Chapter 2
PURPOSE AND NEED

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Chapter 2 discusses the underlying purpose and need addressed by the proposed action and alternatives in this Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS). It addresses relevant national security policy considerations and issues associated with maintaining the safety, security, and reliability of the nuclear weapons stockpile. The Chapter concludes with a discussion of the potential for a Reliable Replacement Warhead (RRW), nonproliferation issues and the possibility of future reductions in the size of the stockpile.

2.0 PURPOSE AND NEED FOR AGENCY ACTION

The security policies of the United States (U.S.) require the maintenance of a safe, secure, and reliable nuclear weapons stockpile, and the maintenance of core competencies to design, manufacture, and maintain nuclear weapons. The Stockpile Stewardship Program (SSP)[1] is the National Nuclear Security Administration's (NNSA) program that fulfills these requirements. Broad in scope and technically complex, the SSP involves the integrated activities of three NNSA national laboratories, four industrial plants, and a nuclear test site. The SSP helps adjust the nuclear weapons complex (Complex) as required by NNSA to continue to meet national security requirements established by the President and the Congress. The purpose and need underlying the alternatives analyzed in this *Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Complex Transformation SPEIS) derive from changes in national security policy since the Record of Decision (ROD) on the 1996 Stockpile Stewardship and Management Programmatic Environmental Impact Statement (SSM PEIS), as well as the effects of aging facilities; aging weapons; and evolving security requirements. The underlying purpose and need addressed in this SPEIS are the following:

- Maintain core competencies in nuclear weapons;
- Maintain a safe and reliable nuclear weapons stockpile; and
- Create a responsive nuclear weapons infrastructure that is cost-effective, and has adequate capacity to meet reasonably foreseeable national security requirements; and consolidate Category I/II SNM at fewer sites and locations within sites to reduce the risk and safeguards costs.

The fundamental principle underlying NNSA's evaluation of alternatives is that the SSP must continue to support existing and reasonably foreseeable national security requirements. This is NNSA's obligation and responsibility under the *Atomic Energy Act* and the *National Nuclear Security Administration Act*. This SPEIS does not analyze alternatives to the United States' national security policy. Rather, it examines the environmental effects of proposed actions and reasonable alternatives for execution of the program based on the existing policy and foreseeable changes in this policy.

[1] In 1996, the program was named the Stockpile Stewardship and Management Program. It is now called the Stockpile Stewardship Program. There has been no significant change in the objectives of the program.

The alternatives analyzed in this SPEIS are based on the need for a more responsive Complex infrastructure that has:

- All necessary technical and industrial capabilities;
- Adequate production capacity for a smaller stockpile, including pit production;
- A smaller size for more cost-effective operations; and
- Enhanced security, particularly for activities involving special nuclear materials.

A more responsive Complex would also have the capabilities needed to produce a Reliable Replacement Warhead (RRW) if the President and the Congress decide that NNSA should develop one. An RRW would be pursued if it is able to enhance the safety, security, and reliability of the stockpile over the long term without nuclear testing.[2] Transformation of the Complex infrastructure is required whether or not an RRW is developed. If there is a decision to proceed with RRW or remain with life-extension legacy weapons, NNSA must have the infrastructure to support those decisions. The current estimate is that the first RRW could not be produced before 2014. NNSA will not make a decision on whether to proceed with an RRW in this SPEIS. NNSA can proceed with Complex Transformation with or without RRW. The relationship of RRWs to the proposed actions and alternatives in this SPEIS are discussed in this chapter using the best available information.

The possibility that NNSA might be directed to develop an RRW does not affect the alternatives analyzed or their potential impacts. Pit production and other production activities would be allocated between legacy weapons and RRWs – production capacity would not be increased if NNSA is directed to develop an RRW. Development of an RRW would enable less hazardous materials and operations but it would not require changes to the proposed facilities that are analyzed as part of the alternatives evaluated in this SPEIS. If an RRW were developed and produced, it is intended that its production would be in lieu of refurbishment and production activities for legacy weapons.

2.1 NATIONAL SECURITY POLICY CONSIDERATIONS

There are four principal national security policies and three treaties relevant to the SSP. They are:

- Presidential Decision Directives through 1996 and Public Law (103-160);
- Presidential Directives after 1996 and Public Law (109-163);
- Annual Nuclear Weapons Stockpile Plans;
- Nuclear Posture Reviews (1994 and 2001);
- Treaty on the Nonproliferation of Nuclear Weapons (NPT) (1968);
- Proposed Comprehensive Test Ban Treaty (1995); and
- Strategic Offensive Reductions Treaty (2003) – referred to as the Moscow Treaty.

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[2] Current U.S. Policy is to refrain from nuclear testing while maintaining an ability to resume testing. The NTS maintains the U.S. ability to conduct tests if authorized by the President. The Environmental Impacts associated with nuclear testing are analyzed in the NTS Site-Wide Environmental Impact Statement (DOE/EIS-0243).

These policies and treaties form the foundation for the Stockpile Stewardship Program. They determine today's national security requirements that the alternatives analyzed in this SPEIS must satisfy. Earlier policies and treaties formed the foundation for the Stockpile Stewardship and Management Program (SSM), as well as the 1996 SSM PEIS. Figure 2-1 illustrates the relationship of the new national security policies to the purpose and need and alternatives evaluated in this SPEIS.

