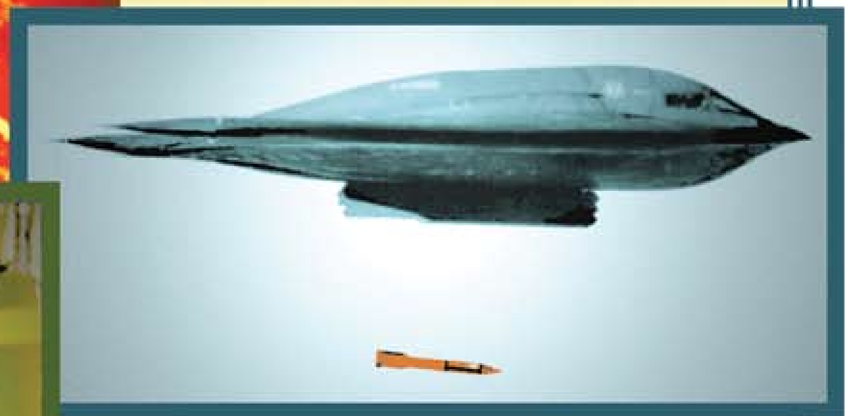


Transforming the U.S. Strategic Posture and Weapons Complex

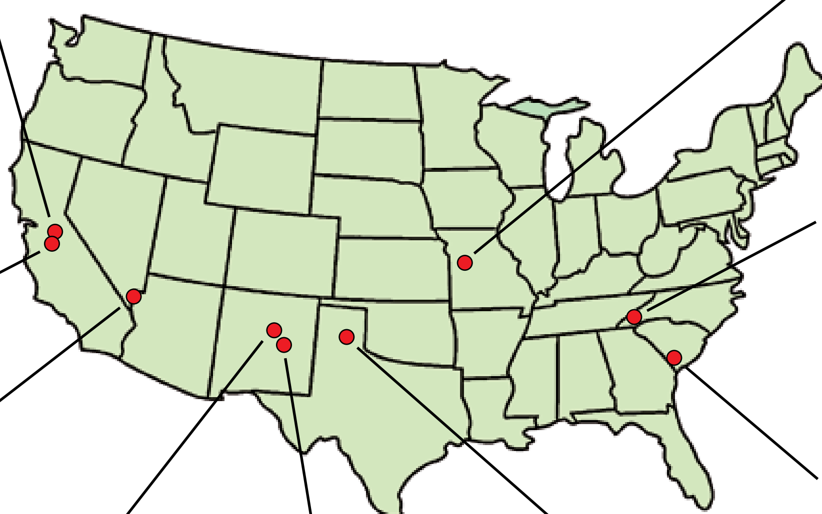
for Transition to a Nuclear Weapons-Free World

Nuclear Weapons Complex Consolidation Policy Network

April 2009

Nuclear Weapons Complex Consolidation Policy Network

Our Plan for Shrinking the Complex from Eight Sites to Three by 2025



Lawrence Livermore National Lab

Current Activities/Capabilities:
- Nuclear Design/Engineering
- Plutonium R&D
- High Explosives R&D
- Tritium R&D
- Hydrotesting
- Weapons Env. Testing

Our Plan:
- Transferred out of weapons programs by 2012.

Sandia - CA

(see NM Site below)

Nevada Test Site

Current Activities/Capabilities:
- Underground Test Readiness
- High Explosives Testing
- Hydrotesting

Our Plan:
- Transferred out of weapons programs by 2012.

Kansas City Plant

Current Activities/Capabilities:
- Non-nuclear Components Production

Our Plan:
- Weapons activities end by 2015.

Y-12 National Security Complex

Current Activities/Capabilities:
- Production and Dismantlement of Secondaries
- HEU Operations

Our Plan:
- Weapons activities end by 2025.

Savannah River Site

Current Activities/Capabilities:
- Tritium Extraction, Loading, Unloading
- Tritium R&D

Our Plan:
- Weapons activities end by 2020.

Los Alamos National Lab

Current Activities/Capabilities:
- Nuclear Design/Engineering
- Plutonium R&D and Pit Production
- Assembly/Disassembly of Secondaries
- Tritium Operations
- Some Non-nuclear Components
- High Explosives R&D
- Hydrotesting
- Weapons Env. Testing

Our Plan:
- Reduce weapons/plutonium R&D.
- Pit production capability put on cold standby.
- Replace tritium in the residual stockpile.
- Transfer high explosives R&D to Pantex.
- Reduce Weapons Env. Testing.
- Maintain capabilities for surveillance and certification.

Sandia National Laboratories

Current Activities/Capabilities:
- Non-nuclear Design/Engineering
- Some Non-nuclear Component Production
- Explosive Components R&D
- Major Weapons Env. Testing

Our Plan:
- End weapons activities in CA.
- Reduce weapons R & D in NM.
- Maintain capabilities for surveillance and certification.
- Fabricate more types of nonnuclear replacement parts for fewer weapons.

