions. The downsized KCP facility would be optimally configured for the reduced future workload, would operate more efficiently, and would require 1,669 core stockpile management workers for single-shift operation. To perform operations in the downsized KCP facility in a three-shift mode, 2,257 workers would be required. This is 251 workers less than the No Action single-shift number of workers. Another 443 indirect jobs would also be lost. The loss of a total of 694 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 increases of 240 and 131 total (direct plus indirect) jobs, respectively. At each of these sites, socioeconomic indicators would change by less than 1 percent. At SNL, 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 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 3,179 direct jobs and the loss of 5,609 indirect jobs in the regional economic area. The loss of 8,788 total jobs from KCP would cause the regional economic area unemployment rate to increase from 4.9 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.

During construction activities, socioeconomic impacts would result, but would be small. At KCP, 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, 379 direct jobs would be created during construction activities, plus another 421 indirect jobs. The 800 total jobs created during construction at SNL would represent less than a 1 percent increase in employment in the regional economic area, and would not cause any socioeconomic indicator to change by more than 1 percent.

Resource 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 at each of the sites, and water requirements would be adequately met.

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.

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 29 percent of the Kirtland Air Force Base groundwater rights. Thus, no adverse impacts are expected.

Radiation, Waste Management, and Accident Impacts. 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. 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 a large number 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 are a relatively unconsolidated Complex that is downsized/rightsized in place or a relatively consolidated Complex that is rightsized by upsizing the laboratories and NTS.

For the first configuration (referred to as Downsize/Rightsize-in-Place), the Complex would consist of A/D at Pantex, HE fabrication at Pantex, pit fabrication at LANL (or SRS), secondary and case fabrication at ORR, and nonnuclear fabrication at KCP. This is essentially the preferred alternative for stockpile management. For the second configuration (referred to as Maximum Consolidation), the Complex would consist of A/D at NTS, HE fabrication at LANL (or LLNL), pit 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.

Socioeconomic Impacts. 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 and HE missions at Pantex, under No Action, the core stockpile management workforce would be reduced from the current level of 3,107 workers (3,002 for A/D and 105 for HE) to 1,020 workers (915 for A/D and 105 for HE) for single-shift operation. The physical downsizing of the facility would also improve efficiency such that the workforce could be reduced even further, to 831 workers for single-shift operation (800 for A/D and 31 for HE). Three-shift operation of the downsized Pantex facility would require 1,303 core stockpile management workers (1266 for A/D and 37 for HE).

For the secondary and case fabrication mission at ORR, under No Action, the workforce would be reduced from the current level of 3,126 core stockpile management workers to 2,741 workers for single-shift operation. The physical downsizing of Y-12 (essentially an 86-percent reduction in facility size) would also improve efficiency such that the core stockpile management workforce could be reduced even further, to 784 workers for single-shift operation. Three-shift operation of the downsized Y-12 facility would require 1,376 core stockpile management workers. The adverse socioeconomic impacts associated with the Y-12 downsizing would be mitigated by the creation of 1,152 new jobs associated with landlord activities in preparation for the D&D of the facilities no longer needed.

At KCP, workforce reductions consistent with a reduced workload have already taken place; therefore, the projected No Action workforce (2,508 core stockpile management workers) is equal to the current workforce. Downsizing the KCP facility would improve efficiency such that the workforce could be reduced to 1,669 workers for single-shift operation. Three-shift operation of the downsized KCP facility would require 2,257 workers.

Overall, socioeconomic impacts from construction for the Maximum Consolidation configuration would be minimal, except at NTS and SNL. Socioeconomic impacts from construction for the Downsize/Rightsize-in-Place configuration would also be minimal.

Resource Impacts. 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.

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 (2.47 acres). Most construction activities would be modifications to existing facilities, with no significant land disturbance, and no potential impacts to biota or cultural resources.

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. For the Maximum Consolidation configuration, the greatest potential for any significant environmental impacts would occur at LANL, which would be the site for pit fabrication, secondary and case fabrication, HE fabrication, and a portion of nonnuclear fabrication. For each of the resources evaluated in this 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 2.5 percent, but would still be less than the LANL allotment.

Radiation, Waste Management, and Accident Impacts. Cumulative doses to the population from normal operation would be less than regulatory limits. Impacts from accidents are independent of other missions (e.g., accident risks are additive, not multiplicative). Thus, the potential accident would be the sum of the risks from each mission. For maximum consolidation at LANL, there would be a statistical risk that one fatal cancer to a member of the public would result approximately every 135,000 years from accidents. LANL would have adequate existing waste management facilities to treat, store, and/or dispose of wastes that would be generated by these missions.

A 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. 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.3.5 Alternatives Considered but Eliminated from Detailed Study and Related Issues

This section of the PEIS has been revised in response to comments received on the Draft PEIS concerning its scope and the alternatives considered. To begin, it is important to review the basic logic used in constructing this PEIS and to restate the nature of the decisions expected to be made based on the contents of the PEIS.

Section S.2 describes the national security policy framework that defines the purpose and need for DOE's nuclear weapons mission for the foreseeable future. It also describes the development of proposed actions and reasonable alternatives in response to recent changes in national security policy. Section S.2 also puts those changes in broad technical perspective. Successive levels of technical detail are provided in chapters 3 and 4 of Volume I, and in Volumes II and III. The discussions that follow refer to the appropriate sections of this PEIS to avoid unnecessary repetition.

As stated in the Notice of Intent (60 FR 31291) published on June 14, 1995, DOE intends that the ROD on this PEIS will:

- Identify the future missions of the Stockpile Stewardship and Management Program; and
- Determine the configuration (facility locations) of the Complex necessary to accomplish the Program missions

While the terms "stockpile stewardship" and "stockpile management" are relatively new, the Program is not new when considered in terms of its substructure capabilities (section S.1). What the terms are meant to convey is a change in Program focus away from large-scale development and production of new-design nuclear weapons with nuclear testing, to one that focuses on the safety and reliability of a smaller, aging stockpile without nuclear testing. Even with this change in focus, however, national security policies require DOE to maintain the capabilities of the ongoing Program. The proposed actions flow logically from the mission purpose and need, given the policy constraints placed on the Program. Enhanced experimental capability is proposed because it is the surrogate source of experimental data that are needed to continually assess and certify a safe and reliable stockpile constrained by the absence of nuclear testing. Rightsizing manufacturing capacities is proposed in direct response to the reduced requirements of a smaller, aging stockpile constrained by the absence of new-design weapon production. Reestablishing pit manufacturing capability is proposed because it restores a required capability of the Program that was temporarily lost as a consequence of the closure of the Rocky Flats Plant.

In developing this PEIS, DOE judged the above three proposed actions to be significant at the programmatic level. Some additional strategies of the Stockpile Stewardship and Management Program, such as enhanced computational capability, were judged not to have significance for this PEIS because they did not have the potential for significant environmental impacts relative to the ongoing Program at a site, nor was the mission capability being considered for transfer to another site. The programmatic level environmental impacts of the ongoing Program at each of the eight sites in the Complex are described in chapter 4 of Volume I. Projects and facilities to support the ongoing Program are subject to site-specific NEPA review.

The issue of Stockpile Stewardship and Management Program alternatives is complex because nuclear weapons require a complete integrated set of technical capabilities and an appropriately sized manufacturing capacity. The technical capabilities are generally characterized as research, design, development, and testing; reliability assesument and certification; and manufacturing and surveillance operations (section S.2.1 and figure S.2-2). From a technical point of view, none of these capabilities can be deleted if DOE is to maintain a safe and reliable stockpile (section S.2.3). In addition, DOE has been directed to maintain these capabilities by national security policy from the President and Congress (section S.2.3).

S.3.5.1 *Alternatives in General*

Commentors questioned the different treatment of stewardship and management alternatives, mainly the lack of stewardship alternatives. Stewardship and management alternatives are treated differently in the PEIS because they address fundamentally different problems. Stockpile stewardship capabilities form the basis of U.S. judgments about the safety, reliability, and performance of U.S. nuclear weapons, and in a larger context, U.S. judgments about the nuclear weapons capabilities of others (section S.2.3). DOE did not consider it reasonable to propose stewardship alternatives that would diminish stewardship capabilities, particularly given the fact that historic confidence in the safety and performance of the stockpile was derived from nuclear testing that is no longer part of the ongoing stewardship program. National security policy requires DOE to maintain, and in some areas enhance, the stewardship capabilities of the three weapons laboratories and NTS (section S.2.1). The PEIS also explains the basis for this in a technical context, including the need for two independent nuclear design laboratories (section S.2.3). Therefore, this PEIS has no proposed actions that transfer ongoing stockpile stewardship missions from one site to another, or that would otherwise diminish ongoing stewardship missions.

National security policy also requires DOE to maintain stockpile management capabilities and appropriate manufacturing capacity for a smaller stockpile. Unlike stockpile stewardship capabilities, the smaller stockpile does permit some reasonable siting alternatives for stockpile management capabilities and capacities to accomplish the mission purpose and need within the current national security policy framework (section S.2.3).

S.3.5.2 *Enhanced Experimental Capability*

DOE has considered that there are differing opinions on the technical merit of DOE's proposed actions with regard to enhanced experimental capability. Nuclear weapons design information, including the complex physics of nuclear weapon explosions, is classified for reasons of national security and nonproliferation. Even if this information were unclassified, the physics problems remain daunting; hence, the reason why nuclear testing was so important to the past program. Both the classification of information and technical complexity of the issues form natural barriers to public communication. The technical complexity alone engenders significant debate among qualified experts, especially in the area of high energy density physics. This PEIS attempts to explain the weapon physics issues in an unclassified, comprehensible manner regarding its relation to mission purpose and need (section S.2), proposed actions and alternatives (section 3.3 of Volume I), and project-specific technical detail (Volume III). In the absence of nuclear testing, there are two basic alternatives: (1) rely on existing facilities as sources of experimental data described by the No Action alternative, and (2) pursue the enhanced capability of the proposed facilities to provide the sources of experimental data needed.

Role of Existing Experimental Facilities. In DOE's technical judgment, the existing facilities described by the No Action alternative are inadequate to meet the challenge of assessing and certifying a safe and reliable stockpile over the longer term. It is also DOE's technical judgment that it is impossible to speculate at this time whether any of the existing facilities could be retired, because they would be obsolete or redundant, as a result of a decision to construct and operate any or all of the three proposed new stewardship facilities. The uncertainties inherent in the R&D nature of the stewardship program would make that kind of exercise essentially guesswork. The development of machines to simulate the intricacies of a nuclear detonation requires a highly sophisticated scientific R&D program. It very likely will take 5 to 10 years to begin obtaining reliable data from the new facilities. Until those facilities are operational, DOE cannot reliably predict how the additional capabilities they provide will mesh with the capabilities of previously existing machines to further the goals of the Program. It is only through incremental advances in the state of the science that decisions can eventually be made regarding the retirement of obsolete or redundant facilities.

DOE is committed to making maximum efficient use of the stewardship capabilities at its disposal. However, it is not reasonable to speculate at this time about how future stewardship requirements might affect existing facilities and capabilities.

Next Generation Experimental Facilities. Commentors suggested that potential next generation experimental facilities be analyzed as part of the proposed action. This PEIS includes a discussion of potential next-generation experimental facilities and the reasons why they are not proposed actions or alternatives (section S.2.4 and section 3.3.4 of Volume I). These facilities, while contemplated on the basis of anticipated technical need, have not reached the stage of design maturity through R&D for DOE to include a decisionmaking analysis at this time. However, this PEIS does broadly describe, in general terms or by reference, what is known today about their potential environmental impacts. The environmental impacts from these facilities as contemplated today would not be significantly different from existing "similar" facilities. By characterizing the potential impacts in this way, the decisionmaker will be aware of the potential program-level cummulative impacts of the next-generation facilities when deciding whether to pursue a program of enhanced experimental capability. If DOE proposes to construct and operate such facilities in the future, appropriate NEPA review will be performed.

New Weapon Design. Commentors have suggested that the proposal for enhanced experimental capabilities is directed more at the capability to design new weapons in the absence of nuclear testing than at maintaining the safety and reliability of the existing stockpile and that stewardship alternatives could be different if the facilities were directed only at maintaining the existing stockpile. This PEIS explains why these capabilities are needed to maintain the safety and reliability of a smaller, aging stockpile in the absence of nuclear testing (section S.2). The existing U.S. stockpile of nuclear weapons is highly engineered and technically sophisticated in its design for safety, reliability, and performance. The stewardship capabilities required to make technical judgments about the existing stockpile are likewise technically sophisticated; therefore, it would be unreasonable to say that these stewardship capabilities could not be applied to the design of new weapons, albeit with less confidence than if new weapons could be nuclear tested.

However, the development of new weapon designs requires integrated nuclear testing such as occurs in nuclear explosive tests. Short of nuclear testing, no single stockpile stewardship activity, nor any combination of activities, could confirm that a new-design weapon would work. In fact, a key effect of a "zero-yield" CTBT would be to prevent the confident development of new-design weapons. National security policy requires DOE to maintain the capability to design and develop new weapons, and it will be a national security policy decision to use or not use that capability. Choosing not to use enhanced experimental capability for new weapons designs would not change the technical issues for the existing stockpile and, therefore, the stewardship alternatives would not change.

The issue of new-design weapons is separate from DOE's need to perform modifications to existing weapons that require research, design, development, and testing. The phrase used in this PEIS, "without the development and production of new-design weapons," is meant to convey the fact that the historical continuous cycle of large scale development and production of new weapons designs replacing older weapon designs has been halted. For example, during the 1980s, about a dozen new-design weapons were in full-scale development or production. Over the decade, production of new-design weapons replaced dismantled weapons nearly one for one. Today, only modifications to parts of existing weapons are being performed or planned; dismantlement has continued. This results in a smaller, aging stockpile that must be assessed and certified without nuclear testing. This is now the primary focus of the stewardship program.

Nonproliferation. Commentors have suggested that enhanced experimental capability is a proliferation risk. The national security policy framework discussed in this PEIS seeks a new balance between U.S. arms control and nonproliferation objectives and U.S. national security requirements for nuclear deterrence while pursuing these objectives (section S.2.1). In addition, a discussion is provided on some of the more difficult issues that must be considered in determining the balance, including a discussion of experimental capability (section S.2.5). In particular, the issue of nonproliferation and the proposed NIF was studied in detail. The study, prepared by the DOE Office of Arms Control and Nonproliferation, has been the subject of extensive public involvement, interagency review, and review by outside experts. The study concluded that the technical proliferation concerns of NIF are manageable and can therefore be made acceptable and that NIF can contribute positively to U.S. arms control and nonproliferation policy goals (appendix section I.2.1 of Volume III). NIF is a proliferation concern because of its broader scientific applications and expected frequent use by researchers worldwide, and, like the other proposed enhanced experimental facilities because of its possible relevance to the development of new weapon designs. However, the development of new weapon designs requires integrated testing. None of the proposed facilities, either alone or together, could perform such integrated testing of new concepts, and therefore cannot replace nuclear testing for the development of new weapon designs. The role of these facilities will be to help assess and certify the safety and reliability of the nuclear weapons remaining in the stockpile in the absence of nuclear testing. The national security policy framework and the technical issues that drive the proposed action for enhanced experimental capability remain the same.

Subcritical Experiments. With regard to the treatment of ongoing stewardship activities or enhanced experimental capability, subcritical experiments are an example of how changes in terminology have caused some confusion about what is evaluated in this PEIS under the No Action alternative. Subcritical experiments have been conducted at NTS over many years. Historically, operations at NTS have included tests or experiments that included both HE and special nuclear materials that were intended to produce no nuclear yield or negligible nuclear energy releases. These experiments frequently remained subcritical (i.e., they did not achieve self-sustaining fission chain reactions). The term "subcritical experiments" does not define a new form of activity or mission. It is intended to underscore the fact that in the future such experiments will be configured to ensure that the condition of criticality cannot be achieved. This issue has been clarified in the NTS Site-Wide EIS.

S.3.5.3 *Safe and Reliable Stockpile*

Some commentors have suggested that nuclear weapon reliability is not important in the post-Cold War era. National security policy as established by the President and Congress requires a safe and reliable stockpile. In order for the nuclear deterrent to be credible within the current national security policy framework, it must be reliable in a militarily effective way. A program designed to ensure the safety but not the reliability of the stockpile would require DOE to speculate on an alternate concept of nuclear deterrence and a national security policy framework to support it. See also the discussion of denuclearization in section S.3.5.4.

Commentors have also suggested acceptance of lower standards of reliability as an alternative to enhanced stewardship capabilities. This PEIS explains how the assesument and certification of nuclear performance is carried out, and how this process differs from the more conventional statistical methods used for assessing reliability of the nonnuclear portion of the weapon. Assesument and certification of nuclear performance is a technical judgment by the weapons laboratories based on scientific theory, experimental data, and computational modeling (sections S.2.2 and S.2.3). The question is not whether to accept a lower standard of nuclear performance (less nuclear explosive yield), but whether or not there is a technical basis to confidently know how well the weapon will perform at all. Enhanced stewardship capability is focused on the technical ability to confidently judge nuclear safety and performance in the absence of nuclear testing.

Aside from being inconsistent with national security policy, attempting to separate weapon safety and reliability is more technically complex than it sounds. A modern nuclear weapon is highly integrated in its design for safety, reliability, and performance. It contains electrical energy sources and many explosive energy sources in addition to the main charge HE. The principal safety concern is accidental detonation of the HE causing dispersal of radioactive materials (plutonium and uranium). Modern weapons are designed and system-engineered to provide a predictable response in accident environments (e.g., fire, crush, or drop). However, because of the technical complexity of potential accident scenarios (i.e., combined environments) and the fact that complete nuclear weapons cannot be used for experimental data, assesument of the design and the effect of changes that might be occurring due to stockpile environments must rely on other sources of experimental data and complex computer modeling. Enhanced experimental capability specifically related to the weapon secondary is a nuclear performance concern. Enhanced computational capability in general, and enhanced experimental capability related to the weapon primary in particular, are both nuclear safety and performance concerns.

S.3.5.4 *Description of Alternative Approaches*

Commentors have suggested that DOE consider alternative forms of stewardship. While their comments are responded to in Volume IV, this section discusses DOE's consideration of the broad range of views on this issue. The Congressional Research Service report, Nuclear Weapons Stockpile Stewardship: Alternatives for Congress, December 14, 1995, provides a reasonable description of the various viewpoints on alternatives and a framework for discussion. (The report uses the term stockpile stewardship generically to describe the Stockpile Stewardship and Management Program.) The following discussion of alternative approaches is taken from the summary of that report.