2.1.1 Presidential Directives through 1996 and Public Law (103-160)

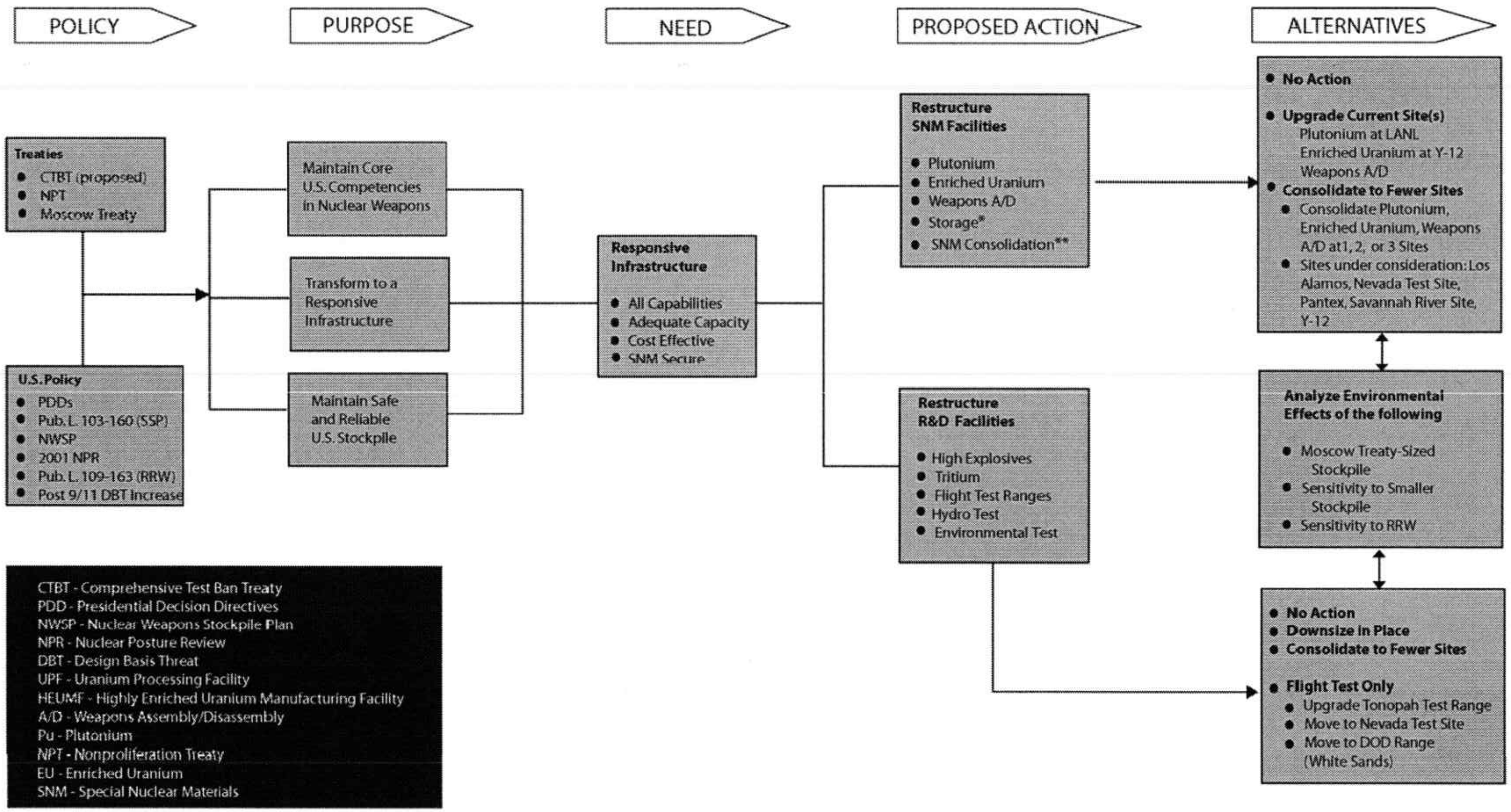
The following is a summary of the important features of Presidential Directives in effect through 1996 and Public Law 103-160; those formed the foundation of the SSP and established the purpose and need for the alternatives analyzed in the 1996 SSM PEIS.

- 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 U.S. in nuclear weapons will be maintained. This includes competencies in research, design, development, and testing (including the ability to conduct nuclear testing); reliability assessment; certification; manufacturing; and surveillance capabilities.
- The U.S. will develop new ways to maintain a high level of confidence in the safety, reliability, and performance of its nuclear weapons stockpile without nuclear testing. The strategy for this objective is 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.
- The continued vitality of all three NNSA national security laboratories is essential in addressing the challenges of maintaining a safe and reliable nuclear weapons stockpile without nuclear testing.

2.1.2 Nuclear Posture Reviews (NPR)

Beginning in 1991, several Presidential policy decisions, some unilateral and some made in conjunction with international treaties, resulted in the Department of Defense (DoD) conducting a comprehensive NPR that was approved by President Clinton in 1994. The 1994 NPR defined and integrated past and present U.S. policies for nuclear deterrence, arms control, and nonproliferation objectives. At the time of the 1994 NPR, it was anticipated that the START II Treaty would enter into force in 2004. Based on this anticipation, the 1996 SSM PEIS analyzed the potential effects of reasonable alternatives over a 10-year period.

In 2001, another NPR was conducted; it concluded that a strategic posture that relies solely on offensive nuclear forces is inappropriate for deterring potential future adversaries. A classified summary of the 2001 NPR was submitted to Congress in February 2002. A "new triad" was defined consisting of nuclear and non-nuclear strike capabilities, defenses, and a robust, responsive nuclear weapons infrastructure supported by enhanced intelligence and adaptive



* All Category I/II SNM as a minimum

** The programmatic alternatives (restructuring SNM facilities) include an assessment of consolidating category I/II SNM currently stocked at LLNL and Pantex.

Figure 2-1 — Policy Perspective of the Stockpile Stewardship Program and Complex Transformation

planning capabilities. Prior to the 2001 NPR, the term "triad" generally referred to strategic land, sea, and air nuclear forces. The 2001 NPR was the foundation for the Moscow Treaty with Russia in 2002 (ratified in 2003). The relevance of this treaty to this SPEIS is discussed in the section on the Moscow Treaty.

2.1.3 Proposed Comprehensive Test Ban Treaty (CTBT)

The U.S. Senate has not ratified the CTBT; however, the U.S. has been observing a moratorium on nuclear testing that was first directed by President Clinton in 1992. Assessment and certification of the safety and reliability of the stockpile without nuclear testing will remain a significant technical challenge for the SSP as weapons in the stockpile age beyond the range of relevant historical technical data.

It has been almost 15 years since the last U.S. nuclear test and more than 15 years since the last new nuclear weapon entered the stockpile. While no issues have yet developed in maintaining legacy weapons that would require a return to nuclear testing in the reasonably foreseeable future, there is concern that the current weapon "life extension" approach to maintaining a safe and reliable stockpile will not ultimately, over the longer term, allow a continued moratorium on testing as weapons continue to age.

2.1.4 Treaty on the Nonproliferation of Nuclear Weapons (NPT)

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 establish a time frame for achieving these goals and the President and the Congress have not set a schedule for these goals. Actions by the U.S., including its moratorium on nuclear testing accompanied by significant reductions in its strategic force structure, nuclear weapons stockpile, and production infrastructure, constitute significant progress toward these goals. However, unless and until there are significant changes in national security policy, NNSA is required to design, produce, and maintain the nuclear weapons stockpile pursuant to requirements established by the President and Congress. In conjunction with the 2001 NPR, President Bush set an objective of "achieving a credible nuclear deterrent with the lowest-possible number of nuclear warheads consistent with our national security needs." In recognition of this objective and the reduction in the U.S. stockpile since the end of the Cold War, this SPEIS qualitatively evaluates changes in the alternatives that would be appropriate if the stockpile is reduced below the level set by the Moscow Treaty. Accordingly, this SPEIS analyzes alternatives that satisfy requirements of the existing national security policy framework, as well as a capability-based alternative that, while not capable of meeting current requirements, could meet those requirements if the stockpile were reduced below the level called for by the Moscow Treaty.