Pantex Plant

Current Activities/Capabilities:
- Weapons Assembly/Disassembly
- High Explosives R&D and Production
- Weapons Dismantlement
- Plutonium Pit Storage

Our Plan:
- Increase weapons dismantlement.
- Increase capacity for pit storage.

Residual Capabilities

in a 3-site Nuclear Weapons Complex Supporting 500 Warheads

[Note: In "Environmental Testing" the Labs subject nuclear weapons to extremes of temperature, vibration, shock and radiation to mimic the conditions of delivery to the target and ensure their performance during a nuclear war.]

April 2009

Transforming the U.S. Strategic Posture and Weapons Complex for Transition to a Nuclear Weapons-Free World

PREPARED BY THE

Nuclear Weapons Complex Consolidation (NWCC) Policy Network

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APRIL 2009

ON THE COVER (top to bottom): The BADGER test, part of Operation Upshot-Knothole, a 23 kiloton tower shot, April 18, 1953 at the Nevada Test Site.

A B-2 Spirit Bomber, from Whiteman Air Force Base, MO., test drops a de-armed B61-11 at the Tonapah Test Range in Nevada. The B61-11 is an earth-penetrating modification of a nuclear bomb. It entered the stockpile in 1997.

W76 warheads destined for Trident submarines. The Bush Administration planned to process ~2,000 of these 100 kiloton weapons through a Life Extension Program that would give them a new fuse capable of ground bursts and a reentry vehicle with improved target accuracy. That combination could effectively change the W76 from a "countervalue" weapon for deterrence to a "counterforce" first strike weapon against hardened targets.

Technical Area-55 at LANL, with the existing plutonium pit production facility PF-4 on the right, the new "Radiological Lab" for the CMRR Project on the left, and behind it the excavation for the pending CMRR "Nuclear Facility." Photo courtesy of Nuclear Watch New Mexico.

Foreword

This is a time for change in America, especially in our relations with the rest of the world. There are no aspects of U.S. policy more ripe for change than the nation's strategic posture and the nuclear weapons activities it conducts to support that posture. Congress recognized this by mandating, in the 2008 Defense Authorization Act, that the new Administration complete a comprehensive review of the nuclear posture of the United States by the end of 2009.[1] In Sec. 106 of the same bill, Congress established a Commission on the Strategic Posture of the United States to "conduct a review of the strategic posture of the United States, including a strategic threat assessment and a detailed review of nuclear weapons policy, strategy, and force structure." That Commission plans to release its report in April 2009.

In October 2008, before either of those reviews was completed, the National Nuclear Security Administration (NNSA), a semi-autonomous arm of the U.S. Department of Energy (DOE), issued a Final Supplemental Programmatic Environmental Impact Statement (SPEIS)[2] on its plans for the nuclear weapons complex.[3] In December, NNSA issued two Records of Decision on the future of the complex.[4] The NNSA based its environmental analysis and decisions on an obsolete "Nuclear Posture Review" that the Bush Administration conducted in 2001.

The Obama Administration has given every indication that it plans to alter U.S. strategic policy dramatically in its upcoming Nuclear Posture Review (NPR). For example, the White House website states, "Obama and Biden will set a goal of a world without nuclear weapons, and pursue it."[5] The Administration has also announced it intends to seek a reduced limit of 1,000 warheads in the next round of treaty negotiations with Russia. This report sets out numerous recommendations for the Obama Administration to include in a revised nuclear strategy and force posture.

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1 National Defense Authorization Act for Fiscal Year 2008 (P.L. 110-181). Sec. 1061.

2 U.S. Department of Energy. National Nuclear Security Administration. *Final Complex Transformation Supplemental Programmatic Environmental Impact Statement (Final SPEIS)*. DOE/EIS-0236-S4. October 2008. www.complextransformationspeis.com/project.html.

3 The term "nuclear weapons complex" refers to eight major sites around the country where NNSA performs research, development, testing, maintenance, production, refurbishment, and dismantlement activities for all the nuclear weapons in the U.S. stockpile. The eight sites are: Los Alamos National Laboratory (LANL) in Los Alamos, NM; Livermore National Laboratory (LLNL) in Livermore, CA; Sandia National Laboratory (SNL), which has facilities in Albuquerque, NM and Livermore, CA; the Pantex Plant near Amarillo, TX; the Y-12 Site in Oak Ridge, TN; the Savannah River Site (SRS) near Aiken, SC; the Nevada Test Site (NTS) near Las Vegas, NV; and the Kansas City Plant (KCP), in Kansas City, MO. NNSA also conducts flight tests of nuclear weapons at the Tonopah Test Range near Tonopah, NV.

4 Records of Decision for the Final SPEIS, U.S. Federal Register. Vol. 73, No. 245. December 19, 2008. Pp. 77644–77663. http://frwebgate1.access.gpo.gov/cgi-bin/PDFgate.cgi?WAISdocID=63150117454+2+2+0&WAISaction=retrieve.