Denuclearizers would eliminate nuclear weapons worldwide in the foreseeable future, perhaps one to two decades. Until then, they would have a minimal U.S. stewardship program whose personnel, as curators of weapons knowledge, would monitor weapons. **Restorers** would maintain nuclear weapons with the only proven method, an ongoing program of research, development, design, testing, and production, downsized to meet post-Cold War needs. Three intermediate positions seek to maintain weapons indefinitely without nuclear testing. **Remanufacturers** believe that since current weapons have been tested and certified as meeting military requirements, this Nation can maintain them indefinitely by "remanufacturing"--reproducing them to the exact specifications of the originals. Remanufacturers would go to great lengths to do so in order to avoid risks that even slight changes to warheads might introduce. **Enhancers**, who take the Administration's position on stewardship, see identical remanufacture as impossible. They believe some changes in design, process, and materials are unavoidable and others are desirable. A robust science program, they hold, is the best that can be done without testing to monitor warheads, anticipate problems, modify warheads when problems arise, and revalidate stockpile effectiveness on an ongoing basis. They would have a small manufacturing program. **Maintainers** fall between remanufacturers and enhancers. They focus on how to maintain warheads. They prefer to avoid changes to warheads but would not go to great lengths to do so. They view a strong science program as essential, but only to the extent that its elements connect directly to maintaining weapons. They emphasize manufacturing as the ultimate guarantor of U.S. ability to solve warhead problems. They, along with enhancers, favor some link to testing if confidence cannot be maintained in any other way.

Beyond the broad overview of alternative approaches to stockpile stewardship and management, the main text of the report discusses variations within each of the five points of view. Given the political and technical complexity of the Program, many approaches can appear to be distinct or reasonable alternatives for detailed study. In fact, while the enhancer's viewpoint as described above most closely resembles the Program described in this PEIS, the Program actually embraces elements of all five viewpoints. The following discussion illustrates this point and focuses on the main issue(s) that, in DOE's view, eliminate the other approaches as distinct or reasonable alternatives for this PEIS.

Denuclearization. This approach is reflected in this PEIS to the extent that national security policy is pointed toward the goals of denuclearization. Since the end of the Cold War, more than 8,000 U.S. nuclear weapons have been dismantled, no new-design weapons are being produced, three former nuclear weapons industrial plants have been closed, and the United States is observing a nuclear test moratorium and seeking a "zero-yield" CTBT. Maintenance of a safe and reliable stockpile is not inconsistent with working toward the NPT goal of eliminating nuclear weapons worldwide at some unspecified time in the future. However, denuclearization is not a reasonable alternative for this PEIS because it is not feasible based on current national security policy.

The main issue discussed in this section is consideration of an alternative with a very small (10s or 100s) or zero stockpile. Two of the stockpile sizes analyzed in this PEIS, a START I Treaty- and START II protocol-sized stockpile, are the only ones currently defined and directed by national security policy. The PEIS also analyzes a hypothetical 1,000 weapon stockpile for the purpose of a sensitivity analysis for manufacturing capacity decisions. The NWSM specifies the types of weapons and quantities of each weapon type by year (section S.1). The NWSM is developed based on DOD force structure requirements necessary to maintain nuclear deterrence and comply with existing arms control treaties while pursuing further arms control reductions. This PEIS explains the complexity of this process and why DOE does not believe it reasonable to speculate using a large number of arbitrary assumptions (section S.2.1). DOE has considered that a future national security policy framework could define a path to a smaller stockpile. However, DOE has the following perspective on this issue.

Stockpile stewardship capabilities are currently viewed by the United States as a means to further U.S. nonproliferation objectives in seeking a "zero-yield" CTBT. Likewise, it would be reasonable to assume that U.S. confidence in its stewardship capabilities would remain as important, if not more important, in future arms control negotiations to reduce its stockpile further. The path to a very small (10s or 100s) or zero stockpile would require the negotiation of complex international treaties, most likely with provisions that require intrusive international verification inspections of nuclear weapons related facilities. Therefore, DOE believes it reasonable to assume that complex treaty negotiations, when coupled with complex implementation provisions, would likely stretch over several decades. On a gradual path to a very small or zero stockpile, stockpile size alone would not change the purpose and need, proposed actions, and alternatives in this PEIS as they relate to stewardship capabilities. The issues of maintaining the core competencies of the United States in nuclear weapons, and the technical problems of a smaller, aging stockpile in the absence of nuclear testing, remain the same.

On a gradual path to a very small or zero stockpile, this PEIS evaluates reasonable approaches to stockpile management capability and capacity. At some point on this path, further downsizing of existing industrial plants or the alternative of consolidating manufacturing functions at stewardship sites would become more attractive as manufacturing capacity becomes a less important consideration. However, in the near term, the preferred alternative of downsizing the existing industrial plants would still be a reasonable action because the projected downsizing investment pays back within a few years through reduced operating expense; in addition, the downsizing actions are consistent with potential future decisions regarding plant closures. In regard to the proposed action of reestablishing pit manufacturing capability, DOE does not propose to establish higher manufacturing capacities than are inherent in the reestablishment of the basic manufacturing capability. In developing the criteria for reasonable stockpile management alternatives, DOE was careful not to propose the introduction of significant new types of environmental hazards to any prospective site. On a gradual path to a very small or zero stockpile, stockpile size alone would not change the purpose and need, proposed actions, and alternatives in this PEIS with regard to stockpile management capabilities and capacities.

To achieve eventual denuclearization, some commentors have asserted that DOE should adopt a passive curatorship approach to maintaining the declining nuclear weapons stockpile. The concept of curatorship is already being implemented at the existing sites in the form of knowledge preservation programs. While not necessary in an era of continuous development and production of new-design weapons and nuclear testing, knowledge preservation is now part of DOE's overall effort to maintain core competency in the weapons complex. However, as an inherently imperfect reconstruction, this effort can never ensure completeness of information nor relevance to future stockpile problems. More importantly, knowledge preservation does not address the fundamental issue of confidence in future technical judgments about issues that are yet to arise regarding the safety and performance of the stockpile. In highly technical matters, confidence arises from having appropriate data to support conclusions. In the absence of nuclear testing, the science-based approach to stockpile stewardship is focused on achieving the capability to acquire appropriate data.

From an environmental impact point of view, this PEIS displays the environmental impacts of each site's ongoing Program operations on an annual basis. The impacts of alternatives for proposed actions are displayed individually on the same basis. If one assumes that denuclearization leads to eventual site closure, then this PEIS, together with the Tritium Supply and Recycling PEIS, presents the environmental impacts of closing the four remaining industrial plants. While this PEIS does not directly consider the closure of the weapons laboratories and NTS, it is not at all clear what nuclear weapons capabilities the U.S. would retain even if it decided on a zero stockpile. However, the environmental impacts of the ongoing Program (No Action alternative) are essentially what would be phased out, with or without the proposed actions. DOE does not believe that speculative combinations of this data on speculative time lines provides any useful information for decisionmaking.

Restoration. The restorer's point of view is reflected in this PEIS to the extent that current national security policy requires DOE to maintain all the historical capabilities of the Program, including the capability for new-design weapons and nuclear testing. However, restoration is not a reasonable alternative for this PEIS because it requires a national security policy decision to reverse the constraints placed on the Program, namely, by resuming nuclear testing and new-design weapons production.

The environmental impacts of the restoration approach would be the same as those described in this PEIS to the extent that such a decision did not require manufacturing capacities higher than analyzed in this PEIS. In addition, this PEIS includes a brief description of the environmental impacts of nuclear testing (section 4.12 of Volume I); the Site-Wide EIS for NTS contains detailed information.

Remanufacturing . The remanufacturer's point of view is reflected in this PEIS by the fact that remanufacturing to specification will be attempted when possible and when appropriate to the problem being solved. With more than a half dozen different weapon types projected to remain in the stockpile, and with each weapon type containing thousands of parts, remanufacturing will undoubtedly occur for a significant number of repair and replacement activities. However, remanufacturing is not reasonable as a distinct exclusive alternative to the ongoing stockpile stewardship program or the proposed action of enhanced experimental capability for the technical reasons discussed below. In addition, it would not be a reasonable alternative because it does not fully support national security policies that require the conduct of a science-based stockpile stewardship and maintenance of the capability to design and produce new weapons.

Remanufacturing weapon components to their original specification, or maintaining weapons to their original design specifications, would superficially appear to be a reasonable approach to maintaining the safety and reliability of the stockpile in the absence of nuclear testing. Precise replication, however, 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. Implicit in the remanufacturing assumption is that the design blueprint, manufacturing process, and the materials used are specified in exact detail in every way. However, there is an unwritten element of "know how" that knowledgeable and experienced personnel contribute to any complicated manufacturing process (for this reason, controlling the acquisition of "know-how" is a major nuclear weapons nonproliferation objective). Materials and processes are not always specified in important ways because, at the time, they were not known to be important. The problem is illustrated by the following hypothetical example:

A material produced for a critical weld has a specification for a trace impurity; the manufacturing process consistently produced the material with a trace impurity less than the maximum allowed and the welds were satisfactory; the manufacturing process is changed for some reason, such as cost or environmental concerns; the material is now being produced with less trace impurity than before the process was changed; the material is still within specification; however, the welds are no longer satisfactory; it was unknown at the time that the higher level of the trace impurity was necessary to produce a satisfactory weld.

While remanufacturing sounds simple in principle, it is likely in fact to present complex issues of design, manufacturing process, and material variables. A simplified view of remanufacturing cannot serve as a "stand alone" manufacturing approach, let alone an alternative approach to enhanced stewardship capability. In the absence of underground nuclear testing, nuclear components (pits and secondaries) cannot be functionally tested. Stewardship capabilities provide the analytical tools (experimental and computational) to assess the significance of a problem observed during surveillance and to decide if the problem should be fixed; and if fixed, to certify that the fix will work (section S.2.3). In the past, the decision to fix or not fix an observed problem could be made with nuclear testing (section S.2.2). Stockpile stewardship strategies focus on the basic material science and the enhanced experimental and computational tools necessary to better predict age-related defects and to make sound technical judgments on nuclear safety and performance in the absence of nuclear testing.

The DARHT EIS (DOE/EIS-0228, section 2.3.2) provides an additional discussion of the limitations of a remanufacturing-to-specification approach. It discusses, as an example, the actions taken to evaluate and resolve unanticipated deterioration of HE in the now-retired W68 warhead for a submarine-launched ballistic missile. In that case it was necessary to replace the HE with a more chemically stable formulation. In addition, some other materials were no longer commercially available, requiring changes in the rebuilt weapons. Nuclear testing was ultimately used to verify that the necessary changes were acceptable. DOE does not consider it feasible to maintain all potentially obsolescent commercial sources and processes used for materials in existing weapons; aging would still occur in stored reserves of such materials.

With regard to stockpile management, remanufacturing without enhanced stewardship capability would also have notable drawbacks. DOE plans to maintain the capability to produce secondaries, and proposes to reestablish the capability to produce pits, by producing small quantities (10s) of each annually to maintain capability. This capacity should be sufficient to replace components attrited from the stockpile by surveillance testing. Remanufacturing these components, without the enhanced stewardship analytical capability to determine if and when replacement is necessary, is likely to require higher levels of production than DOE believes necessary to maintain production capability. Also, remanufacturing a nuclear component to the original specifications will not prevent age-related problems related to those specifications from recurring. Since these components use plutonium and uranium, radiation exposure to personnel and generation of radioactive waste would also be higher than necessary. If repeated remanufacturing were required, further unnecessary risks would result from additional weapon A/D operations and additional transport of nuclear components between sites.

From an environmental impact point of view, the remanufacturing concept would have greater impacts for the proposed action of reestablishing pit capability because DOE proposes to use a cleaner, less waste-generating process than was used at the Rocky Flats Plant. All other environmental impacts would not be distinguishable from those described in this PEIS because existing manufacturing processes form the Program baseline.

Maintenance . The maintainer's point of view is reflected in this PEIS to the extent that it is consistent with the No Action alternative. 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 weapons laboratories. These attributes are all part of the ongoing Program that will continue into the future. The principal difference between the Program as presented in this PEIS and this point of view is differing judgment on how much enhanced experimental capability would be needed to assess and certify a safe and reliable stockpile over the long term. The maintainers believe that less (or no) additional experimental capability would be required if DOE placed more emphasis on enhanced surveillance and dual revalidation.

DOE believes that this approach would not provide a sufficient basis for assessing and certifying the safety and reliability of the stockpile. Although enhanced surveillance will play an important role in the future of the Program, it serves a limited purpose. Surveillance activities identify stockpile problems through the examination and analysis of weapons sampled from the stockpile. An enhanced surveillance program would serve to identify problems with greater confidence and increased warning time. However, it would not provide a sole basis for assessing the significance of the problem or determining its solution. The ability of the laboratories to validate that the problem has been corrected, in the absence of nuclear testing, depends on their experimental and computational capabilities. In DOE's judgment, as explained in section S.2.3, those capabilities are inadequate. Therefore, to the extent that maintainance would not provide sufficient enhanced experimental capability, it is not a reasonable alternative.

From an environmental impact point of view, the maintenance concept is not distinguishable from the impacts of the No Action alternative for stockpile stewardship and the proposed actions for stockpile management.

S.4 PREFERRED ALTERNATIVE

CEQ regulations require an agency to identify its preferred alternative(s) in the Final EIS (40 CFR 1502.14[e]). The preferred alternative is the alternative that the agency believes would best fulfill its statutory mission, considering environmental, economic, technical, and other factors. This PEIS provides information on the environmental impacts. Cost, schedule, and technical analyses have also been prepared and are presented in the *Analysis of Stockpile Management Alternatives report and the Stockpile Management Preferred Alternatives Report* , which are available in the appropriate DOE Public Reading Rooms for public review.

DOE has identified the following preferred alternatives of the Stockpile Stewardship and

Management Program:

Stockpile Stewardship :

- Construct and operate NIF at LLNL
- Construct and operate CFF at LLNL
- Construct and operate the Atlas Facility at LANL

Stockpile Management :

- Secondary and Case Component Fabrication--downsize the Y-12 Plant at ORR
- Pit Component Fabrication--reestablish capability and appropriate capacity at LANL
- A/D--downsize at Pantex
- HE Fabrication--downsize at Pantex
- Nonnuclear Component Fabrication--downsize at KCP
- Based on the analyses performed to support this PEIS, the preferred alternatives for strategic reserve storage are as follows: (1) HEU strategic reserve storage at Y-12 and (2) plutonium pit strategic reserve storage in Zone 12 at Pantex. The preferred alternatives for strategic reserve storage could change based upon decisions to be made in regard to the Storage and Disposition PEIS. Decisions on strategic reserve storage will not be made in the upcoming ROD for the Stockpile Stewardship and Management Program. Storage decisions are not expected to be made until both the Stockpile Stewardship and Management PEIS and the Storage and Disposition PEIS are completed.

The preferred alternative for plutonium-242 oxide at SRS is to transport the material to LANL for storage.

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

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

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

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

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

5 Facilities used to investigate the physics of nuclear weapons secondaries may also be used to investigate some physics phenomena related to nuclear weapons primaries and weapons effects.

6 No new facilities solely to investigate weapons effects phenomena are being proposed at this time.

7 Surveillance is included in all capabilities.

8 Includes nonintrusive modification pit reuse and the option of strategic reserve storage of plutonium and HEU.

9 KCP functions would be distributed among two or three of the laboratories.

10 Staging and storage of working inventories of nuclear materials and components are included.

11 Research and development capability only.

12 Includes strategic storage of HEU reserve.

CHAPTER 1: INTRODUCTION

Chapter 1 begins with an overview of the Stockpile Stewardship and Management Program and the Department of Energy's roles and responsibilities. This chapter also includes a discussion of the background of the Program, a brief description of the organization of the document, and the Department of Energy's National Environmental Policy Act of 1969 strategy for stockpile stewardship and management. Chapter 1 concludes with a discussion of related National Environmental Policy Act actions and other programmatic, project-specific, and site-wide reviews that are currently being prepared.

1.1 Overview

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.

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-design 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 (CTBT). 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 predecessor programs that served this mission over previous decades. With no underground nuclear testing, and no new-design 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. Figure 1.1-1 depicts the NWSM process.

Chapter 2 discusses the relevant factors, such as treaties, that shape the NWSM. Also explained is the fact that potential variances in stockpile size, such as a Strategic Arms Reduction Talks (START) I Treaty-sized stockpile 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.

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 " rightsize" existing facilities or consolidate them to fulfill expected requirements for manufacture of repair or replacement components for an aging U.S. stockpile.

This Programmatic Environmental Impact Statement for Stockpile Stewardship and Management 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 1.1-2 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.

Figure 1.1-1.--Nuclear Weapons Stockpile memorandum Process.
Figure 1.1-2.--Current Stockpile Stewardship and Management Sites (Includes Recent Consolidation of Three Former Sites).

1.2 Alternatives Analyzed in the *Programmatic Environmental Impact Statement for Stockpile Stewardship and Management*

The alternatives analyzed in this PEIS are described in detail in chapter 3 and summarized in this section. Alternatives are analyzed for both stockpile stewardship and stockpile management.

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 3.3, the three independently justified proposed facilities include: the National Ignition Facility (NIF), the Contained Firing Facility (CFF), and the Atlas Facility. Four sites (figure 1.1-2) are potentially affected by the stockpile stewardship alternatives: Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), Sandia National Laboratories (SNL), and NTS (includes NLVF). 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 advancements occur. Additional experimental facilities, such as the Advanced Hydrotest Facility, the High Explosives Pulsed Power Facility, the Advanced Radiation Source, and the Jupiter Facility, are considered to be next generation facilities (see section 3.3.4) 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 decisionmaking.

The stockpile management portion of this PEIS evaluates the potential environmental impacts of the reasonable alternatives for carrying out the stockpile management functions. As described in section 3.4, alternatives are assessed for nuclear weapons assembly/disassembly (A/D) and for fabricating pit, secondary and case, high explosives (HE), and nonnuclear components. Eight sites (figure 1.1-2) 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.

1.3 Background

To aid the reader's understanding of this PEIS, background information on the evolution of this PEIS and an unclassified description of a nuclear weapon follow.

1.3.1 Evolution of the *Programmatic Environmental Impact Statement for Stockpile*

Stewardship and Management

Stockpile stewardship and management responsibilities have been ongoing for decades and the Program now reflects the cumulative effects of relatively recent U.S. national security policy changes. This PEIS experienced three general stages of evolution.

The first stage of evolution began in January 1991, when the Secretary of Energy announced that DOE would prepare a PEIS examining alternatives for reconfiguring the Complex. The framework for the Reconfiguration PEIS was described in the January 1991 Nuclear Weapons Complex Reconfiguration Study (DOE/DP-0083), a detailed examination of alternatives for the future Complex. This Reconfiguration Study contemplated large, stand-alone replacement facilities for the plutonium fabrication capability of the Rocky Flats Plant, as well as possible replacement and relocation of other Complex missions.