2.1.5 Moscow Treaty

This treaty does not limit the total number of nuclear weapons possessed by each party — it limits the strategic nuclear warheads that are operationally deployed. The provisions of the

START I Treaty, which is scheduled to expire in 2009, are still being implemented. The START II Treaty, while ratified, never entered into force. Both parties ratified the Moscow Treaty in 2003 and it further reduced the number of deployed strategic offensive nuclear warheads below the proposed START II levels.

For comparative purposes, 6,000 operationally deployed warheads were allowed under START I, 3,500 operationally deployed strategic warheads would have been allowed under START II and a range of 1,700-2,200 operationally deployed warheads is allowed under the Moscow Treaty. The U.S. plans to achieve a stockpile in this range by the end of 2012.

2.1.6 Nuclear Weapons Stockpile Plans (NWSPs)

NWSPs are normally issued each year by the President and define the actual stockpile size and composition in the near-term (usually for a six-year period). A joint DoD/DOE requirements and planning document is also developed annually that provides long-term planning for up to several decades. The NWSP creates the requirements for nuclear weapons that NNSA is required to meet. The NWSP is a classified document and contains details about the stockpile size and composition that is not part of treaties or unclassified government sources. However, the following unclassified information explains the latest NWSP and its effects on planning assumptions for weapon production capabilities and capacities.

Stockpile composition refers to the number of different weapon types scheduled to remain in the stockpile; currently there are seven types. This number has not changed significantly after the Cold War from START I to the Moscow Treaty. These weapons types contain the same general types of components and subsystems. They differ in technical and manufacturing detail, but these details have little effect on the basic technical and industrial "capabilities" required by NNSA to support the overall stockpile.

Stockpile size refers to the total number of weapons expected to remain in the stockpile for the foreseeable future of the seven major types. The total number includes both the treaty-accountable, operationally deployed strategic nuclear warheads and additional warheads retained for a number of reasons, such as support of routine maintenance cycles, repairs and attrition due to destructive testing. Beyond these requirements, a decision to dismantle any excess weapons in inventory, i.e., weapons not considered part of the stockpile, is considered carefully. An excess weapon can become a valuable asset if exchanged for deployed weapons of the same type in the event a problem is discovered that affects only part of the inventory of that type – for example, one bad manufacturing lot out of ten lots. Also, some of the weapon types were produced over a number of years. If an aging problem is discovered, perhaps a younger weapon could be exchanged for one that may be older. This could allow more time to investigate and find a solution to the problem. Excess weapons also provide some insurance against the need to return to nuclear testing to confirm or fix a problem.

Weapon reliability is assessed annually based in part on laboratory and surveillance tests on a relatively small number of each weapon type. There can be no "end-to-end" functional test of a complete nuclear weapon in its "stockpile-to-target" environments. In lieu of this, laboratory and flight surveillance tests are conducted at the component and subsystem levels and the data are combined and analyzed to produce a reliability estimate for the weapon. While this methodology is adequate for estimating the current reliability of a weapon, it does not provide high-confidence predictions of the future behavior of an aging weapon. Because of these uncertainties, NNSA needs to plan some excess capacity beyond known requirements to be able to respond to unknown policy and technical issues that may arise over the next decades.

2.1.7 Presidential Directives after 1996 and Public Law (109-163)

Beginning in 2001, additional national security policies for the SSP began to develop. The 2001 NPR mandated a smaller U.S. nuclear weapons stockpile, but also a more robust and responsive infrastructure as part of the deterrence strategy. Starting in 2005 with Section 3111 of the National Defense Authorization Act for FY2006 (Public Law 109-163), the Congress established the Reliable Replacement Warhead program (RRW program) with the following objectives:

(1) To increase the reliability, safety, and security of the United States nuclear weapons stockpile.

(2) To further reduce the likelihood of the resumption of underground nuclear weapons testing.

(3) To remain consistent with basic design parameters by including, to the maximum extent feasible and consistent with the objective specified in paragraph (2), components that are well understood or are certifiable without the need to resume underground nuclear weapons testing.

(4) To ensure that the nuclear weapons infrastructure can respond to unforeseen problems, to include the ability to produce replacement warheads that are safer to manufacture, more cost-effective to produce, and less costly to maintain than existing warheads.

(5) To achieve reductions in the future size of the nuclear weapons stockpile based on increased reliability of the reliable replacement warheads.

(6) To use the design, certification, and production expertise resident in the nuclear complex to develop reliable replacement components to fulfill current mission requirements of the existing stockpile.

(7) To serve as a complement to, and potentially a more cost-effective and reliable long-term replacement for, the current Stockpile Life Extension Programs.

Section 3111 mandates the study of a different technical approach to the production and maintenance of the safety, security and reliability of the nuclear weapons stockpile without nuclear testing.

2.2 SAFETY, SECURITY AND RELIABILITY OF THE U.S. STOCKPILE

This section focuses on the technical effects of national security policies in shaping the purpose, need, proposed actions, and alternatives of the SSP and this SPEIS.

2.2.1 Stockpile History

1945 to 1990: Following World War II, the U.S maintained a nuclear deterrent force as safe and reliable as the evolution of military requirements and technology development would permit. The size of the 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 on a nearly one-for-one basis.

1990 to 2000: The beginning of the 1990s brought the collapse of the Warsaw Pact and the Soviet Union and the end of the Cold War. Changes in U.S. policy in the early 1990s led to dramatic reductions in the size and diversity of the nuclear weapons stockpile. Many thousands of weapons have been dismantled and there have been significant reductions in the size and capabilities of the U.S. weapon production infrastructure.

2000 to the Present: The beginning of the new century brought a new strategy for nuclear deterrence. The 2001 NPR establishes the framework of the new strategy, in which a responsive infrastructure replaces a large standing stockpile as a hedge against future uncertainties. Operationally deployed strategic nuclear warheads will be reduced to between 1,700 and 2,200 warheads by 2012 under this framework.

2.2.2 Historical Stockpile Data and the Smaller, Aging Stockpile

Before the early 1990's, the stockpile's reliability was maintained by a robust nuclear testing program, production of new weapons types, and a continuous cycle of modernization and replacement of existing types to meet evolving safety, security and military requirements. During this period, these practices resulted in the rapid turnover of the stockpile, keeping the average age of weapons in it at approximately 12 years, or about half their typical design-life goal of 20-25 years. The last generation of weapons produced, now referred to as the legacy stockpile, was built in the 1970s and 1980s, with more than half the weapons produced before 1985.