5 www.whitehouse.gov/agenda/foreign_policy.

This report is the fruit of a two-year collaboration among six citizens' groups to promote a major consolidation and reduced level of operations for the U.S. nuclear weapons complex. Our groups are based near five of the eight sites in the nuclear weapons complex and together we have significant expertise in the workings of the entire complex. Consequently, this report goes beyond questions of strategic posture and nuclear weapons policy and places emphasis on how to shrink the nuclear weapons complex to support a smaller stockpile in a safer, more secure, and less costly manner. A smaller weapons complex can sufficiently maintain the nation's nuclear deterrent until nuclear weapons are eliminated, while devaluing the importance of nuclear weapons and improving U.S. credibility in working to halt and reverse their proliferation.

The lead author of the report is Robert Civiak, who is a former Office of Management and Budget (OMB) Examiner for the Department of Energy's Nuclear Weapons Programs, and is now an independent consultant. Major contributions were also made by Christopher Paine of the Natural Resources Defense Council (NRDC), Jay Coghlan of Nuclear Watch NM, and Marylia Kelley of Tri-Valley CAREs. Ingrid Drake and Peter Stockton of the Project On Government Oversight (POGO) drafted Chapter 7 on security issues. Representatives from all of the groups in the NWCC Policy Network participated in the planning and review of this report.

Acknowledgments

First and foremost, this project would not have occurred without the support and encouragement we received from the Connect U.S. Fund and its staff, especially Eric Schwartz and Heather Hamilton, and from the project's independent evaluators David-Devlin Foltz and Joshua Weissburg of the Aspen Institute. We hope that the resulting fruits of our collaboration, including critical analysis in the public review of NNSA's *Supplemental Programmatic Environmental Impact Statement on Complex Transformation*, litigation against a new nuclear weapons component production plant, and fresh thinking on policy as evidenced by this report, are what the Connect U.S. Fund had in mind when it advanced the notion of supporting "policy networks" willing to challenge status-quo thinking in foreign and security policy. We also would like to thank the staff of the Tides Foundation for their patience and diligence in helping us to assemble all the necessary grant documentation from the six disparate organizations belonging to the network.

Several of our groups also received generous support from the Ploughshares Fund and the Colombe Foundation that was vital to their participation in this project. In addition, NRDC wishes to acknowledge the support of the David and Katherine Moore Foundation, the Prospect Hill Foundation, and the Telemachus Foundation for its work on nuclear weapons complex issues. Tri-Valley CAREs would like to thank the New-Land Foundation, and the Samuel Rubin Foundation for their support of TVC's activities regarding nuclear weapons. Nuclear Watch New Mexico thanks the Town Creek Foundation and the New Mexico Community Foundation. Just Peace thanks the Rachael and James Dougherty Foundation for its financial support and the Dallas Peace Center for its administrative support. In addition, we all thank our private contributors for their invaluable support

The authors also wish to thank Mavis Belisle of Just Peace and Ann Suellentrop of the Greater Kansas City Chapter of Physicians for Social Responsibility. They contributed their significant knowledge to many discussions of the NNSA facilities in their local areas and reviewed drafts of the document.

Finally, we would like to thank Sally James and Katie Burgess of Cutting Edge Design in Washington, DC for transforming a dull looking manuscript into a vibrant document. They were helped in that regard by John Witham of Nuclear Watch New Mexico, who produced numerous versions of a map of the existing and our shrunken nuclear weapons complex, before he was able to incorporate the gist of our story onto one page. In addition, Sasha Pyle of Nuclear Watch New Mexico provided our cover art.

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Summary and Recommendations

The world of today is very different from that of the Cold War era. The superpower competition, which drove the deployment of tens of thousands of nuclear warheads, no longer exists. Nevertheless, the combined nuclear stockpiles of the United States and Russia still number roughly 20,000 warheads. Seven other nations (Britain, France, China, India, Pakistan, Israel, and North Korea) have independent nuclear arsenals, with a combined 1,000 to 1,200 warheads. New dangers have arisen that present more likely threats to U.S. security than a deliberate large-scale nuclear attack by Russia. Terrorists or rogue elements within governments might gain access to nuclear weapons or the fissile materials needed to make them. Nuclear-armed states embroiled in regional conflicts or internal strife could use their nuclear weapons or lose control of them. And, nuclear-tipped missiles still maintained on high alert could be launched accidentally.

New dangers have arisen that present more likely threats to U.S. security than a deliberate large-scale nuclear attack by Russia.

The continued existence of large nuclear weapon stockpiles in the United States, and in other countries, does not increase our security, but instead makes it more precarious. The time for a new approach to nuclear weapons is long overdue. Countering nuclear proliferation and terrorism and reducing nuclear arsenals must become the central focus of U.S. nuclear weapons policy and strategy.