During the 1992 through 1994 timeframe, the second stage of the evolution reflected changes in DOE's thinking due to the reduction in weapons resulting from the end of the Cold War, unilateral stockpile reductions, and the START II protocol. Because of the planned significant stockpile reductions, the scope of the Reconfiguration Study changed to reflect a smaller and more integrated Complex than previously envisioned. Additionally, DOE placed increased importance on the stewardship of special nuclear materials that were determined to be in excess of the Nation's weapons needs.

DOE concluded in October 1994 that the framework described in the Reconfiguration Study no longer fit current circumstances or supported any realistic proposal for reconfiguring the Complex. Contributing factors to that conclusion included public comments from Reconfiguration Study scoping meetings, the fact that production of new-design nuclear weapons was not required for the foreseeable future, and DOE's decision to prepare a separate *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement (DOE/EIS-0229-D, draft published in February 1996).*

As a result of these changed circumstances, the third stage evolved, whereby DOE separated the previously planned Reconfiguration PEIS into two new PEISs: the *Programmatic Environmental Impact Statement for Tritium Supply and Recycling* and this *Stockpile Stewardship and Management PEIS.* As explained in section 1.6, the Tritium Supply and Recycling PEIS has been completed and this Stockpile Stewardship and Management PEIS has been revised to better reflect current and expected Program requirements.

1.3.2 Nuclear Weapons

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 Program. Figure 1.3.2-1 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 (HEU). This is surrounded by a layer of 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. The A/D of nuclear weapons is done only at Pantex.

Figure 1.3.2-1.--Nuclear Weaponse Design.

1.4 Organization of this Programmatic Environmental Impact Statement

This PEIS consists of four volumes. Volume I contains the main text; Volume II contains technical appendixes that support the analyses in Volume I and additional project information; and Volume III contains the project-specific environmental analyses for the proposed NIF, CFF, and Atlas Facility. Volume IV contains the comments received on the Draft PEIS during the public review period and the DOE responses. The Summary is a separate publication.

Volume I contains 10 chapters, which include the following information:

Chapter 1--Introduction. Stockpile Stewardship and Management Program background and the environmental analysis process.

Chapter 2--Purpose and Need. Reasons why DOE needs to take action and the objectives DOE proposes to achieve.

Chapter 3--Proposed Action and Alternatives. How DOE proposes to meet the specified need and achieve the objectives. This chapter also includes a summary comparison of the potential environmental impacts of the PEIS alternatives.

Chapter 4--Affected Environment and Environmental Impacts. Aspects of the environment (i.e., natural, built, and social) that might be affected by the PEIS alternatives and analyses of the potential impacts on the environment. Impacts are compared to the projected environmental conditions that would be expected to support the base case if no action were taken (the No Action alternative).

Chapter 5--Regulatory Requirements. Environmental, safety, and health regulations that would apply to the PEIS alternatives and agencies consulted for their expertise.

Chapters 6 through 10. A list of references; a list of preparers; a list of agencies, organizations, and persons to whom copies of this PEIS were sent; a glossary; and an index.

Volume II contains eight appendixes of technical information supporting the environmental analyses presented in Volume I. These appendixes contain the following information: Stockpile Stewardship and Management Program facilities; air quality; *threatened, endangered, and special status species*; socioeconomics; human health; facility accidents; intersite transportation; and environmental management.

Volume III contains three appendixes that comprise the project-specific environmental analyses for the NIF, CFF, and Atlas Facility proposed actions.

Volume IV (Comment Response Document) contains a description of the public hearing process, information on the document's organization and instructions for its use, a brief summary of changes to the Draft PEIS, and all comments received and DOE responses.

1.5 *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) of 1969, 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(s) 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 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 this 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 of this PEIS.

1.6 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 *Tritium Supply and Recycling* PEIS and the *Dual Axis Radiographic Hydrodynamic Test* (DARHT) *Facility Environmental Impact Statement.* These two actions, and their relationship to the Stockpile Stewardship and Management PEIS, are described below.

1.6.1 *Programmatic Environmental Impact Statement for Tritium Supply and Recycling*

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 (DOE/EIS-0161) was issued in March 1995 and was followed by public hearings in April 1995. A Final PEIS was issued in October 1995, followed by the ROD, published in the *Federal Register* (60 FR 63878), on December 12, 1995.

In the ROD, DOE announced that it will embark on a dual track strategy for acquiring a new tritium production capability that involves the use of existing commercial light water reactors via the purchase of a reactor or purchase of irradiation services (with the option to purchase the reactor), and the development of a linear accelerator. DOE will seek to fully prove the feasibility of both approaches over the next 3 years, then implement the most promising approach, while completing the design and necessary procedures (e.g., regulatory approval) for the other path to allow it to serve as a backup to the preferred path. If an accelerator is built, it will be located at SRS.

Tritium, a radioactive gas that decays at a rate of more than 5 percent per year, is a necessary component of every nuclear weapon in the existing stockpile and must be replenished periodically in order for the weapons to operate as designed. No new tritium has been produced since 1988, when the last of the DOE's tritium production reactors at SRS was shut down. Currently, tritium recycled from weapons retired from the stockpile is used to meet stockpile requirements. However, based on a START II protocol stockpile size, even with tritium recycling, new tritium will be needed by 2011. Because it could take up to 15 years for a tritium source, once selected, to begin producing tritium, it was necessary for DOE to make a decision on tritium supply in advance of this Stockpile Stewardship and Management PEIS. The decision resulting from the Tritium Supply and Recycling PEIS is accounted for in the No Action alternative of this PEIS.

1.6.2 *Dual Axis Radiographic Hydrodynamic Test Facility Environmental Impact Statement*

The DARHT Facility *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 was about 34 percent complete when construction was halted under a U.S. District Court preliminary injunction issued on January 27, 1995, pending completion of the DARHT Facility EIS and issuance of the ROD. The DARHT Facility 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 Facility Draft EIS (DOE/EIS-0228) 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 the ROD, published in the *Federal Register* (60 FR 53588) on October 16, 1995.

In the ROD, DOE announced that it will complete and operate the DARHT Facility at LANL while implementing a program to conduct most tests inside steel vessels, with containment to be phased in over 10 years. Following the ROD, DOE filed a motion for dissolution of the injunction. On April 16, 1996, the U.S. District Court concluded that the purpose of the injunction has been satisfied, and therefore lifted the injunction and dismissed the case.

DOE will rely on hydrodynamic testing in the absence of underground nuclear testing to ensure the stockpile's safety and reliability. Under any course of action analyzed in this Stockpile Stewardship and Management PEIS, DOE will still need to continue hydrodynamic testing and acquire near-term enhanced radiographic capability such as that provided by the DARHT Facility. DOE determined that implementing the DARHT Facility ROD will not prejudice any decisions in the Stockpile Stewardship and Management Program. The impacts of the DARHT Facility for each resource area are addressed in the No Action impact discussions for LANL in section 4.6.3.

1.7 Other *National Environmental Policy Act* Reviews

In addition to the two interim actions identified above, DOE is currently preparing other programmatic, project-specific, and site-wide NEPA documents. These documents, and their relationship to the Stockpile Stewardship and Management PEIS, are discussed below.

1.7.1 Waste Management Programmatic Environmental Impact Statement

Alternatives for managing radioactive, hazardous, and mixed (radioactive and hazardous) wastes are analyzed in the Waste Management Programmatic Draft Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (DOE/EIS-0200-D), issued in August 1995. When completed, the Waste Management PEIS will support DOE decisions on the management of, and facilities for, the treatment, storage, and/or disposal of radioactive, hazardous, and mixed wastes.

Wastes would be generated by the Stockpile Stewardship and Management Program. Although there may be changes from site to site, for the Complex as a whole, the wastes will be similar in form and quantity to wastes currently generated by DOE facilities and analyzed in the Waste Management PEIS. Wastes generated by the Program would be managed in accordance with decisions made as a result of the Waste Management PEIS. Nonetheless, for the purposes of thoroughly analyzing the impacts of the proposed action, the treatment, storage, and/or disposal of these wastes in existing facilities is analyzed in the Stockpile Stewardship and Management PEIS.

Both the Stockpile Stewardship and Management PEIS and the Waste Management PEIS consider national strategies. The Waste Management PEIS considers alternatives that include local, regional, and/or consolidated waste management facilities. This Stockpile Stewardship and Management PEIS addresses alternatives that could result in the relocation of current missions and/or closure of existing sites. These two strategies are mutually consistent; however, the RODs will require coordination.

1.7.2 *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement*

The Storage and Disposition PEIS will analyze alternatives for the long-term storage of all weapons-usable fissile materials, primarily HEU and plutonium, and the disposition of weapons-usable fissile materials, primarily plutonium the President has declared to be surplus to national defense needs. *The Implementation Plan for the Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement* was issued in March 1995, and the Draft PEIS was issued in February 1996.

Both this Stockpile Stewardship and Management PEIS and the Storage and Disposition PEIS analyze reasonable alternatives for the long-term storage of strategic reserves of plutonium and HEU. Because the overall scope of each PEIS is significantly different, different long-term strategic reserve storage alternatives are reasonable for each PEIS. For example, the Stockpile Stewardship and Management PEIS evaluates alternatives for strategic reserve storage (in the form of pits and secondaries) at the weapons A/D Facility, which is where these strategic reserves might be first used. The Storage and Disposition PEIS has a relatively broader scope regarding fissile material storage, which will include the storage of all surplus material, naval reactor fuel, and naval reactor fuel feed stock, as well as nonweapons research and development materials. It analyzes alternatives, among others, that would collocate strategic reserves with surplus fissile materials.

Preparation of these two PEISs is being closely coordinated to ensure that all reasonable alternatives for long-term strategic reserve storage are assessed. Decisions on strategic storage will not be made in the upcoming ROD for the Stockpile Stewardship and Management Program. Storage decisions are not expected to be made until both the Stockpile Stewardship and Management Final PEIS and the Storage and Disposition Final PEIS are completed.

1.7.3 *Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components*

The Draft Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components (Pantex Site-Wide EIS) (DOE/EIS-0225D), which was issued in March 1996, analyzes the alternatives and environmental impacts associated with conducting nuclear weapons operations at Pantex for approximately the next 5 to 10 years. Included in the Pantex Site-Wide Draft EIS is an analysis of a plan to increase the interim storage of plutonium pits from 12,000 to 20,000 pits. The EIS also analyzes alternative locations to Pantex for interim pit storage operations.

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 decisionmaking on the long-term storage of pits by at least several years. Accordingly, the Pantex Site-Wide Draft 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 NEPA 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). As discussed above, the Storage and Disposition PEIS 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 PEISs 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.

This PEIS includes Pantex as an alternative site for the following stockpile management missions: HE fabrication, weapons A/D, and strategic reserve storage. Programmatic decisions on these alternatives will be identified in the ROD for this PEIS; however, a decision on storage may occur later than decisions on the other two missions.

1.7.4 *Site-Wide Environmental Impact Statement for the Los Alamos National Laboratory*

The LANL Site-Wide Draft EIS is currently being prepared and analyzes alternatives for LANL's operation over the next 5 to 10 years. The Stockpile Stewardship and Management PEIS includes LANL as an alternative site for two stockpile stewardship facilities (NIF and Atlas) and the following stockpile management missions: pit fabrication, secondary and case fabrication, HE fabrication, and nonnuclear fabrication. Programmatic decisions on these alternatives will be identified in the ROD for this PEIS.

1.7.5 *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada*

The NTS Site-Wide EIS (DOE/EIS 0243), analyzes alternatives for NTS's operation over the next 5 to 10 years. The Stockpile Stewardship and Management PEIS includes NTS as an alternative site for both a stockpile stewardship facility (NIF) and two stockpile management missions: weapons A/D and strategic reserve storage. Programmatic decisions on these alternatives will be identified in the ROD for this PEIS; however, a decision on storage may occur later than a decision on weapons A/D.

1.8 Public Participation

Public participation for the PEIS consisted of two primary activities: the scoping process and the public comment process. CEQ regulations require "an early and open process for determining the scope of issues to be addressed and for identifying the significant issues to be addressed and for identifying the significant issues related to a Proposed Action (40 CFR 1501.7)." This is usually called the public scoping process. Section 4.1 of the Implementation Plan Stockpile Stewardship and Management Programmatic Environmental Impact Statement (DOE-EIS-0236IP, December 1995) describes the scoping process. The following sections describe the public comment process on the Draft PEIS.

1.8.1 Public Comment Process on the Draft Programmatic Environmental Impact Statement

In February 1996, DOE published the *Stockpile Stewardship and Management Draft PEIS that* evaluated the siting, construction, and operation of the proposed stockpile stewardship facilities and the modification/construction and operation of facilities proposed for stockpile management at eight alternative sites within the Complex. The 60-day public comment period for the Draft PEIS began on March 8, 1996, and ended on May 7, 1996. However, late comments were considered to the extent practical.

During the comment period, public hearings were held in Los Alamos, NM; Albuquerque, NM; Las Vegas, NV; Oak Ridge, TN; Kansas City, MO; Livermore, CA; Washington, DC; Amarillo, TX; Santa Fe, NM; and North Augusta, SC. Five of the public hearings were joint meetings to obtain comments on both the Stockpile Stewardship and Management PEIS and the Storage and Disposition PEIS. Two of the joint meetings (Pantex and SRS) also included the Pantex Site-Wide EIS. In addition, the public was encouraged to provide comments via mail, fax, electronic bulletin board (Internet), and telephone (toll-free 800 number). Figure 1.8.1-1 shows the dates and locations of the hearings.

The public hearings held for the Draft PEIS were conducted using an interactive workshop-type format. The format chosen allowed for a two-way interaction between DOE and the public and encouraged informed public input and comments on the document. Neutral facilitators were present at the hearings to direct and clarify discussions and comments. Court reporters were also present to provide a verbatim transcript of the proceedings and record any formal comments.

All public hearing comment summaries were combined with comments received by mail, fax, Internet, or telephone during the public comment period. Volume IV of this PEIS, the Comment Response Document, describes the public comment process in detail, presents comment summaries and responses, and provides copies of all comments received.

Figure 1.8.1-1.--Public Hearing Locations and Dates, 1996.

1.8.2 Major Comments Received on the Draft Programmatic Environmental Impact Statement

A large number of the comments received on the Draft PEIS related to concerns that the analysis of particular alternatives and/or alternative sites did not adequately consider such factors as cost and technical feasibility. Although these concerns made up the majority of the comments, many other comments related to the resources analyzed, NEPA and regulatory issues, and DOE and Federal policies as they related to this PEIS. The major issues identified by commentors include the following:

- The potential conflict between the Stockpile Stewardship and Management Program and the Nuclear Nonproliferation Treaty goals, and the pursuit of a CTBT
- Using the funds allocated for the Stockpile Stewardship and Management Program for social programs and on research of alternative sources of energy
- The generation, storage, and disposal of radioactive and hazardous wastes and the associated risks

- The impacts of the alternatives on human health (both from radiation and hazardous chemicals) and how these risks were determined and evaluated
- The relationship of this PEIS to other DOE documents and programs, particularly the Pantex and NTS Site-Wide EISs, the Waste Management and the Storage and Disposition PEISs, and the need to make decisions based on all associated programs and activities concurrently
- The need for decisions to be based on many different factors, including environmental, cost, and safety concerns
- The need for DOE to consider a zero-level stockpile, remanufacturing, and denuclearization as alternatives
- Maintaining deterrence with surveillance, curatorship, and remanufacturing without the need for the proposed facilities
- The need for DOE to adequately consider the ongoing stewardship program
- The need for DOE to perform detailed analysis of future stockpile stewardship facilities

All of the issues identified above are summarized and responded to in detail in chapter 3 of Volume IV. Substantial revisions to this PEIS resulting from public comments are discussed below.

Revisions in the Final PEIS include additional discussion and analysis in the following areas: alternatives considered but eliminated (section 3.1.2); the No Action alternative (appendix A, Stockpile Stewardship and Management Facilities, sections A.1.5, A.1.6, A.1.7, and A.1.8); socioeconomics at ORR, Pantex, and KCP; accident impacts at Pantex; normal operation impacts for radiological and chemical sections; cumulative impacts (section 4.13); and minor changes to LANL water resources section (section 4.6.2.4). A new section was also added to appendix F (section F.4, Secondary Impacts of Accidents). Each of these areas is discussed in more detail in the following section.

1.8.3 Changes from the Draft Programmatic Environmental Impact Statement

In response to comments submitted after issuance of the Draft PEIS and due to additional technical details not available at the time of issuance of the Draft, Volumes I, II, and III of the Final PEIS contain revisions and changes. The revisions and changes made since the issuance of the Draft PEIS are indicated by a double underline for minor word changes or by a sidebar in the margin for paragraph or larger changes. In addition, Volume I and each appendix in Volume III provide a unique reference list to enable the reader to further review and research selected topics. Volume IV (*Comment Response Document*) of the PEIS contains the comments received during public review of the Draft PEIS and the DOE responses to those comments. DOE has public reading rooms near each affected site and in Washington, DC, where these referenced documents may be reviewed or obtained for review. A brief discussion of the more significant changes is provided in the following paragraphs.

>Alternatives Considered but Eliminated from Detailed Study and Related Issues. In response to public comments expressing a concern that DOE had not analyzed a reasonable range of alternatives, section 3.1.2 was expanded. The changes were in response to specific questions concerning compliance with treaties, stockpile size, maintenance and remanufacturing options, and the stockpile stewardship alternatives including No Action. The discussions in section 3.1.2 provide greater detail and more clarification on why alternatives were eliminated from detailed study in this PEIS. Together, chapter 2 and section 3.1.2 explain the framework and the constraints of national security policy that have shaped the proposed actions and reasonable alternatives for this PEIS.

No Action Alternative. Several commentors did not think that the No Action alternative was clearly explained in the Draft PEIS. More specifically, they were not sure which existing facilities at LANL, LLNL, SNL, and NTS were part of the ongoing stockpile stewardship program. As a result, the description of No Action was modified in appendix A to include a listing of major DOE Office of Defense Programs function facilities at LANL, LLNL, SNL, and NTS. Additionally, the discussion of impacts of No Action at LANL (section 4.6.3) was revised as appropriate to include the effects of the DARHT Facility.

Socioeconomics at Oak Ridge Reservation, Kansas City Plant, and Pantex Plant. Based on public comments and revised workforce size estimates, the socioeconomic impact sections for the downsizing alternatives at ORR (section 4.2.3.8), KCP (section 4.4.3.8), and Pantex (section 4.5.3.8) have been revised. The analyses were also expanded to cover the base case single-shift option in greater detail. At these three sites, downsizing of existing facilities is the preferred alternative. For such downsizing, the base case single-shift scenario represents the bounding analysis for the workforce. The change in worker estimates did not cause any of the major indicators in the socioeconomic analysis to change in any significant manner.

Accident Impacts at Pantex Plant. The analyses of impacts due to an aircraft impact and resulting release of plutonium by a fire or an explosion were modified to include more updated data on probability and source terms developed for the Pantex Site-Wide EIS. Section 4.5.3.9 and appendix sections F.2.1.1 and F.2.1.2 were revised to incorporate the new analytical results. Based on the updated data, the potential impacts and risks to the public from the composite accident presented in this PEIS would be less than previously reported in the Draft PEIS. This change was not significant.