A nuclear weapon has several thousand individual parts grouped into a dozen or more hermetically sealed subsystems, each of which contain some combination of organic, inorganic, radiological and hazardous materials. Each of these major subsystems can age or otherwise deteriorate independent of the others even though they are subjected to the same environment. The 1996 SSM PEIS included a lengthy discussion on historical stockpile data. It explained the role that nuclear testing played in finding and correcting defects in the stockpile. It also summarized the results of more than 35 years of data from stockpile surveillance and environmental testing programs and NNSA's requirements for making modifications to these programs to assure the continued safety and reliability of the stockpile in the absence of nuclear testing.

The overall conclusion, drawn in 1996, was that there would be needs, over the next ten ensuing years (1995- 2005) for "certified repairs and replacements" within the stockpile due to its aging. This has, in fact, been the case. NNSA has completed or is conducting major retrofits on three of the seven weapon types currently scheduled to remain in the stockpile to correct certain defects. Some but not all of the defects were due to aging. Also, some, but not all, of the major retrofits have been accomplished as part of a life extension program (LEP). An LEP is a systematic approach by weapon type that consists of a coordinated effort by the design laboratories and production facilities to: (1) determine which components will need refurbishing to extend each weapon's life; (2) design and produce the necessary refurbished components; (3) install the components in the weapons; and (4) certify that the changes do not adversely affect the safety and reliability of the weapon. There have been, during this same period, a number of retrofits of the seven weapon types performed outside the nuclear explosive package that have not been part of the LEP for that type.

It is important to note that predictions of major findings and actionable defects made in 1996 were for the following ten years. Now, more than ten years later, the weapons themselves, and also many of their individual components and subcomponents are beginning to enter an age where there may be far less relevant data available to base performance and reliability predictions. NNSA is responding by adjusting surveillance and environmental testing requirements and developing new computer codes and simulation tools to extend its predictive capabilities. This is no small task and collecting the types and amounts of data required to make credible assessments and predictions can take a considerable amount of time. It should not be assumed that the infrastructure of NNSA's aging facilities will always be able to support the operating environment required for some of the tools and processes for these evolving test programs or to support the weapons modifications that they may indicate will be needed in the future. Similarly, it is becoming increasingly difficult to predict whether it will always be possible for these programs to detect and correct whatever problems may develop as the stockpile continues to age with the same level of confidence as we have in the past.

At the end of FY 2006 the nuclear physics laboratories (LANL and LLNL) completed the first ever assessment of the effects of the aging of plutonium on the lifetimes of pits in nuclear weapons. This study was reviewed by JASON. The unclassified version of the JASON report, which substantially agreed with the NNSA laboratory results, has received significant attention. This overall study is an example of the excellent stockpile stewardship work on the part of the technical community that supports the U.S. stockpile. The results, however, can not be extrapolated to a general prediction of the remaining life of legacy stockpile weapons. While this study revealed important information, it was only the first such estimate for pits, and only addressed the known and measurable aging mechanisms for the plutonium components in the pits. There are thousands of components in modern nuclear weapons, many of which are subject to aging, and, as pointed out by the JASON review, there is still additional work to do on plutonium and the other materials in primaries. The import of this study on the planning assumptions for the SSP is that it is unlikely that legacy pits will need to be replaced in the near future. There cannot be an absolute certainty established even in this regard since some aspects of the performance of modern nuclear weapons are not experimentally accessible without underground testing. There is always the potential for the emergence of issues affecting pit lifetime of which we are currently unaware. Therefore NNSA will continue to investigate the aging of plutonium and all the other materials of concern to nuclear weapons, while monitoring the aging of weapons through stockpile surveillance.

2.3 PURPOSE AND NEED FOR NNSA ACTION

In accordance with the national security policies developed after 1996, this SPEIS focuses on the present need for a more responsive NNSA Complex that will:

- Maintain core competencies in nuclear weapons;
- Maintain a safe and reliable nuclear weapons stockpile; and
- Create a responsive nuclear weapons infrastructure that is cost-effective, has adequate capacity to meet reasonably foreseeable national security requirements, and consolidate Category I/II special nuclear materials (SNM) at fewer sites and locations within sites to reduce the risk and safeguards costs.

The Complex must be transformed independent of whether an RRW proceeds or life-extension of legacy weapons remains the authorized approach to sustain the stockpile. Likewise, the potential environmental effects associated with the infrastructure to support a smaller stockpile than established by the Moscow Treaty are evaluated to the extent practical.

2.3.1 Responsiveness of the Nuclear Weapons Complex Infrastructure

The current production infrastructure is not sufficiently responsive or cost-effective. Responsiveness means the ability to successfully meet national security requirements on schedule and react to new developments. Lack of responsiveness has been evidenced by difficulties in executing weapon production schedules in support of maintenance, retrofit, and Life Extension Programs, and by the lack of a sufficient pit production capability.

A reliable and responsive infrastructure is a cornerstone of the new triad discussed in the 2001 Nuclear Posture Review (Figure 2-2) and in section 3111 of the National Defense Authorization Act for FY 2006 (Public Law 109-163). The purpose of a reliable and responsive infrastructure is to deter adversaries from trying to seek advantage – an attempt to seek advantage would be detected and negated by a quick response. A more responsive infrastructure is expected to permit further reductions in the weapons stockpile. In the context of the SSP, this responsiveness could permit deeper reductions in the total weapons stockpile that supports the deployed stockpile.