We recommend that the United States lead the world in halting and reversing nuclear weapons proliferation and reducing the threat of nuclear weapons. To that end, the United States should dramatically reduce its own nuclear weapons stockpile and devalue nuclear weapons as instruments of national security.

This report sets out numerous detailed recommendations for a new strategic posture and nuclear weapons policy to move toward a world without nuclear weapons. We discuss steps that can be taken now to reduce the numbers of nuclear weapons and strategic delivery vehicles and to lessen the risk inherent in existing nuclear weapons and materials. The United States should devalue the importance of nuclear weapons by, among other steps, halting efforts to improve them.

Until an assured international mechanism for eliminating nuclear weapons is established, the United States can maintain a more than adequate nuclear deterrent without modifying or attempting to improve its existing nuclear weapons. **We recommend that the United States refrain from installing new military capabilities in existing nuclear weapons, freeze the current designs, and drastically reduce nuclear weapons research and development activities.**

The underpinning of the nuclear weapons policy and strategy recommended here is a vision of a world free of nuclear weapons. That vision, articulated by Presidents

Reagan and Gorbachev at Reykjavik, Iceland in 1986, was brought back into the political spotlight through essays in the *Wall Street Journal* in January 2007 and January 2008 by former Secretaries of State George Schultz and Henry Kissinger, former Secretary of Defense William Perry, and Senator Sam Nunn. Since then, numerous leaders from around the world, including President Barack Obama, have expressed their support for the concept. There is no question that this is a long-term effort. However, the world will be a safer, more secure, less hostile place when the vision of a world free of nuclear weapons is realized.

What Are Nuclear Weapons For?

If our recommendations are followed, the United States will maintain a small but credible nuclear deterrent, until no other nation has nuclear weapons. Nuclear weapons will serve no other purpose. However, we do not believe that nuclear deterrence is a legitimate or even a stable long-term position. Rather, we believe that continued reliance on nuclear weapons is morally unacceptable and dangerous. **We recommend that the United States pursue a strategy that will lead to the verified and enduring elimination of nuclear weapons throughout the world as quickly as possible.**

This report does not prescribe the political and military security arrangements that should replace nuclear deterrence. Instead, we focus on nearer-term changes. We outline a transitional nuclear deterrent doctrine and the weapons stockpile needed to support it. We also propose a maintenance strategy and nuclear weapons complex for a smaller stockpile. Our plan points the United States in a new direction, positioning it to conduct negotiations with other nations on building the global institutional arrangements that will be required to supplant nuclear deterrence and pave the way to eliminate nuclear weapons.

The United States should eliminate even veiled threats to use nuclear weapons from its global military posture.

The immense destructive power of nuclear weapons sets them apart from any other type of weapon. The term "weapons of mass destruction" (WMD), which lumps chemical and biological weapons with nuclear weapons, blurs the very real distinction we see between them. While we also view the prospective use of chemical or biological weapons as morally reprehensible, the effects of their use are different in scale and their production and use are already banned by international agreement. We believe that military means other than the threat of nuclear preemption or retaliation can and must suffice to address these lesser threats.

We recommend that the strategic posture of the United States eliminate any reference to the use of nuclear weapons in retaliation to (or in preemption of) other nations' use of chemical or biological weapons or to the generalized threat of "weapons of mass destruction." Indeed, the United States should eliminate even veiled threats to use nuclear weapons from its global military posture and forego integrating the potential use of nuclear weapons with strategies for use of conventional force. Both would be a distinct and welcomed change from the Bush 2001 Nuclear Posture Review. The United States must live up to its democratic ideals, defending its interests primarily by engaging other nations through negotiation and reciprocal accommodation, without invoking a nuclear "ace-in-the-hole."

The United States must respect the principles of the UN Charter. A responsible strategic policy should reject any notion of an “exceptional” U.S. privilege to engage in the unilateral use of military force to further its interests or to extinguish perceived threats anywhere on the globe. Other than the potential use of nuclear weapons by others, the United States is not confronted by any credible threat to its security, or to that of its allies, which might require nuclear escalation to counter it. Therefore, **we recommend that the President and the Congress declare, without qualification, that the United States will not be the first nation to use nuclear weapons in any future conflict.** This “no first use” policy should be reflected in our nuclear force structure and readiness posture. U.S. nuclear forces should neither be structured nor postured for preemptive attacks against any other nation.

In today’s world, regional tensions in South Asia, the Middle East, and the Korean Peninsula are significant drivers of nuclear weapons development. Resolving tension in those regions must be seen as an important aspect of the strategic posture and nuclear weapons policy of our nation. This requires adherence to a set of principles that will detach nuclear forces and threats of preemption from the process of resolving political and territorial disputes. Only then can negotiations reach beyond issues of national survival and attempt to reconcile the specific conflicting objectives that are causing tension. Regional military imbalances should be dealt with through co-operative security negotiations and arrangements to reduce tension and, if necessary, by commitments of our own or allied conventional forces, not by the threatened use of nuclear forces or strategies employing preemptive or preventive nuclear attacks.