Normal Operation Radiological/Chemical Impacts. The discussion of the normal operation radiological affected environment for LANL, section 4.6.2.9, has been updated to include the latest data from Environmental Surveillance at Los Alamos During 1993 (LA-12973-ENV, October 1995). The normal operation radiological impact sections 4.2.3.9, 4.3.3.9, and 4.6.3.9 have also been revised to include the contribution of recent facilities at ORR, SRS, and the new environmental surveillance data for LANL. The chemical health effects, section 4.6.3.9 for LANL and section 4.7.3.9 for LLNL, were revised based on new analyses using updated dispersion rates. Tables in appendix section E.3.4 supporting these sections were also updated. The majority of these changes affected the No Action alternative analyses. None of the changes to these sections significantly changed the analysis of impacts for the "action" alternatives.

Cumulative impacts. The cumulative impact section, 4.13, has been modified to incorporate a discussion of normal operation radiological impacts and other changes based on more recent data from NEPA documents and RODs. The changes to this section did not have a meaningful effect on the analysis/comparative evaluation of alternatives.

Los Alamos National Laboratory Water Resources. Changes were incorporated in section 4.6.2.4 (Water Resources) for LANL based on more recent water use and water quality data. The Draft PEIS had erroneously stated that the LANL water allotment would be fully used by about 2000. The Final PEIS correctly reports that this allotment would be fully used by about 2052. This change did not have a meaningful effect on the analysis/comparative evaluation of alternatives. Minor revisions reflecting the baseline changes were also made to the LANL water resources impact section, 4.6.3.4.

Health Effects Studies. Appendix section E.4, which outlines epidemiological studies at the alternative sites, was rewritten to provide more detail and incorporate more recent and other applicable studies. Although these epidemiology sections do not affect the environmental analysis of future stockpile stewardship and management missions, they do provide relevant information regarding potential health effects from past actions. These changes did not have a meaningful effect on the analysis/comparative evaluation of alternatives.

New Section. A new section has also been added to the Final PEIS (appendix section F.4, Secondary Impacts of Accidents). This section evaluates the secondary impacts of accidents that affect elements of the environment other than humans (e.g., farmland). The section was added because of public comments. The results of this analysis show that secondary impacts from accidents would generally not extend beyond site boundaries, except at Pantex and LLNL, where it is possible that some surface contamination could occur. This new analysis did not have a meaningful effect on the analysis/comparative evaluation of alternatives.

CHAPTER 2: PURPOSE OF AND NEED FOR THE STOCKPILE STEWARDSHIP AND MANAGEMENT ACTION

Chapter 2 describes the purpose of and need for the Stockpile Stewardship and Management Program. It includes a discussion of national security policy considerations and the technical effects of national security policy on shaping the Program's purpose and need. The proposed action and alternatives are also discussed. The final section summarizes the chapter and introduces the logic flow diagrams that depict the framework of the Program from national policy and stockpile perspectives.

2.1 Introduction

The Stockpile Stewardship and Management gram 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 Programmatic Environmental Impact Statement (PEIS)for Stockpile Stewardship and Management purpose, need, proposed action, and alternatives, it is useful to view the Program from two different perspectives. One perspective (see section 2.2) 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 2.3) 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 referenced in the chapter summary (see section 2.7) and appear at the end of chapter 2.

2.2 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 (PDDs)
- National Defense Authorization Act of 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 (START) 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.

2.2.1 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 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 weapons retained for nonstrategic nuclear forces, DOD operational spares, and spares to replace weapons attrited by Department of Energy (DOE) surveillance testing. In the START II case, the stockpile may also include weapons retained 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 2.3.4, 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 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 the reasonably foreseeable future. For the same reason, DOE has chosen not 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 this PEIS where they are relevant.

2.2.2 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 testing. 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.
- 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 2.3.3, 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 (see section 3.1.1.2).

2.2.3 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 of 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.

2.3 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 as safe and reliable.

2.3.1 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 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.

2.3.2 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-design weapon types replaced old ones. Now, with no new-design 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.

2.3.3 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 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 development (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 more than 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 2.3.3-1 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.

TABLE 2.3.3-1.-Summary of Distinct and Actionable Findings Since 1958

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

Source: SNL 1996a.

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 it was an isolated case that did not require remediation.

2.3.4 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 aging characteristics of some of the materials used in the weapon types remaining in the stockpile 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.

2.4 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 the Nevada Test Site (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. A classified appendix has also been prepared to support this PEIS.

2.4.1 Stockpile Stewardship--The Weapons 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 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 DOE 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.

2.4.2 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-design 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:

- Weapons assembly/disassembly (A/D)
- Pit components
- Secondary and case components
- High explosives (HE) components
- Nonnuclear components
- Tritium supply and recycling

As explained in chapter 1, tritium supply and recycling was evaluated in a separate PEIS.

Weapons 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 Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (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 Explosives 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 LANL and LLNL, 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 onsite and those expected from near-term weapon dismantlement. A major Program consideration would be the synergism of this function in maintaining the core competencies of the weapons laboratories.

Nonnuclear Components. Kansas City Plant (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. Sandia National Laboratories (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.

2.5 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
- Reestablishing 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.

2.5.1 Providing 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.

The National Ignition Facility (NIF) and the Atlas Facility are proposed new facilities. The Atlas Facility would be collocated in TA-35 with the existing Pegasus II Facility at LANL, and the two facilities would use common infrastructures and support facilities. The Contained 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 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 these technologies reach the appropriate level so as to be ripe for decisionmaking, DOE would complete National Environmental Policy Act (NEPA) documentation for them.

2.5.2 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 2.4.2: (1) transfer 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 discusses these alternatives in detail.

2.5.3 Reestablishing Manufacturing Capability and Capacity for Pit Components

Plutonium pit manufacturing is a special case among those stockpile management functions discussed in section 2.4.2. 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-design nuclear weapons. Reestablishing pit manufacturing capability and capacity was to be part of the Reconfiguration PEIS discussed in chapter 1. 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 of 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.

2.6 Nonproliferation

On August 11, 1995, the President announced his commitment to seek a "zero yield" CTBT. He also established several safeguards that condition 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 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.

2.7 Summary

National security policies require DOE to maintain the historical nuclear weapon competencies and capabilities of three weapons laboratories, the industrial plants, and NTS. In addition, DOE must maintain an appropriately sized industrial capacity to manufacture repair and replacement components for weapons that remain in the stockpile. The environmental impacts of maintaining these historical capabilities will be established by the No Action characterization of the sites. With this baseline, the proposed actions and alternatives are analyzed incrementally for each relevant site. In this manner, the broad cumulative impact of the Program and the specific impacts of the proposed actions and alternatives can be displayed and discussed.

In preparation for the Stockpile Stewardship and Management PEIS public scoping process, DOE published a document entitled The Stockpile Stewardship and Management Program in May 1995. This document supplements this chapter with a broader discussion of Program strategies to address the major issues and policy constraints placed on the Program. There are five strategies discussed:

- Enhanced experimental and computational capabilities
- Enhanced weapon and materials surveillance technologies
- Effective and efficient production complex
- Long-range stockpile support
- Tritium production

In developing the Stockpile Stewardship and Management PEIS proposed actions, the significant aspects of "enhanced experimental capability" and "effective and efficient production complex" are directly addressed. As explained in chapter 1, the enhanced experimental capability of the Dual Axis Radiographic Hydrodynamic Test Facility and tritium production are addressed as related interim actions in separate environmental impact statements. The remaining elements of these strategies are primarily a redirection of R&D efforts at the weapons laboratories away from the design of new weapons toward the development of appropriate technologies to address the needs of a safe, reliable, and smaller, aging stockpile. As such, they are not judged to be significant NEPA issues and do not have broad environmental impacts beyond what is analyzed in this PEIS.

Figure 2.7-1 presents the framework used for discussing the Stockpile Stewardship and Management Program from a U.S. national security policy perspective. Figure 2.7-2 presents a view of the complete Stockpile Stewardship and Management Program from a stockpile perspective, integrating all aspects of the proposed action.

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

2 The effects of radiation on nuclear weapons and military systems are referred to as "weapon effects" throughout this PEIS.

3 Other than in specific discussions, the word surveillance is used generically throughout this

document in place of the Stockpile Evaluation Program.

CHAPTER 3: STOCKPILE STEWARDSHIP AND MANAGEMENT PROGRAM ALTERNATIVES

Chapter 3 provides descriptions of the alternative sites and the program alternatives for meeting the Nation's nuclear weapons stockpile stewardship and management requirements. The chapter begins with a summary of the development of the alternatives, followed by descriptions of the alternative sites and their current missions. The stockpile stewardship discussion provides a description of the three basic stewardship areas, along with the associated alternatives, including a brief description of concepts for next-generation stewardship facilities. The stockpile management discussion provides a description of the various management functions and their associated alternatives. Brief discussions of emerging technologies that may affect stockpile management facilities and functions in the future and a discussion of a potential next-generation plutonium fabrication facility follow. The chapter concludes with a comparison of the stockpile stewardship and management alternatives and a discussion of the preferred alternatives.

3.1 Development of Stockpile Stewardship and Management Program Alternatives

This programmatic environmental impact statement (PEIS) evaluates the direct, indirect, and cumulative impacts associated with the Stockpile Stewardship and Management Program alternatives that are summarized in figure 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, when applicable, 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.

3.1.1 Planning Assumptions and Basis for Analysis

In the Stockpile Stewardship and Management Program and in this PEIS, the Department of Energy (DOE) will:

- Emphasize compliance with applicable laws and regulations and accepted industrial and weapons safety practices that safeguard the health of workers and the general public, protect the environment, and ensure the security of nuclear material and weapons
- 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

As explained in section 1.7, DOE is currently preparing site-wide environmental impact statements (EIS)s covering continued operations for some of the alternative sites evaluated in this PEIS. Some of the existing activities covered by these site-specific, site-wide EISs are similar to those of the No

Action alternative of this PEIS. Although the near-term analytical periods for the site-wide EIS analyses are different from those of the Programmatic Environmental Impact Statement for Stockpile Stewardship and Management, 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 has been incorporated, as appropriate. In the preparation of the Stockpile Stewardship and Management Final PEIS, any updated information relating to the sites' affected environment was reviewed and appropriate changes were made if new information could potentially change results of the impact analyses.

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

3.1.1.1 *No Action Alternative Assumptions*

- The No Action alternative for this PEIS is defined in a way that takes into account the fact that DOE for decades has had in place a program for the stewardship and management of the nuclear weapons stockpile. Consistent with CEQ guidance, the No Action alternative consists of those facilities necessary to maintain the status quo in terms of DOE's current program direction. These consist primarily of existing facilities where DOE currently conducts weapons activities, including modifications to those facilities necessary to maintain their current mission capabilities. However, the No Action alternative also includes a small number of minor new facilities that will also be needed simply to maintain current mission capabilities at individual sites. Finally, the No Action alternative includes two major new facilities which are proceeding independent of this PEIS, and for which DOE has prepared separate EISs under the interim action provisions of the CEQ regulations. These EISs are the Programmatic Environmental Impact Statement for Tritium Supply and Recycling (DOE/EIS-0161) and the EIS for the Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility (DOE/EIS-0228).

3.1.1.2 *Stockpile Management Assumptions*

- Base case stockpile size for the PEIS analysis is consistent with the Strategic Arms Reduction Talks (START) II protocol, but larger than 3,500 weapons. This PEIS also analyzes a high and a low case stockpile size to determine how the environmental impacts may change due to changes in the 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.
- Analysis is provided for facilities that would be sized to support estimated average annual manufacturing requirements resulting from the base case stockpile size assuming single-shift operation, 5 days per week. This PEIS analyzes environmental impacts of the base case quantitatively, including an evaluation of three-shift operation, 5 days per week (surge operation), to provide a bounding analysis. For stockpile management, this PEIS assesses alternatives that would downsize or modify existing facilities. With the exception of one nonnuclear facility at Sandia National Laboratories (SNL) and the expansion of the Device Assembly Facility at Nevada Test Site (NTS), there would be no greenfield construction of new facilities for any of the stockpile management alternatives. Existing facilities that would be downsized or modified have inherent differences in capacities when operated in the base case three-shift surge mode. For a given stockpile management mission, the downsize alternatives generally have a greater inherent capacity than other alternatives. For the downsize alternatives,

therefore, a portion of the environmental impacts are due to the higher output associated with the three-shift surge mode of operation.

- This PEIS also qualitatively assesses each stockpile management alternative against identical low and high case single-shift workloads. Differences in environmental impacts for these single-shift workloads are attributable primarily to inherent differences in the existing facility and support infrastructure of the different sites.

Table 3.1.1.2-1.-- ***Stockpile Management Facility Sizing Assumptions (Annual Activity on Single Operating Shift)***

Function	Low Case	Base Case	High Case
Weapons Assembly/Disassembly			
Rebuilds			
(disassemblies)	50	150	300
(assemblies)	50	150	300
Evaluation			
(disassemblies)	120	120	140
(rebuilds)	110	110	140
High Explosives Fabrication	50	150	300
Nonnuclear Fabrication			
Field and factory retrofits	up to 100	up to 300	up to 600
Nuclear Fabrication			
Pit fabrication	50 [1]	50 [1]	100
Pit reuse (nonintrusive modification)	50	100	200
Secondary and case fabrication	50 [1]	50 [1]	100

- The facility sizing assumptions for the various stockpile management facilities, based on the above assumptions, are shown in table 3.1.1.2-1.
- 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 2005. A 25-year lifetime was evaluated for operations.
- Proven technologies are presented in this PEIS as a baseline for the various management alternatives. Section 3.5 discusses emerging technologies that have the potential to offer even greater environmental advantages. The design goal of all facilities includes consideration of waste minimization and pollution prevention to minimize facility and equipment contamination, and to make the future decontamination and decommissioning (D&D) of facilities as simple and inexpensive as possible. This PEIS includes a general discussion of environmental impacts from D&D, including a discussion of the D&D process, the types of actions associated with D&D, and the general types of impacts associated with D&D. Any discussion of specific impacts would be too speculative because the extent of contamination, the degree of decontamination, and the environmental impacts associated with performing D&D cannot be known without performing a detailed study of the facility. Such analyses are more appropriate for tiered project-specific National Environmental Policy Act (NEPA) documents.

- Designs of facilities for the fabrication of nuclear components include provisions for handling and storing working inventories of nuclear materials. For plutonium, working inventories would be stored at Savannah River Site (SRS) or Los Alamos National Laboratory (LANL). For < highly enriched uranium (heu), working inventories would be stored at oak ridge reservation (orr), lanl, or lawrence livermore national laboratory (llnl).
- For plutonium, strategic reserve storage is evaluated at the Pantex Plant (Pantex) and NTS. For HEU, strategic reserve storage is evaluated at ORR, Pantex, and NTS. For the purposes of this PEIS, DOE does not intend to move the strategic reserves of HEU to Pantex or NTS if ORR is chosen as the secondary and case fabrication site.
- This PEIS contains an analysis of low-consequence/high-probability accidents (evaluation basis) and high-consequence/low-probability accidents (beyond evaluation basis). A spectrum of both types of accidents is analyzed. For radiological accidents, impacts are evaluated both for 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.

In developing alternatives for pit components, the following additional assumptions were used for new pit fabrication and intrusive modification pit reuse:

- Plutonium would not be introduced into a site that does not currently have a plutonium infrastructure because of the high cost of new plutonium facilities and the complexity of introducing plutonium operations into sites without current plutonium capabilities.
- The plutonium research and development (R&D) mission and functions would remain at LANL and LLNL, and the plutonium pit surveillance mission would remain at LANL. Both sites would store the materials required to support these missions.

In developing alternatives for secondaries and cases, the following additional assumptions were used:

- HEU would not be introduced into a site that does not currently have an infrastructure because of a desire to use suitable existing structures where possible and because of the high cost of new facilities.
- The uranium R&D mission and functions would remain at LANL and LLNL. If the Y-12 Plant (Y-12) at ORR is selected to retain the secondary and case fabrication mission, these R&D missions would be undertaken in partnership with Y-12. These sites would store the materials required to support this mission.

3.1.1.3 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. As explained in chapter 2, national security policies require all the historical stockpile stewardship and management capabilities to be maintained. Capabilities are independent of stockpile size. Stockpile stewardship functions are basic capabilities. For the same reason it is not reasonable to assume a "zero level" stockpile for the foreseeable future (sections 2.2.1 and 3.1.2), it is also not reasonable to assume the United States would eliminate the basic capabilities it needs to maintain a safe and reliable stockpile within the same foreseeable future.
- National security policy requires a safe and reliable stockpile without further nuclear testing

and with an aggressive pursuit of enhanced experimental capabilities (section 2.5.1). Three stockpile stewardship facilities are proposed in this PEIS: the National Ignition Facility (NIF), the Contained Firing Facility (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 analyses are the same as described under stockpile management.

3.1.2 Alternatives Considered but Eliminated from Detailed Study and Related Issues

This section of the PEIS has been revised in response to comments received on the Draft PEIS concerning its scope and the alternatives considered. To begin, it is important to review the basic logic used in constructing this PEIS and to restate the nature of the decisions expected to be made based on the contents of the PEIS.

Chapter 2 describes the national security policy framework that defines the purpose and need for DOE's nuclear weapons mission for the foreseeable future. It also describes the development of proposed actions and reasonable alternatives in response to recent changes in national security policy. Chapter 2 also puts those changes in broad technical perspective. Successive levels of technical detail are provided in chapters 3 and 4, and in Volumes II and III. The discussions that follow refer to the appropriate sections of this PEIS to avoid unnecessary repetition.

As stated in the Notice of Intent (60 FR 31291) published on June 14, 1995, DOE intends that the ROD on this PEIS will:

- Identify the future missions of the Stockpile Stewardship and Management Program; and
- Determine the configuration (facility locations) of the Complex necessary to accomplish the Program missions

While the terms "stockpile stewardship" and "stockpile management" are relatively new, the Program is not new when considered in terms of its substructure capabilities (section 1.1). What the terms are meant to convey is a change in Program focus away from large-scale development and production of new-design nuclear weapons with nuclear testing, to one that focuses on the safety and reliability of a smaller, aging stockpile without nuclear testing. Even with this change in focus, however, national security policies require DOE to maintain the capabilities of the ongoing Program. The proposed actions flow logically from the mission purpose and need, given the policy constraints placed on the Program. Enhanced experimental capability is proposed because it is the surrogate source of experimental data that are needed to continually assess and certify a safe and reliable stockpile constrained by the absence of nuclear testing. Rightsizing manufacturing capacities is proposed in direct response to the reduced requirements of a smaller, aging stockpile constrained by the absence of new-design weapon production. Reestablishing pit manufacturing capability is proposed because it restores a required capability of the Program that was temporarily lost as a consequence of the closure of the Rocky Flats Plant.