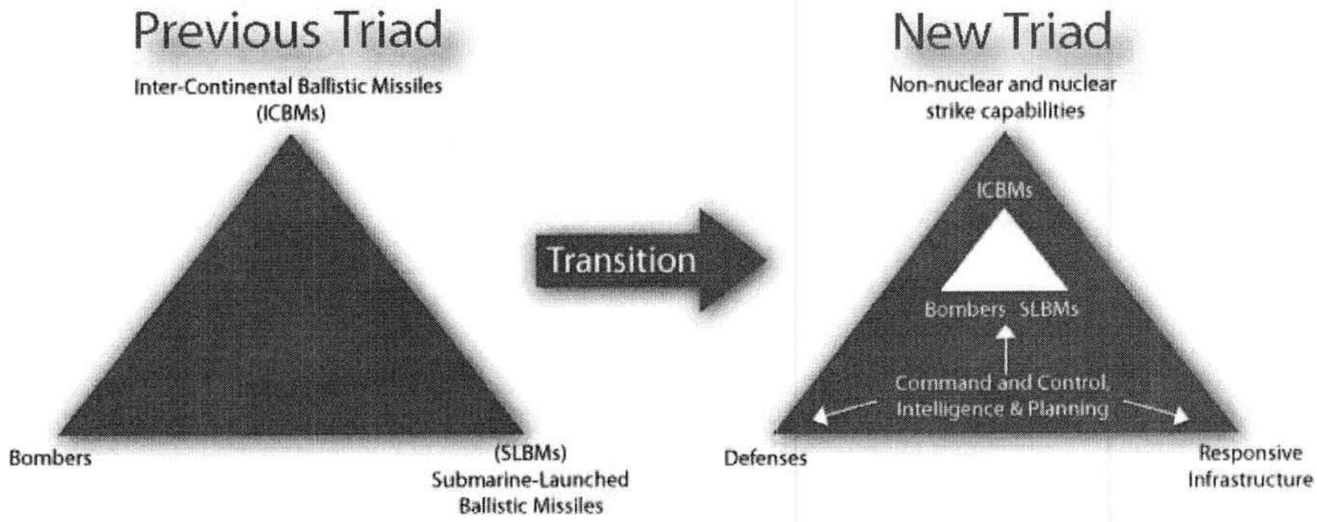


Figure 2-2 — Transition to the New Triad

2.3.2 Laboratory Technical and Industrial Base Capabilities

The underlying purpose and need for the technical and industrial capabilities of the SSP remain unchanged from that described in the 1996 SSM PEIS. National security policies still require the core competencies and capabilities of NNSA and its national laboratories, production plants, and test site. They are basic needs that must be maintained for the foreseeable future in order for NNSA to meet its national security obligations.

2.3.3 Adequate Production Capacity for a Smaller Stockpile

The Complex must retain a reasonable capability to produce required weapons and components. Production capacity, therefore, is established based on NNSA's judgment as to what might be reasonably required. There is presently no validated model that can predict with absolute certainty when major components or subsystems will develop a condition that would require their repair or replacement. Only a few component types are known to have a specific limited life, such as those that are determined by the half-life of the tritium they contain. Technical judgments on the relevance of available data, and the implications of other factors for potential production needs, must be used to arrive at the planning assumptions for future production. A capacity to produce components does not mean that those quantities of components will actually be produced. National security requirements and the authorization and appropriation of funds by the Congress will determine actual production.

A responsive production infrastructure needs to fix problems in a timely way, and therefore it is appropriate to introduce some conservatism into the planning assumptions. A number of other factors also call for conservatism in consolidation and downsizing or "rightsizing" the complex and its facilities. One such factor is the potential for common failure modes among weapon types that use similar components or materials. Certain types of problems could affect several weapon types at the same time. Another factor is the difficulty in determining the level of responsiveness needed to feel confident about reducing the total stockpile size to the minimum required to support the deployed weapons.

2.3.3.1 *Production Capacity Planning Assumptions*

For the nuclear production alternatives, this SPEIS assumes, as a base case, a manufacturing capacity operated in single shift, five days per week that produces 50-125 weapons per year. The bounding case of producing approximately 200 weapons per year assumes operations in multiple shifts and extended workweeks. The SPEIS also analyzes infrastructure needs for a production rate as low as 50 weapons per year.

Due to the significant investment that may be required for new or modified plutonium and uranium component production facilities, more discussion follows on the technical details that could affect decision-making in this regard. The pit and the secondary assembly component (canned subassemblies [CSA]) are the two main weapon components that use plutonium and uranium.

2.3.3.2 *Technical Considerations for Pit Production Capacity Planning*

A particular need addressed by the alternatives analyzed in this SPEIS is the requirement for adequate production capacity for plutonium pits. The ROD for the 1996 SSM PEIS stated: "DOE's decision is to reestablish the pit fabrication capability at a small capacity at Los Alamos National Laboratory (LANL)...Should a larger pit fabrication capacity be required in the future, appropriate environmental and siting analysis would be performed at that time."

In 1996, the interim production capacity case was 50 pits per year (ppy) with a single shift and 80 ppy with multiple shifts at LANL. While this SPEIS analyzes a bounding pit production capacity (200 ppy in multiple shifts and extended workweeks), the lower rates previously analyzed in the SSM PEIS may provide adequate pit production capacity. One of the reasons is that pit reuse, discussed in the SSM PEIS, while still potentially viable for selective weapon applications, has numerous limitations as discussed below and no weapon has entered the stockpile with an intrusively modified pit. The following description of pit reuse is taken from the SSM PEIS Summary document (page S-20):

> *Intrusive pit modification reuse requires handling and processing of the plutonium internal to the pit. Non-intrusive pit modification reuse involves the external features of the pit and does not require an extensive plutonium infrastructure; the risk of contamination and generation of radioactive waste is very low for non-intrusive modification activities.*

Because the pit reuse option could be seen as a substitute for new pit production capacity, more discussion is provided here on the limitations of pit reuse in weapon design and its effect on facility alternatives.

- Pit reuse can limit the ability to improve the performance margin of the primary, which contributes to longer-term reliability. Lower primary performance margins reduce confidence in performance because the weapon is more sensitive to changes that may cause it to fail, such as undesirable changes due to aging or other environmental factors.

- Pit reuse can limit the ability to upgrade the intrinsic safety and security features of a weapon. This is especially true for the nuclear package in a DoD re-entry vehicle (RV) that sits atop a strategic land- or submarine-based ballistic missile. DoD has no plans to modify existing RV aero-shells or significantly change the mass properties (weight, center of gravity, etc.) limitations placed on the nuclear package since modifying the DoD missile delivery system is very expensive. For example, as to nuclear packages containing Conventional High Explosive (CHE), pit reuse may not allow use of Insensitive High Explosive (IHE) to improve detonation safety in accidents or incorporation of enhanced fire safety features. In addition, certain types of enhanced surety features would be technically precluded if CHE is retained. The greatest gains in weapon safety and security could come from improving features in the primary (pit and high explosive subassembly). Evaluation of the technical trade-offs (reliability, safety, security, etc.) and pit reuse in a specific weapon application is not a simple matter. Pit reuse may make sense for certain weapon applications but not others.

- Reuse in the form of non-intrusive pit modification can range from no external modification of the old pit to the addition of significant new external features to it. Concepts with new external features were studied and prototyped and a few nuclear tests were conducted just prior to the U.S. moratorium on nuclear testing began in 1992. The current weapon assembly/disassembly (A/D) facilities may be able to perform such operations.

- Reuse in the form of intrusive pit modification has not been tested and it would be speculative to predict how such reuse might affect production capacity requirements for a pit facility. Conservatively, intrusive pit modification reuse is assumed to require the same basic capabilities as new pit production and require operations not suitable for current weapon A/D facilities.

Current surveillance data on pits in enduring stockpile weapons indicate that they are holding up well with age. However, should their hermetic seal be broken (due to latent manufacturing defects, corrosion, or long term environmental stresses such as temperature and vibration), their reliability could be compromised in a short time. Consequently, judgments about new pit production capabilities and capacities are complex and warrant careful consideration.