In an ideal world, the question, “what are nuclear weapons for?” would be moot. There would be no nuclear weapons. As we move toward that vision, **the United States should view its nuclear weapons for one purpose and one purpose only—to deter the use of nuclear weapons by others.** The Department of Defense and the National Nuclear Security Administration should structure U.S. nuclear forces and the weapons complex accordingly.

Proposed Force Structure and Readiness Posture

We believe that the target for the next round of U.S. and Russian nuclear force reductions should be 500 total warheads each.

We recommend that President Obama clearly articulate his vision of a world free of nuclear weapons in a major speech. Further, Congress should firmly establish in legislation the pursuit of a world free of nuclear weapons as the cornerstone of U.S. nuclear policy and the guiding principle for decisions regarding nuclear weapons and the future of the U.S. arsenal. The President and the Congress must then define a nuclear force level for the United States that leads the world on the path to zero, but also provides sufficient deterrence against the use of nuclear weapons by others along the way.

Cold War theory envisioned massive force-on-force exchanges between two hostile superpowers bent on achieving some hypothetical advantage by destroying the other side’s capacity for nuclear war fighting. Such thinking was questionable then and is ludicrous today. What then is a reasonable starting point for sizing the U.S. nuclear weapons stockpile? Since the British, French, and Chinese nuclear forces are all at or below 300 operational warheads, we believe that the target for the next round of U.S.

and Russian nuclear force reductions should be 500 total warheads each, including tactical nuclear weapons and any non-deployed warheads, spares, and reserves.

We recommend that the Obama Administration make every effort to extend the Strategic Arms Reduction Treaty (START) with Russia, before it expires at the end of 2009, and speed up negotiations for a follow-on treaty. The U.S. goal should be a verifiable treaty with a limit of 500 total warheads in the active and reserve stockpiles of each nation with commensurate reductions in delivery vehicles for strategic weapons.

In February 2009, the Obama Administration announced its intent to seek a limit of 1,000 warheads in the next round of START negotiations. It is unclear what exactly that figure represents, but it appears that the Administration is referring to the counting rules of the 2002 Moscow Treaty, which apply to only "operationally deployed strategic warheads." That would allow each side to retain thousands of additional warheads. Quick agreement on an interim ceiling of 1,000 operationally deployed strategic warheads, combined with a reduced number of strategic nuclear delivery vehicles within the current START framework, is a good first step. However, this should be merely a stepping-stone to a comprehensive verifiable treaty with a ceiling of 500 *total* warheads in the active and reserve stockpiles of each nation.

We recognize that the number 500 may appear somewhat arbitrary. However, we view getting to 500 total warheads each as a vital confidence-building step that is not complicated by the need to address the arsenal sizes of the other nuclear weapons powers. Once that step is completed, the U.S. and Russia should engage other nations in multilateral negotiations to reduce all nuclear arsenals further.

The details of how the U.S. structures its nuclear forces, within the limit of 500 warheads, are not as important as reducing the overall numbers. A wide range of force structures with 500 warheads could meet the requirement for a credible, survivable deterrent. In Chapter 2, we present potential force structures with as few as two and as many as seven different types of nuclear weapons. However, **we do recommend that the United States remove all U.S. nuclear weapons from foreign bases.** The concept that nuclear weapons must be forward deployed to slow or stop a massive conventional attack is outdated. Furthermore, there is little credibility to claims that U.S. nuclear weapons are needed on foreign territory to guarantee that the United States would come to the defense of its allies. Forward basing of U.S. nuclear weapons is more of a liability than an asset.

We would prefer to see a verifiable treaty with Russia mandating reciprocal reductions before the United States makes any further significant reductions in its nuclear stockpile. Such a treaty would not only provide the U.S. with assurance that Russia will match U.S. reductions, but it would also lay the groundwork for the verification and transparency measures needed for other states to join in moving toward the elimination of all nuclear weapons.

On the other hand, we believe that U.S. nuclear forces remain much larger than needed to deter a nuclear attack by Russia, or any other nation, and remain sufficiently survivable regardless of the size of the opposing force. Thus, even if U.S./Russian conclusion of a new START treaty is delayed, the U.S. should set an example by unilaterally reducing the size of its nuclear stockpile toward 500 total warheads. As a precaution, the U.S. should not dismantle all excess warheads, until a treaty is concluded with Russia or Russia transparently follows the U.S. lead in reducing its stockpile.[6] If the U.S. did so, it could lose leverage in negotiations with Russia for an agreement to verify the irreversible destruction of excess nuclear warheads, which is essential for achieving the longer-term goal of a world free of nuclear weapons.