In developing this PEIS, DOE judged the above three proposed actions to be significant at the programmatic level. Some additional strategies of the Stockpile Stewardship and Management

Program, such as enhanced computational capability, were judged not to have significance for this PEIS because they did not have the potential for significant environmental impacts relative to the ongoing Program at a site, nor was the mission capability being considered for transfer to another site. The programmatic level environmental impacts of the ongoing Program at each of the eight sites in the Complex are described in chapter 4. Projects and facilities to support the ongoing Program are subject to site-specific NEPA review.

The issue of Stockpile Stewardship and Management Program alternatives is complex because nuclear weapons require a complete integrated set of technical capabilities and an appropriately sized manufacturing capacity. The technical capabilities are generally characterized as research, design, development, and testing; reliability assessment and certification; and manufacturing and surveillance operations (section 2.2 and figure 2.7-2). From a technical point of view, none of these capabilities can be deleted if DOE is to maintain a safe and reliable stockpile (section 2.4). In addition, DOE has been directed to maintain these capabilities by national security policy from the President and Congress (section 2.4).

3.1.2.1 *Alternatives in General*

Commentors questioned the different treatment of stewardship and management alternatives, mainly the lack of stewardship alternatives. Stewardship and management alternatives are treated differently in the PEIS because they address fundamentally different problems. Stockpile stewardship capabilities form the basis of U.S. judgments about the safety, reliability, and performance of U.S. nuclear weapons, and in a larger context, U.S. judgments about the nuclear weapons capabilities of others (section 2.4.1). DOE did not consider it reasonable to propose stewardship alternatives that would diminish stewardship capabilities, particularly given the fact that historic confidence in the safety and performance of the stockpile was derived from nuclear testing that is no longer part of the ongoing stewardship program. National security policy requires DOE to maintain, and in some areas enhance, the stewardship capabilities of the three weapons laboratories and NTS (section 2.2). The PEIS also explains the basis for this in a technical context, including the need for two independent nuclear design laboratories (section 2.4.1). Therefore, this PEIS has no proposed actions that transfer ongoing stockpile stewardship missions from one site to another, or that would otherwise diminish ongoing stewardship missions.

National security policy also requires DOE to maintain stockpile management capabilities and appropriate manufacturing capacity for a smaller stockpile. Unlike stockpile stewardship capabilities, the smaller stockpile does permit some reasonable siting alternatives for stockpile management capabilities and capacities to accomplish the mission purpose and need within the current national security policy framework (section 2.4.2).

3.1.2.2 *Enhanced Experimental Capability*

DOE has considered that there are differing opinions on the technical merit of DOE's proposed actions with regard to enhanced experimental capability. Nuclear weapons design information, including the complex physics of nuclear weapon explosions, is classified for reasons of national security and nonproliferation. Even if this information were unclassified, the physics problems remain daunting; hence, the reason why nuclear testing was so important to the past program. Both the classification of information and technical complexity of the issues form natural barriers to public communication. The technical complexity alone engenders significant debate among qualified experts, especially in the area of high energy density physics. This PEIS attempts to explain the weapon physics issues in an unclassified, comprehensible manner regarding its relation to mission purpose and need (chapter 2), proposed actions and alternatives (section 3.3), and project-specific technical detail (Volume III). In the absence of nuclear testing, there are two basic alternatives: (1) rely on existing facilities as sources of experimental data described by the No Action alternative, and (2) pursue the enhanced capability of the proposed facilities to provide the sources of experimental data needed.

Role of Existing Experimental Facilities. In DOE's technical judgment, the existing facilities described by the No Action alternative are inadequate to meet the challenge of assessing and certifying a safe and reliable stockpile over the longer term. It is also DOE's technical judgment that it is impossible to speculate at this time whether any of the existing facilities could be retired, because they would be obsolete or redundant, as a result of a decision to construct and operate any or all of the three proposed new stewardship facilities. The uncertainties inherent in the R&D nature of the stewardship program would make that kind of exercise essentially guesswork. The development of machines to simulate the intricacies of a nuclear detonation requires a highly sophisticated scientific R&D program. It very likely will take 5 to 10 years to begin obtaining reliable data from the new facilities. Until those facilities are operational, DOE cannot reliably predict how the additional capabilities they provide will mesh with the capabilities of previously existing machines to further the goals of the Program. It is only through incremental advances in the state of the science that decisions can eventually be made regarding the retirement of obsolete or redundant facilities.

DOE is committed to making maximum efficient use of the stewardship capabilities at its disposal. However, it is not reasonable to speculate at this time about how future stewardship requirements might affect existing facilities and capabilities.

Next Generation Experimental Facilities. Commentors suggested that potential next generation experimental facilities be analyzed as part of the proposed action. This PEIS includes a discussion of potential next-generation experimental facilities and the reasons why they are not proposed actions or alternatives (sections 2.5 and 3.3.4). These facilities, while contemplated on the basis of anticipated technical need, have not reached the stage of design maturity through R&D for DOE to include a decisionmaking analysis at this time. However, this PEIS does broadly describe, in general terms or by reference, what is known today about their potential environmental impacts. The environmental impacts from these facilities as contemplated today would not be significantly different from existing "similar" facilities. By characterizing the potential impacts in this way, the decisionmaker will be aware of the potential program-level cumulative impacts of the next-generation facilities when deciding whether to pursue a program of enhanced experimental capability. If DOE proposes to construct and operate such facilities in the future, appropriate NEPA review will be performed.

New Weapon Design. Commentors have suggested that the proposal for enhanced experimental capabilities is directed more at the capability to design new weapons in the absence of nuclear testing than at maintaining the safety and reliability of the existing stockpile and that stewardship alternatives could be different if the facilities were directed only at maintaining the existing stockpile. This PEIS explains why these capabilities are needed to maintain the safety and reliability of a smaller, aging stockpile in the absence of nuclear testing (chapter 2). The existing U.S. stockpile of nuclear weapons is highly engineered and technically sophisticated in its design for safety, reliability, and performance. The stewardship capabilities required to make technical judgments about the existing stockpile are likewise technically sophisticated; therefore, it would be unreasonable to say that these stewardship capabilities could not be applied to the design of new weapons, albeit with less confidence than if new weapons could be nuclear tested.

However, the development of new weapon designs requires integrated nuclear testing such as occurs in nuclear explosive tests. Short of nuclear testing, no single stockpile stewardship activity, nor any combination of activities, could confirm that a new-design weapon would work. In fact, a key effect of a "zero-yield" CTBT would be to prevent the confident development of new-design weapons. National security policy requires DOE to maintain the capability to design and develop new weapons, and it will be a national security policy decision to use or not use that capability. Choosing not to use enhanced experimental capability for new weapons designs would not change the technical issues for the existing stockpile and, therefore, the stewardship alternatives would not change.

The issue of new-design weapons is separate from DOE's need to perform modifications to existing weapons that require research, design, development, and testing. The phrase used in this PEIS, "without the development and production of new-design weapons," is meant to convey the fact that the historical continuous cycle of large scale development and production of new weapons designs replacing older weapon designs has been halted. For example, during the 1980s, about a dozen new-design weapons were in full-scale development or production. Over the decade, production of new-design weapons replaced dismantled weapons nearly one for one. Today, only modifications to parts of existing weapons are being performed or planned; dismantlement has continued. This results in a smaller, aging stockpile that must be assessed and certified without nuclear testing. This is now the primary focus of the stewardship program.

Nonproliferation. Commentors have suggested that enhanced experimental capability is a proliferation risk. The national security policy framework discussed in this PEIS seeks a new balance between U.S. arms control and nonproliferation objectives and U.S. national security requirements for nuclear deterrence while pursuing these objectives (section 2.2). In addition, a discussion is provided on some of the more difficult issues that must be considered in determining the balance, including a discussion of experimental capability (section 2.6). In particular, the issue of nonproliferation and the proposed NIF was studied in detail. The study, prepared by the DOE Office of Arms Control and Nonproliferation, has been the subject of extensive public involvement, interagency review, and review by outside experts. The study concluded that the technical proliferation concerns of NIF are manageable and can therefore be made acceptable and that NIF can contribute positively to U.S. arms control and nonproliferation policy goals (appendix section I.2.1 of Volume III). NIF is a proliferation concern because of its broader scientific applications and expected frequent use by researchers worldwide, and, like the other proposed enhanced experimental facilities because of its possible relevance to the development of new weapon designs. However, the development of new weapon designs requires integrated testing. None of the proposed facilities, either alone or together, could perform such integrated testing of new concepts, and therefore cannot replace nuclear testing for the development of new weapon designs. The role of these facilities will be to help assess and certify the safety and reliability of the nuclear weapons remaining in the stockpile in the absence of nuclear testing. The national security policy framework and the technical issues that drive the proposed action for enhanced experimental capability remain the same.

Subcritical Experiments. With regard to the treatment of ongoing stewardship activities or enhanced experimental capability, subcritical experiments are an example of how changes in terminology have caused some confusion about what is evaluated in this PEIS under the No Action alternative. Subcritical experiments have been conducted at NTS over many years. Historically, operations at NTS have included tests or experiments that included both HE and special nuclear materials that were intended to produce no nuclear yield or negligible nuclear energy releases. These experiments frequently remained subcritical (i.e., they did not achieve self-sustaining fission chain reactions). The term "subcritical experiments" does not define a new form of activity or mission. It is intended to underscore the fact that in the future such experiments will be configured to ensure that the condition of criticality cannot be achieved. This issue has been clarified in the NTS Site-Wide EIS.

3.1.2.3 *Safe and Reliable Stockpile*

Some commentors have suggested that nuclear weapon reliability is not important in the post-Cold War era. National security policy as established by the President and Congress requires a safe and reliable stockpile. In order for the nuclear deterrent to be credible within the current national security policy framework, it must be reliable in a militarily effective way. A program designed to ensure the safety but not the reliability of the stockpile would require DOE to speculate on an alternate concept of nuclear deterrence and a national security policy framework to support it. See also the discussion of denuclearization in section 3.1.2.4.

Commentors have also suggested acceptance of lower standards of reliability as an alternative to enhanced stewardship capabilities. This PEIS explains how the assessment and certification of nuclear performance is carried out, and how this process differs from the more conventional statistical methods used for assessing reliability of the nonnuclear portion of the weapon. Assessment and certification of nuclear performance is a technical judgment by the weapons laboratories based on scientific theory, experimental data, and computational modeling (sections 2.4.1 and 2.3). The question is not whether to accept a lower standard of nuclear performance (less nuclear explosive yield), but whether or not there is a technical basis to confidently know how well the weapon will perform at all. Enhanced stewardship capability is focused on the technical ability to confidently judge nuclear safety and performance in the absence of nuclear testing.

Aside from being inconsistent with national security policy, attempting to separate weapon safety and reliability is more technically complex than it sounds. A modern nuclear weapon is highly integrated in its design for safety, reliability, and performance. It contains electrical energy sources and many explosive energy sources in addition to the main charge HE. The principal safety concern is accidental detonation of the HE causing dispersal of radioactive materials (plutonium and uranium). Modern weapons are designed and system-engineered to provide a predictable response in accident environments (e.g., fire, crush, or drop). However, because of the technical complexity of potential accident scenarios (i.e., combined environments) and the fact that complete nuclear weapons cannot be used for experimental data, assessment of the design and the effect of changes that might be occurring due to stockpile environments must rely on other sources of experimental data and complex computer modeling. Enhanced experimental capability specifically related to the weapon secondary is a nuclear performance concern. Enhanced computational capability in general, and enhanced experimental capability related to the weapon primary in particular, are both nuclear safety and performance concerns.

3.1.2.4 *Description of Alternative Approaches*

Commentors have suggested that DOE consider alternative forms of stewardship. While their comments are responded to in Volume IV, this section discusses DOE's consideration of the broad range of views on this issue. The Congressional Research Service report, Nuclear Weapons Stockpile Stewardship: Alternatives for Congress, December 14, 1995, provides a reasonable description of the various viewpoints on alternatives and a framework for discussion. (The report uses the term stockpile stewardship generically to describe the Stockpile Stewardship and Management Program.) The following discussion of alternative approaches is taken from the summary of that report.

Denuclearizers would eliminate nuclear weapons worldwide in the foreseeable future, perhaps one to two decades. Until then, they would have a minimal U.S. stewardship program whose personnel, as curators of weapons knowledge, would monitor weapons. **Restorers** would maintain nuclear weapons with the only proven method, an ongoing program of research, development, design, testing, and production, downsized to meet post-Cold War needs. Three intermediate positions seek to maintain weapons indefinitely without nuclear testing. **Remanufacturers** believe that since current weapons have been tested and certified as meeting military requirements, this Nation can maintain them indefinitely by "remanufacturing"--reproducing them to the exact specifications of the originals. Remanufacturers would go to great lengths to do so in order to avoid risks that even slight changes to warheads might introduce. **Enhancers**, who take the Administration's position on stewardship, see identical remanufacture as impossible. They believe some changes in design, process, and materials are unavoidable and others are desirable. A robust science program, they hold, is the best that can be done without testing to monitor warheads, anticipate problems, modify warheads when problems arise, and revalidate stockpile effectiveness on an ongoing basis. They would have a small manufacturing program. **Maintainers** fall between remanufacturers and enhancers. They focus on how to maintain warheads. They prefer to avoid changes to warheads but would not go to great lengths to do so. They view a strong science program as essential, but only to the extent that its elements connect directly to maintaining weapons. They emphasize manufacturing as the ultimate guarantor of U.S. ability to solve warhead problems. They, along with enhancers, favor some link to testing if confidence cannot be maintained in any other way.

Beyond the broad overview of alternative approaches to stockpile stewardship and management, the main text of the report discusses variations within each of the five points of view. Given the political and technical complexity of the Program, many approaches can appear to be distinct or reasonable alternatives for detailed study. In fact, while the enhancer's viewpoint as described above most closely resembles the Program described in this PEIS, the Program actually embraces elements of all five viewpoints. The following discussion illustrates this point and focuses on the main issue(s) that, in DOE's view, eliminate the other approaches as distinct or reasonable alternatives for this PEIS.

Denuclearization. This approach is reflected in this PEIS to the extent that national security policy is pointed toward the goals of denuclearization. Since the end of the Cold War, more than 8,000 U.S. nuclear weapons have been dismantled, no new-design weapons are being produced, three former nuclear weapons industrial plants have been closed, and the United States is observing a nuclear test moratorium and seeking a "zero-yield" CTBT. Maintenance of a safe and reliable stockpile is not inconsistent with working toward the NPT goal of eliminating nuclear weapons worldwide at some unspecified time in the future. However, denuclearization is not a reasonable alternative for this PEIS because it is not feasible based on current national security policy.

The main issue discussed in this section is consideration of an alternative with a very small (10s or 100s) or zero stockpile. Two of the stockpile sizes analyzed in this PEIS, a START I Treaty- and START II protocol-sized stockpile, are the only ones currently defined and directed by national security policy. The PEIS also analyzes a hypothetical 1,000 weapon stockpile for the purpose of a sensitivity analysis for manufacturing capacity decisions. The NWSM specifies the types of weapons and quantities of each weapon type by year (section 1.1). The NWSM is developed based on DOD force structure requirements necessary to maintain nuclear deterrence and comply with existing arms control treaties while pursuing further arms control reductions. This PEIS explains the complexity of this process and why DOE does not believe it reasonable to speculate using a large number of arbitrary assumptions (section 2.2). DOE has considered that a future national security policy framework could define a path to a smaller stockpile. However, DOE has the following perspective on this issue.

Stockpile stewardship capabilities are currently viewed by the United States as a means to further U.S. nonproliferation objectives in seeking a "zero-yield" CTBT. Likewise, it would be reasonable to assume that U.S. confidence in its stewardship capabilities would remain as important, if not more important, in future arms control negotiations to reduce its stockpile further. The path to a very small (10s or 100s) or zero stockpile would require the negotiation of complex international treaties, most likely with provisions that require intrusive international verification inspections of nuclear weapons related facilities. Therefore, DOE believes it reasonable to assume that complex treaty negotiations, when coupled with complex implementation provisions, would likely stretch over several decades. On a gradual path to a very small or zero stockpile, stockpile size alone would not change the purpose and need, proposed actions, and alternatives in this PEIS as they relate to stewardship capabilities. The issues of maintaining the core competencies of the United States in nuclear weapons, and the technical problems of a smaller, aging stockpile in the absence of nuclear testing, remain the same.

On a gradual path to a very small or zero stockpile, this PEIS evaluates reasonable approaches to stockpile management capability and capacity. At some point on this path, further downsizing of existing industrial plants or the alternative of consolidating manufacturing functions at stewardship sites would become more attractive as manufacturing capacity becomes a less important consideration. However, in the near term, the preferred alternative of downsizing the existing industrial plants would still be a reasonable action because the projected downsizing investment pays back within a few years through reduced operating expense; in addition, the downsizing actions are consistent with potential future decisions regarding plant closures. In regard to the proposed action of reestablishing pit manufacturing capability, DOE does not propose to establish higher manufacturing capacities than are inherent in the reestablishment of the basic manufacturing capability. In developing the criteria for reasonable stockpile management alternatives, DOE was careful not to propose the introduction of significant new types of environmental hazards to any prospective site. On a gradual path to a very small or zero stockpile, stockpile size alone would not change the purpose and need, proposed actions, and alternatives in this PEIS with regard to stockpile management capabilities and capacities.

To achieve eventual denuclearization, some commentors have asserted that DOE should adopt a passive curatorship approach to maintaining the declining nuclear weapons stockpile. The concept of curatorship is already being implemented at the existing sites in the form of knowledge preservation programs. While not necessary in an era of continuous development and production of new-design weapons and nuclear testing, knowledge preservation is now part of DOE's overall effort to maintain core competency in the weapons complex. However, as an inherently imperfect reconstruction, this effort can never ensure completeness of information nor relevance to future stockpile problems. More importantly, knowledge preservation does not address the fundamental issue of confidence in future technical judgments about issues that are yet to arise regarding the safety and performance of the stockpile. In highly technical matters, confidence arises from having appropriate data to support conclusions. In the absence of nuclear testing, the science-based approach to stockpile stewardship is focused on achieving the capability to acquire appropriate data.

From an environmental impact point of view, this PEIS displays the environmental impacts of each site's ongoing Program operations on an annual basis. The impacts of alternatives for proposed actions are displayed individually on the same basis. If one assumes that denuclearization leads to eventual site closure, then this PEIS, together with the Tritium Supply and Recycling PEIS, presents the environmental impacts of closing the four remaining industrial plants. While this PEIS does not directly consider the closure of the weapons laboratories and NTS, it is not at all clear what nuclear weapons capabilities the U.S. would retain even if it decided on a zero stockpile. However, the environmental impacts of the ongoing Program (No Action alternative) are essentially what would be phased out, with or without the proposed actions. DOE does not believe that speculative combinations of this data on speculative time lines provides any useful information for decisionmaking.