2.3.3.3 *Technical Considerations for Secondary Assembly Component (i.e. Cannned Subassembly) Production Capacity Planning*

Internally, both the pit and the canned subassembly (CSA) have complex radioactive and chemical characteristics. CSA production capacity may not be equal to planned pit production capacity due to the difference in their expected lifetimes. For these reasons, CSA production capacity may remain in the same range as the bounding pit production capacity planning assumption (single shift: 125 per year; multiple shifts: 200 per year). Further, there is a very large CSA dismantlement backlog from previously dismantled weapons that needs to be worked off. Higher CSA production capacity, if not used for new production or rebuild, could be used to work off the substantial dismantlement backlog.

2.3.4 A Smaller Infrastructure Footprint for More Cost-Effective Operations

In 2005, a Secretary of Energy Advisory Board (SEAB) task force recommended that NNSA consider a smaller, modernized infrastructure footprint to improve responsiveness, cost effectiveness, and security for high-risk special nuclear materials (SEAB 2005).

2.3.5 Enhanced Security for Special Nuclear Materials

The attacks of September 11, 2001, altered security requirements in the NNSA Complex. As a result, security costs have increased significantly. Most of the effects on NNSA infrastructure are a result of changes to the Design Basis Threat (DBT). The DBT is a profile of the type, composition, and capabilities of a potential adversary. The DBT is used to design safeguards systems to protect against acts of sabotage and to prevent theft of SNM. The details of the DBT, which DOE uses to establish and evaluate its security systems, are classified. However, the effect of changes in the DBT has stimulated proposed actions and an examination of alternatives for consolidating Category I/II SNM at fewer sites and locations within sites to improve security and reduce costs.

2.4 PROPOSED ACTIONS

NNSA's proposed action is to restructure the nuclear weapons complex to make it smaller and more responsive, efficient and secure, while meeting national security requirements. Two basic types of proposed actions result from the needs identified for a more responsive NNSA Complex infrastructure:

- Restructure SNM Facilities (Programmatic Alternatives)
- Restructure R&D and Testing Facilities (Project-Specific Alternatives)

The basic proposed actions appear simple; the alternatives for accomplishing them are complex. It is important to note that "Restructure SNM Facilities" includes evaluation of alternatives having a higher pit production capacity than currently exists at LANL. The details of the alternatives are provided in Chapter 3.

2.4.1 Restructure SNM Facilities

The following functional capabilities are included in this proposed action:

- Plutonium operations, including pit manufacturing, Category I/II SNM storage, and related R&D;
- Enriched uranium operations, including canned subassembly[3] manufacturing, assembly, and disassembly; Category I/II SNM storage; and related R&D; and
- Weapons assembly and disassembly (A/D) and high explosives (HE) production.

To consolidate SNM facilities, which would be a long-term process carried out over a decade or more, the SPEIS alternatives address broad issues such as where to locate those facilities and whether to construct new or renovate existing facilities for these functions. As such, this SPEIS analysis is "programmatic" for the proposed action to restructure SNM facilities, meaning that tiered, project-specific NEPA documents could be needed to inform decisions on these facilities if existing site-wide EISs or other NEPA documents were insufficient.

An understanding of some of the existing conditions at the NNSA sites is useful in providing perspective on the complexity of the evaluation task for alternatives.

- There are operational safety issues at some existing facilities that use Category I/II SNM that call into question their viability for use beyond the next five to ten years. One is the Chemistry and Metallurgy Research (CMR) facility at LANL and another is the CSA production facility, Building 9212, at the Y-12 Plant (Y-12). The need to resolve these safety issues will be an important factor in the development of a preferred alternative for this proposed action.

- There are tens of metric tons of Category I/II plutonium and hundreds of metric tons of Category I/II enriched uranium at various sites under the control of three programs within the NNSA – Defense Programs (DP), Fissile Materials Disposition (FMD) and Naval Reactors (NR). This SPEIS concerns the SSP and the SNM managed by DP; however, the plans for management and ultimate disposition of SNM under the jurisdiction of multiple NNSA programs are also considered.

Of the eight NNSA sites involved in the SSP mission, seven currently have Category I/II SNM. The Kansas City Plant (KCP) does not have Category I/II SNM, and Sandia National Laboratories/New Mexico (SNL/NM) will not have any Category I/II SNM after 2008 based on existing plans and NEPA analyses. Of the eight sites involved in the SSP mission, three are national laboratories, four are manufacturing facilities, and one is a test facility. Two of the national laboratories, Lawrence Livermore National Laboratory (LLNL) and LANL, will have Category I/II SNM after 2008. LANL has extensive plutonium facilities, including the capability to manufacture plutonium weapons components. LLNL has Category I/II material but does not have extensive plutonium facilities as does LANL, nor does it have the capability to manufacture

[3] Canned subassembly – The component of a nuclear weapon which contains the secondary uranium and lithium elements.

plutonium weapons components. If Category I/II SNM is retained at a single NNSA national laboratory site, it would be at LANL because of the nature and size of its current plutonium facilities; neither SNL nor the LLNL are considered reasonable alternatives for plutonium missions over the long term. This SPEIS evaluates the five remaining sites as alternatives for the proposed action to restructure SNM facilities- Los Alamos, Nevada Test Site (NTS), Pantex, Savannah River Site (SRS), and Y-12.

The current NNSA mission at SRS involves tritium processing and not SNM, but there is considerable former weapon plutonium under the jurisdiction of the Fissile Materials Disposition Program (FMD) at the site. Much of it came from the Rocky Flats Plant after it was closed in 1992 and there is much more plutonium waiting to be sent there in the form of pits coming from weapon dismantlements at Pantex. The current two-step disposition path for the NNSA pits and plutonium is to build two new facilities at the SRS. The Pit Disassembly and Conversion Facility (PDCF) will disassemble the pits and convert them into plutonium-oxide. It is expected to be completed in 2019. A mixed-oxide (MOX) fuel facility to fabricate MOX fuel for use in commercial nuclear power plants from the plutonium oxide is expected to be completed in 2017. These plans are considered in the evaluation of SRS as the site for future plutonium operations.

The general approach in this SPEIS analysis is to evaluate the three functional capabilities--plutonium operations, uranium operations, and weapons assembly/disassembly in "building block" fashion so that the blocks can be arranged in any combination among the five alternative sites. Both new facilities and upgrades of existing facilities are considered and the building block approach is intended to allow phasing of construction. For example, to constitute a CNPC, a Consolidated Plutonium Center (pit production facility), a Consolidated Uranium Center (production facility for secondaries and cases), and an A/D/HE Center would be built in separate buildings set in a campus-like arrangement, but all would generally be within the same high-security perimeter.