The United States and Russia each maintain about 2,000 nuclear warheads on land- and sea-based missiles on ready alert. This ready alert status is another carryover from the Cold War and needlessly feeds an adversarial posture between two nations that generally are on otherwise cordial terms. It also elevates the seeming importance of nuclear weapons in our strategic policy and represents an unnecessary risk of mistaken, accidental, or unauthorized launch of a nuclear weapon. Maintaining a high alert status places a continuing burden on command and control systems to correctly identify and respond to a real attack, while never mistaking peaceful space launches or military flight tests for an attack in progress. The U.S. and Russia long ago removed their strategic bombers from ready alert and do not keep nuclear payloads onboard those aircraft.

During the election campaign, Senator Obama declared, "As President, I will immediately stand down all nuclear forces to be reduced under the Moscow Treaty and urge Russia to do the same." We do not think that is enough. **We recommend that President Obama order steps to begin de-alerting all U.S. nuclear forces in a manner that lengthens the time, but does not compromise the capability, for U.S. retaliation in the event of a nuclear attack. He should also encourage Russia to take similar measures.**

We believe that the United States can begin de-alerting its missile forces without prior assurance of Russian reciprocity.

The saying goes that "timing is everything." In this case, the objective is reciprocal measures that impose physical delays in responding to perceived attacks and provocations. That would allow for more rational deliberations, before either side takes steps that could lead to a nuclear apocalypse. De-alerting forces would also greatly reduce the potential for an accidental or unauthorized launch of nuclear weapons. As we discuss in Chapter 3, de-alerting of land- and sea-based missiles goes well beyond simply changing the targeting instructions of those missiles, which can be quickly reinstalled.

As with reducing the number of nuclear weapons, we believe that the United States can begin de-alerting its missile forces without prior assurance of Russian reciprocity. However, to maintain leverage in treaty negotiations on the necessary transparency measures, full de-alerting of U.S. nuclear forces should await reciprocal steps by Russia and other nations within the context of a verifiable agreement. De-alerting a significant portion of U.S. missiles could help ease Russian concerns about the potential vulnerability of its strategic forces and help that nation follow the U.S. lead in further reducing and de-alerting its nuclear forces. Such steps would greatly demonstrate to the world that the U.S. and Russia are stepping away from their reliance on nuclear deterrence as the organizing principle of their geopolitical relationship

6 At triple today's pace of dismantlement, there would still be thousands of warheads awaiting dismantlement for the next decade in any event.

and are, at last, serious about meeting their obligations under Article VI of the Non-Proliferation Treaty (NPT). Article VI requires all treaty signatories *"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."*

Additional Steps to Reduce the Threat of Nuclear Weapons

A Comprehensive Test Ban Treaty

First and foremost among the additional steps, **we recommend that President Obama resubmit the Comprehensive Nuclear Test Ban Treaty (CTBT) to the U.S. Senate for ratification and, following U.S. ratification, work with the remaining nations that must approve the treaty before it enters into force.** Universal adherence to a Test Ban Treaty is important for limiting both the proliferation of nuclear weapons and the further development of new types of weapons in those nations already possessing them.

It would be a mistake for the Obama Administration to strike a deal with the weapons labs to give them more resources and leeway for modifying or improving nuclear weapons.

The CTBT has been signed by 180 states and ratified by 146. However, before it can enter into force, all 44 nations that possessed nuclear research or power reactors in 1996 must ratify it. Of those 44 nations, three—India, Pakistan, and North Korea—have not signed the treaty. A further six nations—the United States, China, Egypt, Indonesia, Iran, and Israel—have signed, but not yet ratified the treaty.

Ratification of the CTBT by the United States would send a strong message to the world regarding its new strategic posture and would strengthen the Non-Proliferation Treaty. China has stated it would ratify the CTBT when the U.S. does so. With all five permanent members of the UN Security Council on board, parties to the treaty could bring stronger pressure on the remaining holdouts.

In 1999, the U.S. Senate failed to gain the necessary two-thirds majority to ratify the CTBT, in part due to misplaced concerns that the treaty could not be effectively verified and that the United States might need to test to maintain its deterrent. Since then, verification techniques have improved and detection networks have been expanded. Regarding the potential need for the U.S. to test, every year since 1999, the Secretaries of Defense and Energy, on the advice of the head of the Strategic Command and the directors of the nuclear weapons labs, have certified that there was no need to perform a nuclear test to assure the reliability or safety of the U.S. nuclear weapons stockpile. In Chapter 5 of this report, we discuss procedures that would better guarantee that the U.S. could maintain its deterrent indefinitely without nuclear testing and without spending nearly as much money on nuclear weapons research as is currently spent.

While ratifying the CTBT is important, it would be a mistake for the Obama Administration to strike a deal with the weapons labs to give them more resources and leeway for modifying or improving nuclear weapons in return for their support for the treaty, as some have suggested. Increasing R&D spending on nuclear weapons technology or improving nuclear weapons would send the wrong message to the world regarding the continuing importance of these weapons in U.S. security policy, open the U.S. to charges of nuclear hypocrisy, and undercut many of the political benefits of ratifying the CTBT.