Restoration. The restorer's point of view is reflected in this PEIS to the extent that current national security policy requires DOE to maintain all the historical capabilities of the Program, including the capability for new-design weapons and nuclear testing. However, restoration is not a reasonable alternative for this PEIS because it requires a national security policy decision to reverse the constraints placed on the Program, namely, by resuming nuclear testing and new-design weapons production.

The environmental impacts of the restoration approach would be the same as those described in this PEIS to the extent that such a decision did not require manufacturing capacities higher than analyzed in this PEIS. In addition, this PEIS includes a brief description of the environmental impacts of nuclear testing (section 4.12); the Site-Wide EIS for NTS contains detailed information.

Remanufacturing . The remanufacturer's point of view is reflected in this PEIS by the fact that remanufacturing to specification will be attempted when possible and when appropriate to the problem being solved. With more than a half dozen different weapon types projected to remain in the stockpile, and with each weapon type containing thousands of parts, remanufacturing will undoubtedly occur for a significant number of repair and replacement activities. However, remanufacturing is not reasonable as a distinct exclusive alternative to the ongoing stockpile stewardship program or the proposed action of enhanced experimental capability for the technical reasons discussed below. In addition, it would not be a reasonable alternative because it does not fully support national security policies that require the conduct of a science-based stockpile stewardship and maintenance of the capability to design and produce new weapons.

Remanufacturing weapon components to their original specification, or maintaining weapons to their original design specifications, would superficially appear to be a reasonable approach to maintaining the safety and reliability of the stockpile in the absence of nuclear testing. Precise replication, however, 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. Implicit in the remanufacturing assumption is that the design blueprint, manufacturing process, and the materials used are specified in exact detail in every way. However, there is an unwritten element of "know how" that knowledgeable and experienced personnel contribute to any complicated manufacturing process (for this reason, controlling the acquisition of "know-how" is a major nuclear weapons nonproliferation objective). Materials and processes are not always specified in important ways because, at the time, they were not known to be important. The problem is illustrated by the following hypothetical example:

A material produced for a critical weld has a specification for a trace impurity; the manufacturing process consistently produced the material with a trace impurity less than the maximum allowed and the welds were satisfactory; the manufacturing process is changed for some reason, such as cost or environmental concerns; the material is now being produced with less trace impurity than before the process was changed; the material is still within specification; however, the welds are no longer satisfactory; it was unknown at the time that the higher level of the trace impurity was necessary to produce a satisfactory weld.

While remanufacturing sounds simple in principle, it is likely in fact to present complex issues of design, manufacturing process, and material variables. A simplified view of remanufacturing cannot serve as a "stand alone" manufacturing approach, let alone an alternative approach to enhanced stewardship capability. In the absence of underground nuclear testing, nuclear components (pits and secondaries) cannot be functionally tested. Stewardship capabilities provide the analytical tools (experimental and computational) to assess the significance of a problem observed during surveillance and to decide if the problem should be fixed; and if fixed, to certify that the fix will work (section 2.4.1). In the past, the decision to fix or not fix an observed problem could be made with nuclear testing (section 2.3). Stockpile stewardship strategies focus on the basic material science and the enhanced experimental and computational tools necessary to better predict age-related defects and to make sound technical judgments on nuclear safety and performance in the absence of nuclear testing.

The DARHT EIS (DOE/EIS-0228, section 2.3.2) provides an additional discussion of the limitations of a remanufacturing-to-specification approach. It discusses, as an example, the actions taken to evaluate and resolve unanticipated deterioration of HE in the now-retired W68 warhead for a submarine-launched ballistic missile. In that case it was necessary to replace the HE with a more chemically stable formulation. In addition, some other materials were no longer commercially available, requiring changes in the rebuilt weapons. Nuclear testing was ultimately used to verify that the necessary changes were acceptable. DOE does not consider it feasible to maintain all potentially obsolescent commercial sources and processes used for materials in existing weapons; aging would still occur in stored reserves of such materials.

With regard to stockpile management, remanufacturing without enhanced stewardship capability would also have notable drawbacks. DOE plans to maintain the capability to produce secondaries, and proposes to reestablish the capability to produce pits, by producing small quantities (10s) of each annually to maintain capability. This capacity should be sufficient to replace components attrited from the stockpile by surveillance testing. Remanufacturing these components, without the enhanced stewardship analytical capability to determine if and when replacement is necessary, is likely to require higher levels of production than DOE believes necessary to maintain production capability. Also, remanufacturing a nuclear component to the original specifications will not prevent age-related problems related to those specifications from recurring. Since these components use plutonium and uranium, radiation exposure to personnel and generation of radioactive waste would also be higher than necessary. If repeated remanufacturing were required, further unnecessary risks would result from additional weapon assembly/disassembly (A/D) operations and additional transport of nuclear components between sites.

From an environmental impact point of view, the remanufacturing concept would have greater impacts for the proposed action of reestablishing pit capability because DOE proposes to use a cleaner, less waste-generating process than was used at the Rocky Flats Plant. All other environmental impacts would not be distinguishable from those described in this PEIS because existing manufacturing processes form the Program baseline.

Maintenance . The maintainer's point of view is reflected in this PEIS to the extent that it is consistent with the No Action alternative. 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 weapons laboratories. These attributes are all part of the ongoing Program that will continue into the future. The principal difference between the Program as presented in this PEIS and this point of view is differing judgment on how much enhanced experimental capability would be needed to assess and certify a safe and reliable stockpile over the long term. The maintainers believe that less (or no) additional experimental capability would be required if DOE placed more emphasis on enhanced surveillance and dual revalidation.

DOE believes that this approach would not provide a sufficient basis for assessing and certifying the safety and reliability of the stockpile. Although enhanced surveillance will play an important role in the future of the Program, it serves a limited purpose. Surveillance activities identify stockpile problems through the examination and analysis of weapons sampled from the stockpile. An enhanced surveillance program would serve to identify problems with greater confidence and increased warning time. However, it would not provide a sole basis for assessing the significance of the problem or determining its solution. The ability of the laboratories to validate that the problem has been corrected, in the absence of nuclear testing, depends on their experimental and computational capabilities. In DOE's judgment, as explained in section 2.4, those capabilities are inadequate. Therefore, to the extent that maintenance would not provide sufficient enhanced experimental capability, it is not a reasonable alternative.

From an environmental impact point of view, the maintenance concept is not distinguishable from the impacts of the No Action alternative for stockpile stewardship and the proposed actions for stockpile management.

3.1.3 Underground Nuclear Testing

The last underground nuclear test conducted by the United States was in 1992. Since then, the United States has observed a moratorium on underground nuclear testing while pursuing a CTBT. On August 11, 1995, the President announced that, "one of my Administration's highest priorities is to negotiate a Comprehensive Test Ban Treaty to reduce the danger posed by nuclear weapons proliferation." In this announcement, the President also stated that he would seek a "zero yield" CTBT, which would "ban any nuclear weapon test explosion or any other nuclear explosion immediately upon entry into force." The President declared his commitment "to do everything possible to conclude the ComprehensiveTest Ban Treaty negotiations as soon as possible so that a treaty can be signed next year."

As part of this announcement, the President also stated that he had been assured "that we can meet the challenge of maintaining our nuclear deterrent under a Comprehensive Test Ban Treaty through a science-based stockpile stewardship program without nuclear testing." However, the President cautioned that "while I am optimistic that the stockpile stewardship program will be successful, as President, I cannot dismiss the possibility, however unlikely, that the program will fall short of its objectives." The President went on to say further: "In the event that I were informed by the Secretary of Defense and Secretary of Energy ... that a high level of confidence in the safety or reliability of a nuclear weapons type which the Secretaries consider to be critical to our nuclear deterrent could no longer be certified, I would be prepared, in consultation with Congress, to exercise our `supreme national interests' rights under the Comprehensive Test Ban Treaty in order to conduct whatever testing might be required."

One of the primary purposes of the Stockpile Stewardship and Management PEIS is to evaluate ways of maintaining a continued safe and reliable nuclear deterrent in the absence of nuclear testing. Thus, the proposal described in this PEIS does not include nuclear testing. However, because it is possible--although not probable--that the United States might one day exercise its "supreme national interests" rights and conduct underground nuclear testing to certify the safety and reliability of its nuclear weapons, this PEIS and the NTS Site-Wide EIS include an analysis of the environmental impacts of underground nuclear testing at NTS.

3.1.4 No Action Alternative

Under the No Action alternative, DOE would not take the actions proposed in this PEIS. Activities associated with stockpile stewardship and management would continue at the Complex sites using existing facilities, and no significant changes would occur.

With regards to stockpile stewardship, under the No Action alternative, activities at the three weapons laboratories (LANL, LLNL, and SNL) and NTS would continue using existing experimental facilities, but the proposed new experimental facilities would not be constructed. The major No Action facilities for the various stockpile stewardship functions include: the DARHT Facility and the Pulsed High Energy Machine Emitting X-Rays (PHERMEX) Facility at LANL, the Flash X-Ray (FXR) Facility at LLNL, and the Big Explosives Experimental Facility (BEEF) at NTS for studying the physics of the weapons primary; the Nova Facility at LLNL and the Pegasus II Facility at LANL for studying physics of the weapons secondary; and the Saturn and Particle Beam Fusion Accelerator (PBFA) Facilities at SNL for studying weapon effects. These facilities are more fully described in section 3.3, while the major activities at sites involved with stockpile stewardship are described in section 3.2.

Under the No Action alternative, stockpile management functions would remain at their current locations, no further rightsizing or consolidation beyond currently planned initiatives would take place, and pit manufacturing capability would not be reestablished. The major No Action facilities for the various stockpile management functions include: *A/D* and HE fabrication at Pantex; secondary and case fabrication at Y-12; nonnuclear fabrication facilities primarily at Kansas City Plant (KCP), with smaller capabilities at LANL and SNL; R&D plutonium fabrication capabilities at LANL and LLNL; and tritium supply and recycling facilities at SRS per the decisions in the Tritium Supply and Recycling ROD. These facilities are more fully described in section 3.4, while the major activities at sites involved with stockpile management are described in section 3.2.

From a programmatic perspective, the No Action alternative would not ensure DOE's ability to maintain core U.S. competencies in nuclear weapons in the long term while also maintaining a safe and reliable, smaller, aging U.S. stockpile. Because this is not acceptable, the No Action alternative is not considered to be reasonable. However, in accordance with the CEQ regulations, the No Action alternative is presented and assessed in this PEIS.

3.2 Alternative Sites

Eight locations (ORR, SRS, KCP, Pantex, LANL, LLNL, SNL, and NTS) are being considered as alternative sites for stockpile stewardship and management missions. All of these sites are currently performing DOE Office of the Assistant Secretary for Defense Programs (DP) activities.

3.2.1 Site Selection

One important strategy of the Stockpile Stewardship and Management Program is to maximize the use of existing infrastructure and facilities as the Complex transitions to be smaller and more efficient in the 21st century. Consequently, only those sites with existing infrastructure or facilities capable of supporting a given stockpile stewardship or stockpile management mission are considered reasonable site alternatives for detailed study in this PEIS. Sites without a technical infrastructure or facilities for a given mission would require significant new construction that would be costly and would create excessive technical risk compared to sites with existing infrastructure and facilities.

For stockpile stewardship, the three existing weapons laboratories and NTS are being considered for new or upgraded stockpile stewardship facilities. This is because the weapons testing mission and stockpile stewardship have always been primary responsibilities of the weapons laboratories and NTS, and existing facilities and capabilities can be built upon to meet the stewardship mission.

For stockpile management, all of the eight current Complex sites could be considered for one or more stockpile management functions. The three weapons laboratories and NTS have various production and manufacturing capabilities and infrastructure that could be improved upon to meet the stockpile management missions. As an example, for the A/D mission there are two reasonable site alternatives: Pantex, which currently performs this mission and has facilities that could be downsized for the future A/D mission; and NTS, which has a relatively new facility known as the Device Assembly Facility that could be upgraded and expanded to perform the A/D mission. Other sites, such as SRS or ORR, that do not have existing facilities or experience necessary to perform the A/D mission, are unreasonable options relative to the sites that have existing A/D facilities. This same logic is similarly applied for the other stockpile management missions.

3.2.2 Oak Ridge Reservation

ORR covers approximately 13,980 hectares (ha) (34,545 acres) in Oak Ridge, TN. ORR contains the Oak Ridge National Laboratory (ORNL), Y-12, and the < k-25 site (k-25). the primary focus of ornl is on conducting basic and applied scientific research and technology development. y-12 engages in national security activities, which are included in this peis. the oak ridge gaseous diffusion plant, which has been shut down, is located at k-25. k-25 now serves as an operations center for environmental restoration and waste management programs.

Table 3.2.2-1.-- ***Current Major Missions at Oak Ridge Reservation***

Mission	Description	Sponsor
Weapon Components	Maintain capability to fabricate uranium and lithium components and parts for nuclear weapons	Defense Programs (DP)
Stockpile Surveillance	Evaluation of components and subsystems returned from the stockpile	Defense Programs (DP)

Uranium and Lithium Storage	Store enriched uranium, depleted uranium, and lithium materials and parts	Defense Programs (DP)
Dismantlement	Dismantle nuclear weapon secondaries returned from the stockpile	Defense Programs (DP)
Special Nuclear Material	Process uranium	Defense Programs (DP); Nuclear Energy (NE)
Test Devices	Provide support to weapons laboratories	Defense Programs (DP)
Environmental Restoration and Waste Management	Waste management and decontamination and decommissioning activities at Oak Ridge National Laboratory and K-25	Environmental Management (EM)
Research and Development	Oak Ridge National Laboratory basic research and development in energy, health, and environment	Energy Research (ER); Environment, Safety, and Health (EH); Nuclear Energy (NE)
Isotope Production	Oak Ridge National Laboratory produces radioactive and stable isotopes not available elsewhere	Nuclear Energy (NE)

Y-12 receives, processes, and provides interim storage for unirradiated enriched uranium returned from dismantled weapons and DOE sites as described in the *Environmental Assessment and Finding of No Significant Impact, Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Level at the Y-12 Plant, Oak Ridge, Tennessee* (DOE/EA-0929). The capacity of existing processing and storage facilities is sufficient to accommodate all of the forecasted amounts of enriched uranium that would be placed in interim storage. The current missions and functions are described in table 3.2.2-1.

Defense Program Activities. The ORR DP assignments are performed at Y-12 and include maintaining the capability to produce secondaries and cases for nuclear weapons, storing and processing uranium and lithium materials and parts, dismantling nuclear weapons secondaries returned from the stockpile, and providing special production support to DOE weapons laboratories and to other DOE programs. To accomplish its storage mission, some processing of special nuclear materials may be required to recover materials from the returned secondaries. In addition, Y-12 performs stockpile surveillance activities on the components it produces.

3.2.3 Savannah River Site

SRS, located on approximately 80,130 ha (198,000 acres) near Aiken, SC, was established in 1950. The major nuclear facilities at SRS have included fuel and target fabrication facilities, nuclear material production reactors, chemical separation plants used for recovery of plutonium and uranium isotopes, a uranium fuel processing area, and the Savannah River Technology Center, which provides process support. Historically, DOE has produced tritium at SRS; however, DOE has not produced new tritium since 1988. Plutonium and spent nuclear fuel processing to produce material for nuclear weapons at SRS, have been terminated. DOE is currently preparing a separate EIS to explore the use of these facilities to stabilize existing quantities of plutonium residues as well as other nuclear materials. Tritium recycling operations will continue at SRS with the Replacement Tritium Facility conducting the majority of these operations. Tritium decays and must be replaced periodically to meet weapons specifications. Tritium recycling facilities empty tritium from weapons reservoirs, purify it to eliminate the helium decay product, and fill replacement reservoirs with specification tritium for nuclear stockpile weapons. Filled reservoirs are delivered to Pantex for weapons assembly and directly to the Department of Defense as replacements for weapons reservoirs. As part of the previous nonnuclear consolidation, SRS is also in the process of receiving some of the tritium processing and reservoir surveillance functions previously performed at the Mound Plant in Miamisburg, OH. The current missions at SRS are shown in table 3.2.3-1.

Table 3.2.3-1.-- ***Current Major Missions at Savannah River Site***

Mission	*Description*	*Sponsor*
Tritium Recycling and Reservoir Surveillance	Operate H-Area tritium facilities	Defense Programs (DP)
Stockpile Surveillance	Evaluation of reservoir components returned from stockpile	Defense Programs (DP)
Research and Development	Savannah River Technology Center technical support of Defense Programs, Environmental Management, and Nuclear Energy programs	Defense Programs (DP); Environmental Management (EM); Nuclear Energy (NE)
Stabilize Targets, Spent Nuclear Fuels, and Other Nuclear Materials	Operate F- and H-Canyons	Environmental Management (EM)
Waste Management	Operate waste processing facilities	Environmental Management (EM)
Environmental Monitoring and Restoration	Operate remediation facilities	Environmental Management (EM)
Space Program Support	Provide plutonium-238 for space program missions	Nuclear Energy (NE)

Defense Program Activities. In the past, the SRS complex for the production of nuclear materials consisted of five reactors (the C-, K-, L-, P-, and R-Reactors) in addition to a fuel and target fabrication plant, two target and spent nuclear fuel chemical separation plants, a tritium-target processing facility, a heavy water rework facility, and waste management facilities.

The K-Reactor, the last operational reactor, was put into cold standby status in 1992 with no planned provision for restart. SRS is now conducting tritium-recycling operations in support of stockpile requirements using dismantled weapons as the tritium supply source.

3.2.4 Kansas City Plant

KCP is situated on approximately 57 ha (141 acres) of the 121-ha (300-acre) Bannister Federal Complex, which is located within incorporated city limits 19 km (12 mi) south of the downtown center of Kansas City, MO. The plant shares the Bannister Federal Complex site with other Federal agencies: the General Services Administration, the U.S. Marine Corps, the Federal Aviation Administration, the National Archives, and the Internal Revenue Service, among others.

KCP produces and procures nonnuclear electrical, electronic, electromechanical, mechanical, plastic, and nonfissionable metal components for the nuclear weapons program. Current missions at KCP are shown in table 3.2.4-1.

Table 3.2.4-1.-- ***Current Major Missions at Kansas City Plant***

Mission	Description	Sponsor
Nonnuclear Component Fabrication	Manufacture electrical, electronic, electromechanical, plastic, and metallic components; fuzing and firing systems; and composite structures	Defense Programs (DP)
Telemetry Assembly	Manufacture telemetry assemblies and neutron detectors for flight test assemblies	Defense Programs (DP)
Test Equipment Design and Fabrication	Manufacture test equipment capable of performing electrical and mechanical tests on nonnuclear weapon components	Defense Programs (DP)
Stockpile Surveillance	Evaluation of components and subsystems returned from stockpile	Defense Programs (DP)

Defense Program Activities. KCP is currently the principal nonnuclear fabrication facility within the Complex. As such, KCP produces a variety of nonnuclear components and provides surveillance testing and repair services for these components.