Production rates to support a stockpile, including pit production, are evaluated for the proposed action. In addition, the environmental effects of smaller stockpiles are evaluated.

2.4.2 Restructure R&D and Testing Facilities

The 1996 SSM PEIS did not include any proposed actions to restructure the laboratory technical base other than adding new facilities for enhanced experimental capability. That PEIS concluded, "The continued vitality of all three NNSA national security laboratories will be essential in addressing the challenges of maintaining a safe and reliable nuclear weapons stockpile without nuclear testing."

In pursuit of a more responsive and cost-effective Complex, a restructuring of the R&D facilities within the laboratory and production complex is being considered. For the proposed action to restructure R&D and testing facilities, the alternatives focus on shorter-term issues to consolidate, relocate, or eliminate duplicative facilities and programs and improve operating efficiencies. The following functional R&D and testing capabilities and capacities are evaluated as part of this proposed action:

- High Explosives R&D
- Tritium R&D
- Flight Test Operations
- Major Hydrodynamic Testing
- Major Environmental Testing

The detailed technical description of these functional capabilities and capacities is provided in Chapter 3.0.

In general, with the exception of flight test operations, the alternatives for these functions are:

- No Action
- Downsize-in-Place
- Consolidate at Fewer Sites

For flight testing, an alternative to the SNL-operated Tonopah Test Range (TTR) is being evaluated. Today, TTR is operated mainly to conduct a small number of surveillance flight tests of air-delivered gravity bombs. With only two gravity bomb weapon types remaining in the stockpile, it may be possible to cease testing at TTR and use the NTS or negotiate with the DoD to use the White Sands Missile Range (WSMR) for this flight testing.

The sites being considered for each of these functions are:

- High Explosives R&D – LLNL, LANL, SNL, Pantex, NTS
- Tritium R&D - LLNL, LANL, SRS
- Flight Test Operations – TTR, NTS, DoD (WSMR)
- Major Hydrodynamic Test Facilities – LLNL, LANL, NTS
- Major Environmental Test Facilities – LLNL, LANL, SNL, NTS, and Pantex

The 1996 SSM PEIS evaluated a proposed action of "enhanced experimental capability" that focused on facilities for high energy density physics (HEDP), such as the National Ignition Facility (NIF) and Atlas, and hydrodynamic test facilities, such as the Contained Firing Facility (CFF). In this SPEIS, only consolidation of existing major hydrodynamic test facilities is being considered. No further consolidations or new HEDP facilities are proposed.

The three national security laboratories, LANL, LLNL, and SNL, are multi-function, multi-disciplinary laboratories that perform R&D work for other NNSA missions, as well as for other programs within DOE, the DoD, and other government agencies. NNSA expects that the nuclear weapon program at the laboratories will change over time, and that other missions arising from 21st century challenges, such as nuclear energy security, will become increasingly paramount. The R&D restructuring alternatives under consideration would retain the unique science, technology, and engineering capabilities at the laboratories for the broader NNSA missions relating to national security. As a result, NNSA does not currently consider it reasonable to propose closure of any of the NNSA laboratories (see also Section 3.1.4). However, such consolidation could be proposed in the future depending upon future national security requirements.

2.5 RELIABLE REPLACEMENT WARHEAD

Even though the RRW is only in the design feasibility study phase, due to high congressional and public interest, this section explains the RRW's possible impact on the nuclear weapons stockpile.

2.5.1 RRW Status

The current status of RRW is that a feasibility study has been completed, a design competition has been concluded, and the Nuclear Weapons Council has selected a design concept. If authorized and funded by the Congress, the design concept would undergo further study and refinement over the coming years and cost estimates would be prepared by the DoD and NNSA. The first RRW being considered is a possible replacement for the Navy's W76 Trident warhead starting as early as 2014. The RRW would not have a different military requirement than the W76 warhead it would replace.

2.5.2 RRW and the Proposed Actions

The RRW would not affect the proposed action related to restructuring SNM facilities, nor the proposed action to restructure R&D facilities.

- Restructure SNM Facilities: The proposed action is based on the current site configuration that houses a very large inventory of SNM that needs to be consolidated in more modern facilities independent of whether an RRW is developed.

- Restructure R&D and Testing Facilities: R&D, hydrodynamic, environmental, and flight test facilities are needed to support the maintenance of the safety, security, and reliability of the existing stockpile as well as RRW warheads. The R&D and flight test facilities retained will be those necessary to support the future legacy stockpile or an RRW.

The potential effects of an RRW on other aspects of the transformation of the Complex, including pit production capacity, are discussed in the sections that follow.

2.5.3 RRW and Nuclear Testing

It is important to note what was said in the 1996 SSM PEIS Summary on the issues of new weapon design and testing (page S-46) and consider what has changed since that time.

> *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.

In 1996, the prevailing technical judgment in the DoD and DOE was that the U.S. should not design and field a new weapon design without nuclear testing, at least equal in sophistication to the testing of weapons already in the stockpile. The judgment was that the technical risk was too high and the confidence too low with the experimental, computational and simulation tools available at the time. Today, more than a decade later, the judgment has changed because of the age of the legacy stockpile, the new experimental, computational, and simulation tools available and new security threats. With either a legacy weapon or an RRW, NNSA does not currently see a need to resume nuclear testing to certify the safety, security, and reliability of the U.S. nuclear deterrent.

2.5.4 Potential Effects of the RRW on the Stockpile

Legacy stockpile weapons were designed to optimize the "yield-to-weight" ratio - that is, the maximum explosive force for the weight and volume of the nuclear warhead specified for the DoD delivery system. This resulted in highly sophisticated, finely tuned warhead designs that optimized yield-to-weight while trying to meet all other competing design requirements for safety, security, reliability, survivability (ability of the weapon to remain fully functional in hostile environments), etc. The RRW design concept allows more weight and volume to be used, which would enable larger margins of safety, security, and reliability to be designed into the warhead. Higher design margins imply higher confidence in meeting the requirements under unanticipated and undesirable conditions over a longer term. For example:

- Warhead Safety and Security… The use of Insensitive High Explosive (IHE) in a warhead requires more weight and volume than conventional high explosives (CHE) to perform the same function reliably, but it significantly reduces the probability of detonation in accidents, such as a fire. Thus, the use of IHE can provide a higher safety margin for the warhead, but, because a larger weight and volume of explosive is required, it occupies a higher fraction of the total weight and volume available for the nuclear package in a DoD delivery system.