Ban on the Production of Fissile Material Directly Usable In Nuclear Weapons

The most difficult step in obtaining a nuclear weapon is producing or otherwise acquiring the fissile materials—plutonium (Pu) or highly enriched uranium (HEU)—needed to make them work. Ending the production of fissile materials and reducing and eventually eliminating existing material stockpiles is a key step on the road to a world without nuclear weapons. A treaty to cut off the production of fissile material for nuclear weapons has been discussed in international circles for more than two decades, but negotiations are deadlocked over two issues—whether to include existing stocks of fissile material in the treaty and whether to make the treaty verifiable.

We recommend that the U.S. seek to jump-start negotiations on a Fissile Materials Cutoff Treaty (FMCT), at the UN Conference on Disarmament, by agreeing to begin the negotiations without preconditions. Once treaty negotiations begin, the U.S. should seek a verifiable treaty that addresses existing stocks of fissile materials as well as new production.

We recommend that the Obama Administration declassify and publicly release all information pertaining to U.S. nuclear weapons that would* not *weaken our national security.

Retrieve and Secure Global Stocks of Weapons Usable Fissile Material

Beyond seeking a fissile materials cutoff treaty, there is much that the U.S. can do to reduce the amount of separated plutonium and HEU in this country and around the world. The most urgent objectives in this regard are the global elimination of civil and poorly secured military stocks of HEU. The U.S. and Russia have cooperated for more than fifteen years to improve the security of military stockpiles of fissile materials that were at risk after the collapse of the Soviet Union. However, more work remains to be done. In addition, about 130 research reactors around the world are still fueled by HEU. They represent an unacceptable proliferation danger, especially since the technology exists to fuel all but a handful of them with low enriched uranium (LEU).

We recommend that the Obama Administration place greater emphasis and more resources on securing all fissile materials and, in particular, on significantly reducing the use of HEU in civil reactors and research facilities throughout the world.

Increase U.S. Nuclear Transparency and Seek Comparable Disclosure by Other Nuclear States

Before the world can be free of nuclear weapons, the community of nations must be assured that no nation has clandestine stores of nuclear weapons or weapons material. This will require an enormous worldwide shift toward transparency in nuclear matters. Eventually it will require a comprehensive treaty regime with strict monitoring and control measures.

We believe the U.S. government should prepare for that by leading the world in increasing the openness and transparency of its nuclear weapons programs. We recommend that the Obama Administration declassify and publicly release all information pertaining to U.S. nuclear weapons that would *not weaken our national security*, including:

- The numbers and types of nuclear weapons in the U.S. stockpile and plans for the future;
- The numbers and types of warheads awaiting dismantlement and past, present and projected rates of dismantlement;
- Basic information regarding each type of nuclear weapon in the stockpile or awaiting dismantlement, such as their yield and when they were built, modified, or refurbished; and
- The aggregate amounts of Pu, HEU, and tritium contained in: (a) nuclear weapons in the active and reserve stockpiles (b) material stockpiles reserved for use in nuclear weapons, including material in components and weapons awaiting dismantlement (c) stockpiles reserved for other uses (e.g. naval propulsion and radioisotope power sources) and (d) amounts declared excess to weapons and other military uses and made available for disposition or civil use.

In Chapter 3, we specify additional information that the Administration should declassify to encourage informed public debate on issues such as maintaining the reliability and safety of the U.S. stockpile, without nuclear testing.

The Nuclear Weapons Complex

The National Nuclear Security Administration (NNSA), a semi-autonomous arm of the U.S. Department of Energy (DOE), is responsible for maintaining the U.S. nuclear weapons stockpile. NNSA also dismantles nuclear weapons after they are removed from service. In the past, the same organization designed, built, and tested new nuclear weapons, and it still maintains capabilities to do so, but the United States has not developed a completely new nuclear weapon in nearly two decades. NNSA conducts its activities at eight major sites around the country, which are collectively referred to as the "nuclear weapons complex."

In October 2008, NNSA released a Final Supplemental Programmatic Environmental Impact Statement (SPEIS) on Complex Transformation. According to NNSA, the SPEIS "analyzes the potential environmental impacts of reasonable alternatives to continue transformation of the nuclear weapons complex to be smaller, more responsive, efficient, and secure in order to meet national security requirements." On December 19, 2008, NNSA published two "Records of Decision" in the Federal Register setting forth its plans for Complex Transformation. According to NNSA, those decisions will result in a smaller and more efficient weapons complex.

However, under NNSA's plan, nuclear weapons activities would continue indefinitely at all eight existing sites. We believe that NNSA's plan, based on continuing support for a stockpile of several thousand weapons and the saber-rattling strategy of the 2001 Nuclear Posture Review for employing them, was woefully outdated even before it was published. In Chapters 5 and 6 of this report, we present a plan for a smaller, more secure, less costly complex to support the nuclear weapons stockpile as it is reduced to 500 weapons and beyond.