3.2.5 Pantex Plant

Pantex is located about 27 km (17 mi) northeast of Amarillo, TX, on approximately 4,119 ha (10,177 acres) of DOE-owned land. Pantex missions are the fabrication of chemical HE for nuclear weapons, assembly, disassembly, maintenance, and surveillance of nuclear weapons in the stockpile, dismantlement of nuclear weapons being retired from the stockpile, and interim storage of plutonium components from dismantled weapons. Weapons activities involve the handling (but not processing) of uranium, plutonium, and tritium components, as well as a variety of nonradioactive hazardous or toxic chemicals. The current Pantex missions and functions are listed in table 3.2.5-1.

In the near term, weapons dismantlement and plutonium pit storage activities will dominate activities at Pantex. Although analysis in the *Environmental Assessment for Interim Storage of Plutonium Components* (DOE/EA-0812) found that Pantex has a sufficient number of storage magazines to safely accommodate 20,000 pits, Pantex only has authority to provide interim storage for up to 12,000 pits as described in a Finding of No Significant Impact (59 FR 3674) on January 26, 1994. Decisions regarding additional pit storage beyond 12,000 pits are being considered in the *Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components* (DOE/EIS-0225).

Defense Program Activities. The main mission of Pantex is the A/D of nuclear weapons. Other than HE, virtually all other components of the weapons come from other DOE or DOD sites. Modification, maintenance, and repair activity at Pantex involves the disassembly of nuclear weapons so that one or more of the components can be repaired, replaced, or modified. After replacing components, the weapons are reassembled and returned to the stockpile. Pantex surveillance activities involve weapon disassembly, laboratory testing of various components, and rebuilding weapons for shipment back to the stockpile. Production of HE components includes processing and machining main charge subassemblies and fabrication of mock components for use in weapon test assemblies, manufacturing small HE components, producing a variety of explosive materials from chemical reactants and commercially produced explosives, and evaluating explosive materials and components through a variety of analytical, mechanical, and explosive tests. Retired weapon dismantlement is the predominant current activity at Pantex. Weapons are returned from DOD, disassembled, and components are either destroyed, reclaimed, or returned to the original manufacturer. The exception is plutonium pits, which are stored onsite on an interim basis.

Table 3.2.5-1.-- ***Current Major Missions at Pantex Plant***

Mission	Description	Sponsor
Weapons Assembly/Disassembly	Assemble and disassemble nuclear weapons as necessary	Defense Programs (DP)
Weapons Dismantlement	Dismantle nuclear weapons no longer required	Defense Programs (DP)
Weapons Maintenance	Retrofit, maintain, and repair stockpile weapons	Defense Programs (DP)
Stockpile Surveillance	Disassembly and inspection	Defense Programs (DP)
High Explosive Components	Manufacture for use in nuclear weapons	Defense Programs (DP)
Plutonium Storage	Provide interim storage of pits	Defense Programs (DP)
Test/training Programs	Assemble nuclear explosive-like assemblies for training or flight test	Defense Programs (DP)
Waste Management	Provide waste management and decontamination and decommissioning activities	Environmental Management (EM)

3.2.6 Los Alamos National Laboratory

LANL was established as a nuclear weapons design laboratory in 1943 and was formerly known as the Los Alamos Scientific Laboratory. Its facilities are located on about 11,300 ha (28,000 acres) about 40 km (25 mi) northwest of Santa Fe, NM.

LANL is a multidisiciplinary research facility engaged in a variety of programs for DOE and other Government agencies. Its primary mission is the nuclear weapons Stockpile Stewardship and Management Program and related emergency response, arms control, and nonproliferation and environmental activities. It conducts R&D activities in the basic sciences, mathematics, and computing with applications to these mission areas and to a broad range of programs including: nonnuclear defense; nuclear and nonnuclear energy; atmospheric, space, and geosciences; bioscience and biotechnology; and the environment. Table 3.2.6-1 illustrates current missions at LANL. A more detailed discussion of the complete spectrum of laboratory activities can be found in the current LANL Institutional Plan, which is unclassified and available to the public.

Table 3.2.6-1.-- ***Current Major Missions at Los Alamos National Laboratory***

Mission	Description	Primary Sponsor
Nuclear Weapons	Stockpile stewardship; production of nonnuclear components; pit surveillance; tritium production R&D	Defense Programs (DP)
Arms Control and Nonproliferation	Intelligence analysis; technology R&D; treaty verification; fissile material control; counterproliferation analysis	Nonproliferation and National Security (NN)
Energy Research, Science and Technology	Neutron science (e.g., at LANSCE); scientific computing; fusion energy; health and environmental research; high energy and nuclear physics; basic energy sciences	Energy Research (ER)
Energy Technology	Fossil; nuclear	Energy Efficiency and Renewable Energy (EE)
Environmental	Environmental restoration; waste management and treatment	Environmental Management (EM)
Work for Others	Conventional weapons; computing, modeling and simulation	DOD and various other agencies

In regard to nuclear weapons, LANL is responsible for the design of the nuclear explosive package in certain U.S. weapons (LLNL has this responsibility for other weapons.) LANL maintains research, design, development, testing (including nuclear testing), surveillance, assessment, and certification capabilities in support of the Stockpile Stewardship and Management Program. In addition, since the end of the Cold War, LANL now conducts the pit surveillance program and some manufacturing of nonnuclear components due to termination of the nuclear weapons mission at the Mound, Pinellas, and Rocky Flats Plants.

3.2.7 Lawrence Livermore National Laboratory

LLNL was established as a nuclear weapons design laboratory in 1952 and was formerly known as the Lawrence Radiation Laboratory. Its facilities are located on about 332 ha (821 acres) in Livermore, CA. A 2,800-ha (7,000-acre) auxiliary testing range known as Site 300 is located about 29 km (18 mi) east of the Livermore Site. Site 300 is used primarily for HE testing and other experimentation, such as particle beam research.

LLNL is a multidisiciplinary research facility engaged in a variety of programs for DOE and other Government agencies. Its primary mission is the nuclear weapons stewardship program and related emergency response, arms control, and nonproliferation activities. It conducts research and development activities in the basic sciences, mathematics, and computing, with applications to these mission areas and to a broad range of programs including: nonnuclear defense; nuclear and nonnuclear energy; atmospheric, space, and geosciences; bioscience and biotechnology; and the environment. Table 3.2.7-1 illustrates current missions at LLNL. A more detailed discussion of the complete spectrum of laboratory activities can be found in the current LLNL Institutional Plan which is unclassified and available to the public. In regard to nuclear weapons, LLNL is responsible for the design of the nuclear explosive package in certain U.S. weapons (LANL has this responsibility for other weapons). LLNL maintains research, design, development, testing (including nuclear testing), surveillance, assessment, and certification capabilities in support of the Stockpile Stewardship and Management Program.

Table 3.2.7-1.-- ***Current Major Missions at Lawrence Livermore National Laboratory***

Mission	Description	Primary Sponsor
Nuclear Weapons	Stockpile stewardship	Defense Programs (DP)
Arms Control and Nonproliferation	Intelligence analysis; treaty verification; fissile material control; counterproliferation analysis	Nonproliferation and National Security (NN)
Energy Research, Science and Technology	Scientific computing; fusion energy; health and environmental research; high energy and nuclear physics; basic energy sciences	Energy Research (ER)
Energy Technology	Nuclear safety; uranium - AVLIS	Nuclear Energy (NE)
Environmental	Environmental restoration; waste management and treatment	Environmental Management (EM)
Radioactive Waste	Repository studies	Radioactive Waste (RW)
Work for Others	Conventional weapons; space	DOD and various other agencies

Note: AVLIS - Atomic Vapor Laser Isotope Separation.

3.2.8 Sandia National Laboratories

SNL was established as a nuclear weapons design laboratory in 1945. Its facilities are in three locations in the continental United States: Albuquerque, NM; Livermore, CA; and Tonopah, NV. The facilities discussed in this document refer only to the main Albuquerque site, which is located on about 1,150 ha (2,842 acres) of DOE property on Kirtland Air Force Base and an additional 6,072 ha (15,003 acres) provided to DOE through ingrant land from Kirtland Air Force Base, the State of New Mexico, and Isleta Pueblo.

SNL is a multidisiciplinary research and engineering facility engaged in a variety of programs for DOE and other Government agencies. Its primary mission is the nuclear weapons Stewardship and Management Program and related emergency, arms control, and nonproliferation activities. In addition, it conducts R&D activities in advanced manufacturing, electronics, information, pulsed power, energy, environment, transportation, and biomedical technologies. Table 3.2.8-1 illustrates current missions at SNL. A more detailed discussion of the complete spectrum of laboratory activities can be found in the current SNL Institutional Plan, which is unclassified and available to the public.

In regard to nuclear weapons, SNL is responsible for the design of nonnuclear components and related system engineering. It maintains research, design, development, testing (including nuclear testing), surveillance, assessment, and certification capabilities in support of the Program. In addition, because of the end of the Cold War, SNL now performs some nonnuclear manufacturing functions due to termination of the nuclear weapons mission at the Mound and Pinellas Plants.

Table 3.2.8-1.-- ***Current Major Missions at Sandia National Laboratories***

Mission	Description	Primary Sponsor
Nuclear Weapons	Stockpile stewardship; nonnuclear component production	Defense Programs (DP)
Arms Control and Nonproliferation	Intelligence support; policy analysis; verification and control	Nonproliferation and National Security (NN)
Energy Research, Science and Technology	Electric, geothermal, solar, wind and photovoltaics; coal, gas and petroleum; fusion; basic energy sciences	Energy Efficiency and Renewable Energy (EE); Fossil Energy (FE); Energy Research (ER)
Environmental	Environmentally conscious manufacturing; environmental restoration; waste management; HazMat transport	Environmental Management (EM)
Work for Others	Satellites; arming, fuzing, and firing systems; probabilistic risk assessment; transport packaging	DOD and various other agencies

3.2.9 Nevada Test Site

NTS occupies approximately 351,000 ha (867,000 acres) in the southeastern part of Nye County in southern Nevada. NTS is located about 104 km (65 mi) northwest of Las Vegas. It 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. The first nuclear test at NTS was conducted in January 1951. Since the signing of the Threshold Test Ban Treaty in 1974, it has been the only U.S. site used for nuclear weapons testing. Approximately one-third of the land (located in the eastern and northwestern portions of the site) has been used for nuclear weapons testing, one-third (located in the western portion of the site) has been reserved for future missions, and one-third has been reserved for R&D and other facility requirements. Facilities include nuclear device assembly, diagnostic canister assembly, hazardous liquid spill, and the radioactive waste management site. In addition, Yucca Mountain, an area on the southwestern boundary of the site, is being evaluated by DOE for siting of a spent nuclear fuel and high-level waste (HLW) repository. While the primary purpose of Yucca Mountain is for commercial HLW, it is also slated to receive some defense HLW.

Activities at NTS are concentrated in several general areas. Most of the onsite work is related to DP activities, although there are DOE Office of Environmental Management (EM), other DOE, and non-DOE activities as well. NTS is a unique facility because it is a large open area into which access is tightly controlled, it has a substantial infrastructure, and it has the capability to handle and run tests with hazardous or radioactive materials. Because of these factors, activities other than nuclear testing, such as mobile missile transporter tests and nuclear rocket tests, have been carried out for other Federal departments and agencies. The current missions and functions of NTS are shown in table 3.2.9-1.

Defense Program Activities. The primary DP mission at NTS is to help ensure the safety and reliability of the Nation's nuclear weapons stockpile. This stewardship program includes maintaining the readiness and capability to conduct underground nuclear weapons tests and conducting such tests if so directed by the President. Other aspects of stockpile stewardship also include conventional HE tests, dynamic experiments, and hydrodynamic testing. The Nuclear Emergency Search Team based at NTS maintains the readiness to respond to any type of nuclear emergency, including search and identification for lost or stolen weapons, and training exercises related to nuclear bomb and radiation dispersal threats.

Table 3.2.9-1.-- ***Current Major Missions at Nevada Test Site***

Mission	Description	Sponsor
Defense Program	Stockpile stewardship activities, including maintenance of readiness to conduct underground nuclear tests, if directed	Defense Programs (DP)
Waste Management	Safe and permanent disposal of waste through disposal on NTS or to offsite commercial waste treatment or disposal facilities	Environmental Management (EM)
Environmental Restoration	Identification and cleanup of contaminated areas	Environmental Management (EM)
Nondefense Research and Development	Original research efforts by DOE, other Federal agencies, and universities	Environmental Management (EM); Energy Research (ER); and others
Work for Others	Provides for the use of NTS areas and facilities by other groups and agencies for activities such as military training exercises	DOD and various other agencies

NTS has also been a key site for past efforts in the areas of nuclear nonproliferation and verification of international treaties. This work was exemplified recently by the Joint Treaty Verification Project, a cooperative effort between the United States and the former Soviet Union.

North Las Vegas Facility . Located on a 32-ha (80-acre) site in the city of North Las Vegas, NV, the North Las Vegas Facility supports the DOE Nevada Operations Office and LLNL, LANL, and SNL weapons test programs and is considered an adjunct to NTS. The facility supports test prestaging activities and fabrication, assembly, and testing of field diagnostic systems that collect data from NTS weapons testing activities. This facility is being considered as an alternative location for NIF and is described more fully in appendix I.

3.3 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, DOE 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, DOE will lack the ability to adequately evaluate some safety and reliability issues, which could significantly affect the Nation's confidence in the stockpile. It is also possible that, without these enhanced capabilities, DOE could not certify the acceptability of certain weapons components repaired or modified to address future safety or reliability issues.

The physical principles involved in nuclear weapons call for a range of experimental capabilities to provide data. These capabilities differ in time and energy density (related to temperature and pressure), and they are complementary rather than duplicative, because they serve different needs. These aboveground sources of experimental data can be categorized most easily by time; that is, by the duration of the output pulse of the data. Thermonuclear processes vary in time down to the nanosecond range. [2] For example, powerful lasers do the best job of producing experimental data at the highest temperatures (millions of degrees) in the laboratory, but only for very short time intervals. Multi-nanosecond pulsed-power sources do the best job of producing very energetic pulses of x radiation in that time period, but at moderate temperatures. And microsecond pulsed-power sources and HE do the best job of providing an energetic but controlled hydrodynamic "push" in that time period for simulation and study of complex hydrodynamic phenomena. [3] The three weapons laboratories are also complementary in providing these technologies. The powerful laser capability is centered at LLNL, the nanosecond pulsed-power capability is centered at SNL, and the microsecond pulsed-power capability is centered at LANL.

As discussed in chapter 2, the historical stockpile data indicate that problems are likely to develop in the aging stockpile that will require certified repairs or replacements without nuclear testing. Thus, U.S. national security policy in pursuit of a "zero yield" CTBT calls for the aggressive pursuit of enhanced experimental capabilities to help ensure a safe and reliable stockpile without additional nuclear testing. Therefore, DOE has included the detailed project-specific analyses for the proposed facilities (NIF, CFF, and Atlas) in this PEIS. Enhanced experimental facilities considered in this PEIS are those that either require or may require budget "line item" authorization from Congress. Next generation facilities are discussed in section 3.3.4. Within the next several years, it is expected that the weapons laboratories may request DOE authorization to begin the formal Congressional budget "line item" process for these facilities. NEPA documentation would be completed as a normal part of this process.

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 3.3-1 depicts the proposed alternatives and facilities for enhanced experimental capability.

Table 3.3-1.-- ***Stockpile Stewardship Enhanced Experimental Capability Alternatives***

Capability	LANL	LLNL	SNL	NTS
Physics of Nuclear Weapons *Primaries*				
No Action	X	X		X
Contained Firing Facility [4]		X		
Physics of Nuclear Weapons Secondaries [5]				
No Action	X	X		
National Ignition Facility [5]	X	X	X	X

Atlas Facility [5]	X			
Weapons Effects				
No Action [6]			X	

3.3.1 Physics of Nuclear Weapons Primaries

Primary implosion is initiated by detonating a layer of chemical HE that surrounds the plutonium pit. The HE drives the pit material into a compressed mass at the center of the primary assembly, resulting in a fission reaction. 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. LANL and LLNL have been conducting basic work in these areas for many years. However, in the absence of additional nuclear testing, new and improved capabilities are needed. Proposed new facilities and site alternatives under consideration, along with the existing facilities which are part of the No Action alternative, are discussed below.

3.3.1.1 *No Action*

The principal diagnostic tools DOE currently uses to study nuclear weapons primaries are hydrodynamic tests and dynamic experiments. Hydrodynamic tests examine interactions among parts of the weapons primary. Dynamic experiments explore broader issues regarding materials science. Under the No Action alternative, DOE would continue to use the hydrodynamic testing facilities currently available at LANL, LLNL, and NTS, and a new facility planned for LANL. The FXR Facility at LLNL Site 300 has been in continuous operation since 1983. The FXR Facility uses linear induction accelerator technology for high-speed radiography. DOE does not perform dynamic experiments with plutonium at LLNL because the necessary infrastructure is not in place at Site 300. The PHERMEX Facility has been in continuous operation at LANL since 1963. The PHERMEX Facility uses a radio-frequency accelerator designed for high-speed radiography at LANL. Because neither the FXR Facility nor the PHERMEX Facility is capable of providing the degree of resolution, intensity, rapid time sequencing, or three-dimensional views that are now needed to provide answers to current questions regarding weapons condition or performance, DOE has decided to construct and operate a new facility (DARHT) at LANL.

The DARHT Facility will consist of a new accelerator building with two accelerator halls to provide two perpendicular lines-of-sight, which will enable two radiographic images to be captured simultaneously or sequentially and will provide a capability to perform three-dimensional diagnostics of a simulated nuclear weapon primary. Most tests and experiments at the DARHT Facility would be conducted inside of modular steel containment vessels. In the future, DOE may perform dynamic experiments with plutonium at the DARHT Facility; these experiments would be conducted in specially designed double-walled containment vessels. DOE has analyzed the environmental impacts of this proposal; the DARHT Facility Final EIS (DOE/EIS-0228) was published in August 1995 and on October 10, 1995, DOE issued its ROD to proceed with the facility. Construction of the facility was enjoined by the U.S. District Court for the District of New Mexico on January 27, 1995, pending completion of the EIS and ROD. Following the ROD, DOE filed motion for dissolution of the injunction. On April 16, 1996, the U.S. District Court concluded that the purpose of the injunction had been satisfied, and therefore lifted the injunction and dismissed the case.

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. Under all alternatives considered in this PEIS, including the No Action alternative, DOE would complete construction and operate both axes of the DARHT Facility. When DARHT becomes operational, DOE would phase out operation of the PHERMEX Facility. Modular steel containment vessels would be used at the DARHT Facility firing site to contain emissions and debris from selected hydrodynamic tests and dynamic experiments; any experiments involving plutonium would always be conducted inside a specially designed double-walled steel vessel.