- Warhead Reliability… The reliability requirement for legacy stockpile warheads is quite high. However, an RRW would have designed-in higher performance margins. This results in increased confidence that the warhead would remain very reliable over a longer period of time - because it would be less sensitive to internal changes that might cause it to fail due to aging or environmental effects. The ability to improve the performance margins of legacy weapons is limited by the constraints on the original designs developed many years ago.

2.5.5 RRW and Complex Transformation

One of the objectives of the RRW is to simplify component and subassembly fabrication and warhead assembly/disassembly processes. In general, simplifying the design to one with fewer, less complex parts would reduce costly production operations in the Complex. Coordination and cooperation between the design laboratories and production plants to achieve this objective were encouraged by NNSA in the design competition for RRW. Some of the benefits accrue simply by fostering a closer working relationship between the laboratories and plants. However, the main benefit would be achieved by the fact that more weight and volume are available, which permits flexibility in the manufacture, assembly, disassembly, and maintenance of weapons. Some specific examples of improvements that emerged in the design competition were:

- Engineering of structural features that would permit safer and more efficient warhead assembly and disassembly operations.
- Avoiding the use of non-nuclear materials in the design where stockpile surveillance data indicated potential life-limiting concerns.
- Eliminating toxic and hazardous materials if technically acceptable substitutes were available.
- Substituting lower cost commercially available materials and components for higher cost specialty manufactured materials and components when feasible.

Some promising examples of efficiency improvements in manufacturing processes include pits and the cases surrounding the nuclear package. For example, a new pit manufacturing process is estimated to reduce the manufacturing time by about 33 percent.

A detailed cost study on an RRW design is in progress. When completed, it should provide the basis for quantifying the cost and efficiency benefits of the RRW approach.

2.5.6 RRW and the Evaluation of Pit Production Capacity

The current rate of pit production at LANL is about 10 pits per year. For comparison purposes 20 pits per year is currently authorized at LANL under the 1999 LANL SWEIS ROD; the 1996 SSM PEIS evaluated rates of 50-80 pits per year at LANL and SRS; and this SPEIS evaluates bounding rates of 125-200 pits per year at five candidate sites. Sections 2.3.3 and 2.4.1 provide more detail on pit production rate and capacity issues and facility siting alternatives. Regardless of location, a new pit facility is estimated to take approximately 10 years from the time funding is authorized by Congress to when it becomes fully operational. In other words, while a RRW might affect actual production rates for pits, it would not significantly increase pit production capacity because in either case— legacy or a RRW— NNSA might need to produce pits.

2.5.7 RRWs and Use of Radioactive and Hazardous Materials

The environmental impacts of the proposed action alternatives in this SPEIS are based on the manufacturing materials and processes needed to support legacy stockpile weapons with life extension programs. An RRW is only in the feasibility study stage. However, the RRW design objectives are directed at reducing the use of radioactive and hazardous materials when compared to legacy weapons. Because the environmental impacts in this SPEIS are based on legacy weapons, these impacts should be larger than the potential impacts of an RRW if it were to go into production.

For example, the current RRW design eliminates the use of a toxic metal by substituting a non-toxic metal. If material substitution is not feasible, another way to reduce environmental impacts is to change manufacturing processes so that less radioactive or hazardous waste is created. For example, a RRW pit design has the potential to reduce the amount of plutonium scrap by as much as 90 percent when compared to the manufacture of the pit in the legacy type weapon it replaces.

2.5.8 RRW Summary

The ultimate fate of the RRW has no effect on the proposed actions in this SPEIS, alternatives, bounding production capacities studied, or the assessment of their environmental impacts. The RRW would enable NNSA to change how operations are conducted within the facilities studied in this SPEIS. While RRW would enable more cost-efficient and less hazardous operations, it would not eliminate the need for SNM operations or substantially reduce near-term production needs. Because the environmental impacts are based on the maintenance of the legacy weapons that are currently in the stockpile, a conservative estimate of the environmental impacts is provided by this SPEIS. A pit and CSA production capacity will be required for the foreseeable future with or without implementation of RRW.

2.6 PROGRAMMATIC IMPACTS OF SMALLER STOCKPILES

As discussed earlier in this chapter, the U.S. has steadily reduced its nuclear weapons stockpile since the end of the Cold War. The U.S. will reduce its stockpile to between 1,700-2,200 operationally deployed strategic warheads by 2012 in accordance with the Moscow Treaty. There are more than the 1,700-2,200 treaty-accountable warheads in the current total stockpile, and, based on the Nuclear Weapons Stockpile Plan, this will remain true in 2012. Section 2.1.6 explains the reasons for extra weapons in support of an operationally deployed stockpile and it also explains the indirect relationship of stockpile size to planning assumptions for the industrial capacities that may be needed to repair or replace weapons. This section discusses the sensitivity of the proposed actions and alternatives in this SPEIS to the possibility of a stockpile smaller than the one set by the Moscow Treaty.

2.6.1 Defining a Smaller Stockpile

In regard to smaller stockpiles, the 1996 SSM PEIS examined a hypothetical smaller stockpile of about 1000 weapons. This stockpile level required retaining a capacity to produce about 50 weapons per year. Prior discussions in this chapter explain the technical reasons why this is a judgment and not a mathematical calculation. This was defined as the low case for the production analyses. This is still a reasonable assumption for a production capacity; only it appears somewhat more likely than it did more than a decade ago. In this SPEIS, the 50 weapons per year rate is referred to as "capability-based capacity."

2.6.2 Capability-Based Capacity

A factory-style layout of the process equipment needed to produce just one stockpile quality component is inherently capable of producing many more components per year if operated throughout the year. The production and maintenance of nuclear components within a weapon are the main determinants for infrastructure size and environmental impacts. A reasonable judgment of the inherent capacity of a production line for nuclear components exceeds 50 per year. A modern factory-style layout could result in a minimum inherent capacity in the range of 125 components per year. At these levels, a further decrease in the annual production rate, based on a reduction in stockpile size, would not significantly change the amount of process equipment, factory floor space, or qualified personnel needed. It would, however, affect the environmental impacts of actual operations.

2.6.3 Potential Effects on the Proposed Actions and Alternatives

For the reasons explained in the preceding paragraph and those that follow, the proposed actions and alternatives in this SPEIS have been scoped to meet a projected smaller stockpile size and annual production rates that are lower than already evaluated (i.e. the No Action Alternative, which includes 20 pits per year).

- Restructure SNM Facilities – A smaller stockpile would not change the intent of the proposed action to consolidate SNM. In addition, the alternatives already evaluate a maximum consolidation alternative at a single production site.

- Restructure R&D and Testing Facilities – In general, a smaller stockpile does not eliminate the need for the basic R&D facilities evaluated in the proposed action in that all legacy weapon types use the same basic materials (tritium, etc.) and require the same type of test capabilities.