Besides LANL and LLNL, NTS has some hydrodynamic testing facilities in place. In addition to its past underground nuclear testing program, DOE has conducted underground and aboveground hydrodynamic tests at NTS. For example, BEEF is used to study hydrodynamic motion associated with HE detonations; however, BEEF does not include a high resolution radiographic diagnostic capability.

3.3.1.2 *Proposed Contained Firing Facility*

As discussed previously, both LANL and LLNL are considered necessary for the continued development of the science-based stockpile stewardship program. In this regard both laboratories will continue to utilize and improve radiographic hydrodynamic test capability.

Table 3.3.1.2-1.-- ***Contained Firing Facility Construction Requirements***

Requirement	Consumption
Material/Resource	
Electrical energy (MWh)	64
Peak electrical demand (MWe)	0.1
Concrete (m^3)	3,000
Steel (t)	1,500
Gasoline, diesel, and lube oil (L)	56,800
Industrial gases [7] (m^3)	4,300
Water (L)	3,790,000
Land (ha)	1.2
Employment	
Total employment (worker years)	60
Peak employment (workers)	30
Construction period (years)	2

The proposed CFF would augment and upgrade the existing FXR Facility at LLNL's Site 300. The containment enclosure would provide for containment of hydrodynamic tests and reduce the environmental, safety, and health impacts of current outdoor testing. The enclosure will also improve the quality of diagnostics data derived from testing by better controlling experimental conditions. Tables 3.3.1.2-1 through 3.3.1.2-3 show CFF construction and operating requirements and waste volumes. More detailed information about CFF can be found in appendix section A.2.2 and in the project-specific analysis presented in appendix J.

Table 3.3.1.2-2.-- ***Contained Firing Facility Annual Operation Requirements***

Requirement	Consumption
Resource	
Electrical energy (MWh)	1,600
Peak electrical demand (MWe)	1.2
Liquid fuel (L)	2,650
Natural gas [8] (m^3)	None
Water (L)	2,300,000
Coal (t)	None
Plant Footprint (ha)	0.4
Employment (Workers)	6 [9]

Table 3.3.1.2-3.-- ***Contained Firing Facility Waste Volumes (100 Tests Per Year)***

Category	Average Annual Volume Generated from Construction (m^3)	Annual Volume Generated from Operation (m^3)	Annual Volume Effluent from Operation (m^3)
Low-Level			
Liquid	None	None	None
Solid	None	90 [10]	90 [11]
Mixed Low-Level			
Liquid	None	None	None
Solid	None	10 [12]	10
Hazardous			
Liquid	None	8 [13]	8
Solid	None	4	4
Nonhazardous (Sanitary)			
Liquid	1,420	284 [14]	284
Solid	64	13 [15]	13
Nonhazardous (Other)			
Liquid	None	None	None
Solid	None	None	None

3.3.2 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. The physics of nuclear weapons secondaries deals with the interaction of many dynamic physics processes, including hydrodynamics, thermodynamics, fission, and fusion. 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. LANL and LLNL have been conducting basic work in these areas for many years. However, without additional nuclear testing, new and improved capabilities are needed. The proposed new 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 weapons 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 is not competing with other alternatives.

3.3.2.1 *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. The Nova Facility and the Pegasus II Facility do not provide conditions sufficiently close to those in a nuclear weapon secondary to improve our understanding of these important concepts and processes. Without improvements to these capabilities, as proposed by NIF and the Atlas Facility, DOE would lack the ability to evaluate some significant nuclear performance issues, which could adversely affect confidence in the Nation's nuclear deterrent.

3.3.2.2 *Proposed National Ignition Facility*

The proposed NIF would make it possible to study radiation physics in laboratory experiments that would approach certain conditions of a thermonuclear detonation. 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. Tables 3.3.2.2-1 through 3.3.2.2-3 show generic NIF construction, operating requirements, and waste volumes. The data in these three tables reflect nonsite-specific estimates developed prior to site-specific analyses. More detailed and site-specific information about NIF can be found in the project-specific analysis presented in appendix I.

Table 3.3.2.2-1.-- ***National Ignition Facility Construction Requirements***

Requirement	Consumption
Material/Resource	
Electrical energy (MWh)	24
Concrete (m^3)	60,000
Steel (t)	10,000
Liquid fuel and lube oil (L)	1,500,000
Industrial gases [16] (m^3)	9,000

Water (L)	14,300,000 [17]
Land (ha)	20
Employment	
Total employment (worker years)	1,627
Peak employment (workers)	470
Construction period (years)	5

Table 3.3.2.2-2.--*National Ignition Facility Annual Operation Requirements*

Requirement	**Consumption**
Resource	
Electrical energy (MWh)	58,000
Peak electrical demand (MWe)	20
Liquid fuel (L)	5,820
Natural gas [18] (m^3)	1,100,000 [19]
Water (L)	152,000,000
Coal (t)	None
Plant Footprint (ha)	20 [20]
Employment (Workers)	267 [21]

Table 3.3.2.2-3.--*National Ignition Facility Conceptual Design Waste Volumes*

Category	Average Annual Volume Generated from Construction (m^3)	Annual Volume Generated from Operation (m^3)	Annual Volume Effluent from Operation (m^3)
Low-Level			
Liquid	None	0.6	None
Solid	None	3	3
Mixed Low-Level			
Liquid	None	2	2
Solid	None	0.3	0.3
Hazardous			
Liquid	None	2.3	2.3

Solid	None	8	8
Nonhazardous (Sanitary)			
Liquid	2,800	17,900 [22]	17,800 [23]
Solid	100	6,000	6,050
Nonhazardous (Other)			
Liquid	180	Included in sanitary	Included in sanitary
Solid	180	Included in sanitary	Included in sanitary

3.3.2.3 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, SNL, or NTS. Tables 3.3.2.3-1 through 3.3.2.3-3 show Atlas Facility construction and operating requirements and waste volumes. Although principally considered as a stewardship facility for study of the physics of nuclear weapons secondaries, the proposed Atlas Facility at LANL could also be used for hydrodynamic experiments to resolve issues related to material properties, mixing and other physics aspects of weapons primaries. More detailed information about the Atlas Facility can be found in the project-specific analysis presented in appendix K.

Table 3.3.2.3-1.--*Atlas Facility Construction Requirements*

Requirement	Consumption
Material/Resource	
Electrical energy (MWh)	520
Peak electrical demand (MWe)	0.1
Concrete (m^3)	100
Steel (t)	10
Liquid fuel and lube oil (L)	1,000
Industrial gases [24] (m^3)	100
Water (L)	10,000
Land (ha)	0.04
Employment	
Total employment (worker years)	53
Peak employment (workers)	35
Construction period (years)	4

Table 3.3.2.3-2.-- *Atlas Facility Annual Operation Requirements*

Requirement	Consumption
Resource	
Electrical energy (MWh)	5,360
Peak electrical demand (MWe)	12
Liquid fuel (L)	None
Natural gas [25] (m^3)	45,710
Water (L)	10,000
Coal (t)	None
Plant Footprint (ha)	0.3
Employment (Workers)	15

Table 3.3.2.3-3.-- ***Atlas Facility Waste Volumes***

Category	Average Annual Volume Generated from Construction (m^3)	Annual Volume Generated from Operation (m^3)	Annual Volume Effluent from Operation (m^3)
Low-Level			
Liquid	None	None [26]	None
Solid	None	None[26]	None
Mixed Low-Level			
Liquid	None	None[26]	None
Solid	None	None[26]	None
Hazardous			
Liquid	None	<1 [27]	None
Solid	None	<1b	None
Nonhazardous (Sanitary)			
Liquid	1,120 [28]	710 [29]	708 [30]
Solid	15.3	7	9
Nonhazardous (Other)			
Liquid	None	Included in sanitary	Included in sanitary
Solid	None	Included in sanitary	Included in sanitary

3.3.3 Weapons 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. Of particular importance is the ability to certify that crucial nuclear weapons components meet military requirements to withstand radiation. Additionally, underground nuclear testing has been used to establish, with high confidence, adherence to military requirements for nonweapons systems such as satellites. Existing facilities at SNL, such as the Saturn Facility or the PBFA Facility, provide a limited capability to investigate these effects, and would continue to operate under the No Action alternative. No alternatives for new facilities designed principally for weapons effects testing are being proposed in this PEIS.

3.3.4 Next Generation Stockpile Stewardship Facilities

The science-based stockpile stewardship program will build upon existing information and capabilities and the program is expected to continuously evolve as better information becomes available and technological advancements occur. Today, because of limitations on data and technology, only the first steps to a fully capable science-based stockpile stewardship program can be taken. Thus, DOE is only in a position to propose NIF, CFF, and Atlas Facility for decisionmaking analysis in this PEIS. These three facilities are described in detail in appendixes I, J, and K, respectively. The goal is to provide a sufficiently detailed analysis for these three facilities in this PEIS to allow for their construction and operation if the decision is made to do so.

While these three proposed facilities 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 potential stockpile stewardship facilities cannot be defined to the degree necessary to perform detailed environmental impact analysis. However, these next generation facilities can be described in general terms such that a consideration of cumulative impacts that might be related to the ultimate science-based stockpile stewardship program can be qualitatively assessed. Next generation facilities anticipated for science-based stockpile stewardship are the Advanced Hydrotest Facility (AHF), the High Explosive Pulsed Power Facility (HEPPF), the Advanced Radiation Source (ARS [X-1]), and the Jupiter Facility. The following sections provide a broad description of what these three facilities might look like. Section 4.11 describes the general impacts of constructing and operating these types of facilities.

3.3.4.1 *Advanced Hydrotest Facility*

AHF would be the next generation hydrodynamic test facility following the DARHT Facility at LANL. AHF would be an improved radiographic facility that would provide for imaging on more than two axes, each with multiple time frames, though the number of axes and time frames is still subject to requirements definition and design evolution. The facility would be used to better reveal the evolution of weapon primary implosion symmetry and boost-cavity shape under normal conditions and in accident scenarios. Due to the nature of the dynamic experiments and hydrodynamic testing to be conducted with the facility, AHF would probably be considered for location at NTS and LANL only.

At this point, the feasibility and definition of an AHF is still insufficiently determined for DOE to propose such a facility. For example: performance requirements and specifications for such a facility (i.e., determination of what capabilities should be required of an AHF for assessment of stockpile aging and related effects, beyond those of the DARHT Facility) have not been fully established. In addition, the type of technology to provide the basis for the facility has not been determined, and concepts for the resultant physical plant would accordingly vary significantly. Three basic technology approaches are currently being examined. These include linear induction accelerators of a type similar to that in the baseline DARHT Facility design (DOE/EIS-0228), an inductive-adder pulsed-power technology based on technology now in use for other purposes at SNL and elsewhere, and high-energy proton accelerators similar to technology in use at LANSCE and a number of facilities in the United States and internationally. The first two are different approaches to accelerating a high-current burst of electrons, which when stopped in a dense target produce x rays for radiography. This is the approach used in the existing PHERMEX (LANL) and FXR (LLNL) Facilities, and which will be used in the DARHT Facility. The third approach would use bursts of very energetic protons, magnetic lenses, and particle detectors to produce the radiographic image. These technologies still require development and validation.

3.3.4.2 *High Explosives Pulsed Power Facility*

This facility would provide experimental capabilities for studying secondary physics at shock pressures and velocities approaching those of actual weapon conditions. Explosive pulsed power is the most economically feasible means of providing aboveground experimental capability at energies above 100 megajoules. While current explosives testing facilities can probably test explosives systems using up to 500 kilograms (kg) (1,100 pounds [lb]) of HE, future systems may require up to 3,000-kg (6,600-lb) explosive charges. Systems so large cannot be tested at current laboratory facilities; therefore, BEEF at NTS is a likely candidate site.

For some years, DOE has pursued both capacitor bank facilities and HE experiments in pulsed power. HE generators offered a means to explore higher energy (higher current) frontiers without major capital investment, albeit at a relatively low data rate, and capacitor banks offered the advantages of repeatable (and indoor) experimental facilities with higher data rates, for broad experimental use. Data from HE experiments, for example, has helped provide validation of technical issues used in the Atlas Facility design concept.

An HE pulsed-power generator, such as Procyon at LANL, is basically an assembly of HE and metal (e.g., copper) and other components which is explosively and destructively detonated a single time, resulting in a brief pulse of high electrical current being delivered to the experimental configuration. High magnetic fields result from the high current pulse and may either be directly used to study materials phenomena or may be used to produce high pressures and implosions of (typically) cylindrical shells. (See the discussion in the Atlas Facility site-specific analysis, appendix sections K.1 and K.2.1.)

As distinct from an explosive generator, a firing site is a facility typically consisting of a firing location, associated hardened bunkers, and related equipment, in an area from which personnel can be excluded. Many different HE experiments (including those in which pulsed electrical power is produced) can be performed at an HE firing site, as long as the explosive blast, and other experiment parameters, do not exceed the designed or permitted capabilities of the firing site. Currently most of the largest-scale HE pulsed-power experiments in the United States, whether for technology development or weapons stockpile stewardship, are conducted at a pulsed-power firing point at TA-39 at LANL. As noted, this experimental capability has a limit of approximately 500 kg (1,100 lb) of HE. Therefore a potential need for a new HEPPF was postulated to support generators using much larger explosive charges, which though not yet demonstrated could produce higher pressures in larger masses and volumes than can be accessed at the LANL site. Existing laboratory sites cannot readily support experiments with much larger charges.

3.3.4.3 *Advanced Radiation Source (X-1) and Jupiter Facility*

The ARS (X-1) and Jupiter Facilities would have advanced pulsed-power x-ray sources to provide enhanced experimental capabilities in the areas of weapons physics and weapon effects.

Conceptually, the ARS(X-1) Facility would be a new facility containing a pulsed-power accelerator capable of producing intense bursts of x rays and high temperature and density plasmas. ARS (X-1) would be a technological advance over the current PBFA II Facility and would provide about 8 megajoules of x-ray energy in contrast to 2 megajoules expected from PBFA II in the near term. ARS (X-1) would be an interim step to the conceptual Jupiter Facility, which limits the risk involved in developing a new facility that requires a much larger investment. Conceptually, the Jupiter Facility would provide about 32 megajoules of x-ray energy.

ARS (X-1) would be used to study the physics of radiation flow, opacities, high energy densities, the effects of radiation on weapons, and potentially, inertial confinement fusion relevant physics. Section 3.3 describes the complementary nature of experimental facilities required to perform weapon assessment and certification functions in the absence of nuclear testing. ARS (X-1) would provide greatly improved capability over the current Saturn and PBFA II Facilities with regard to higher temperatures, higher densities, and longer pulse widths in the multi-nanosecond range. ARS (X-1) would thereby add to the complement of fast pulsed power, slow pulsed power, and laser facilities needed to begin addressing the full spectrum of weapons physics and weapon-effects science in the absence of nuclear testing.

Although other stewardship sites would be considered, if ARS (X-1) were constructed at SNL, the conceptual design would use some of the pulsed-power facility infrastructure existing in Technical Area IV. Various accelerator architecture concepts are being explored which present different performance, cost, and risk options. The ARS (X-1) accelerator is conceived of as a 24-module machine which would store approximately 56 megajoules of electrical energy in capacitors. This electrical energy would be released and compressed to produce an output pulse on the order of 100 nanoseconds long. This pulse may be used to generate an intense burst of x rays and high temperature and density plasmas. Supporting facilities for the accelerator, such as storage and circulation systems for insulating oil and de-ionized water, would also be required to supplement the already present capacity used by the other major facilities collocated in Technical Area IV. About 4,645 m^2 (50,000 ft^2) of space available in Technical Area IV would be needed to construct the facility which would be operated and maintained by a staff of about 20 people.

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1 Capability based capacity - the facility capacity (up to 50 per year) inherent with the facilities and equipment required to manufacture one component for any stockpile system.

Source: DOE 1996j.

2 Nanoseconds are billionths of a second; microseconds are millionths of a second.

3 Under extreme temperatures and pressures, the dynamics (motion) of solids, such as metals, behave more like fluids, thus the term hydrodynamic.

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

5 Facilities used to investigate the physics of nuclear weapons secondaries may also be used to investigate some physics phenomena related to nuclear weapons primaries and weapons effects.

6 No new facilities solely to investigate weapons effects phenomena are being proposed at this time.

7 Cubic meters at standard temperature and pressure.

LLNL 1995i:3; appendix J.

8 Cubic meters at standard temperature and pressure.

9 In addition to current B801/FXR Facility staff of approximately 20.

LLNL 1995i:3; appendix J.

10 Assumes density of 500 kg/m3.

11 Solid low-level waste is not compactible.

12 Assumes 0.1 m *3* (3.7 ft *3*) per test although none is expected.

13 Assumes density of 1,000 kg/m3. Liquid is mostly film processing solutions.

14 Based on 50 gal/day per person and 250 days/yr for six employees.

15 Based on 0.3 ft^3/day per person and 250 days/yr for six employees.

LLNL 1995i:3; LLNL 1996i:2; appendix J.

16 Cubic meters at standard temperature and pressure.

17 11,400 L per day for a 5-year construction period, assuming 250 days of construction per year.

Note: This table provides nonsite-specific requirements. See appendix I for site-specific information.

Source: LLNL 1995m; appendix I.

18 Cubic meters at standard temperature and pressure.

19 Energy requirement is 40,900,000 megajoules. Conversion assumes 1,000 British thermal units per cubic foot and 1,055 joules per British thermal unit.

20 Maximum size could be smaller depending on site conditions.

21 Technicians for baseline operations. Does not include 60 scientists required. For enhanced operations, employment would increase by 50 technicians and 10 scientists.

Note: This table provides nonsite-specific requirements. See appendix I for site-specific information.

Source: ANL 1995a:1; LLNL 1995m; appendix I.

22 Assumes 365 days of operation.

23 Assumes 350:1 wastewater to sludge ratio for treatment of liquid sanitary waste.

Note: This table provides nonsite-specific requirements. See appendix I for site-specific information.

Source: LLNL 1995m; appendix I.

24 Cubic meters at standard temperature and pressure.

LANL 1995b:4; LANL 1996e:1; appendix K.

25 Cubic meters at standard temperature and pressure.

LANL 1995b:4; LANL 1996e:1; appendix K.

26 Anticipated experiments do not utilize radioactive materials.

27 For purposes of this analysis, occasional use of hazardous material is anticipated.

28 Assumes 25 gal/day per construction worker for 250 days/yr and 35 construction workers. Also includes 290 m3 (76,610 gal) from washdown.

29 Assumes 50 gal/day/worker, 250 days/year of operation, and 15 employees.

30 Assumes 350:1 wastewater to sludge ratio for treatment of liquid sanitary wastes.

LANL 1996e:1; appendix K.