We recommend that NNSA significantly modify how it maintains nuclear weapons and that it shrink and consolidate the nuclear weapons complex from

eight sites spread around the country to only three sites (Los Alamos National Laboratory, Sandia National Laboratory-New Mexico, and Pantex Plant) that are within 280 miles of each other. Our complex would be: 1) sharply reduced in scale; 2) an interim step toward a nuclear weapons free world; and 3) would result in no net increase in nuclear weapons activities or funding at any of the three remaining sites.

A map on the inside front cover of this report shows the eight sites in the nuclear weapons complex, as it is today, and the three-site nuclear weapons complex as it would be under our plan to support residual operations for a stockpile of 500 or fewer nuclear weapons.

Existing capacity at the three remaining sites could adequately meet the residual workload, as an interim step toward total, global nuclear disarmament.

Shrinking and consolidating the nuclear weapons complex would demonstrate U.S. leadership toward a world free of nuclear weapons and would save taxpayers billions of dollars. While we are confident in the merits of our plan, we strongly emphasize that due process needs to be followed before it can be implemented. For example, there has to be analysis and public review of such a "major federal action" under the National Environmental Policy Act to insure that potential environmental impacts are properly considered, mitigated, or best of all avoided. Environmental justice issues and Tribal concerns must also be met, the latter on a government-to-government basis as needed. We believe these important concerns can be satisfactorily met, because shrinking the nuclear weapons complex, made possible by a dramatically reduced and technologically stable stockpile, should result in reducing the overall level of activity at each of the three remaining sites (with the possible exception of a short-term increase in dismantlements at Pantex). Another way of saying this is that existing capacity at the three remaining sites could adequately meet the residual workload, as an interim step toward total, global nuclear disarmament. We reiterate, before any major missions are transferred from one site to another within the weapons complex there must be due process involving all potentially impacted communities.

Curatorship: A New Strategy for Maintaining the Weapons Stockpile

Shortly after the U.S. entered a moratorium on underground testing of nuclear weapons in 1992, NNSA's predecessor, the DOE's Office of Defense Programs, adopted a strategy called "Stockpile Stewardship" for maintaining the nuclear weapons stockpile in the absence of testing. The strategy sought to "replace" nuclear testing with costly new experimental and computational capabilities, in an effort to model precisely the behavior of exploding nuclear weapons that could no longer be detonated underground in Nevada.

Computer simulations cannot provide the same level of confidence in modified warheads that was provided for the original warheads through full-scale nuclear tests.

NNSA has made considerable progress in this modeling effort, but there is a fatal flaw in its strategy. The more confident the weapons labs have become in their modeling capabilities, the more they have been tempted to modify the nuclear weapons in the stockpile. However, computer simulations cannot provide the same level of confidence in modified warheads that was provided for the original warheads through full-scale nuclear tests. Presidents Clinton and Bush, on the advice of their Secretaries of Defense and Energy, repeatedly certified that the nuclear weapons in the current stockpile are safe and reliable. However, over time, *if changes continue to be introduced into warheads,* the level of confidence in the stockpile will inevitably diminish.

We recommend a more conservative approach to maintaining the existing nuclear weapons stockpile, based on ensuring that today's safe and reliable warheads are changed as little as possible and only in response to documented findings that corrective action is needed to fix a component or condition that could degrade performance or safety. The key to this approach is our conclusion that there is no need for the United States to design any new nuclear weapons or to make performance or safety-enhancing modifications to existing ones. This technical approach is more consistent with U.S. initiatives in nuclear non-proliferation and nuclear threat reduction.

We recommend that NNSA suspend the current Life Extension Programs.

Our methodology is called "Curatorship." Just as a museum curator maintains artistic treasures and occasionally restores them to their original condition, so too would NNSA and the Department of Defense (DoD) maintain nuclear weapons to their original design and condition, with occasional restorations. NNSA's role in maintaining nuclear weapons would focus on scrupulous surveillance and examination of warheads to determine if any component has changed in any manner that might degrade the safety or performance of the warhead. If so, it would then restore that part as closely as possible to its original condition. With changes to warheads strictly controlled, confidence in the performance of the remaining warheads would be higher than under Stockpile Stewardship. The financial cost and the loss of international credibility regarding nuclear proliferation would be much lower.

Under Stockpile Stewardship, NNSA is performing extensive "Life-Extension Programs" (LEPs) for each type of warhead in the stockpile. In practice, "life extension" has become a misnomer for a nearly complete rebuild and upgrade of a warhead system that is nowhere near the end of its life. Under the LEPs, NNSA, and DoD have jointly authorized hundreds of changes to nuclear weapons, adding new components and modifying weapons' military characteristics. NNSA and DoD have chosen to make weapons lighter, more rugged, more tamper proof, and more resistant to radiation.

Under Curatorship, only if laboratory experts could present compelling evidence that a warhead component has degraded, or will soon degrade, and that such degradation could cause a significant loss of safety or reliability, would NNSA replace the affected parts.

NNSA is currently performing an LEP on the sub-launched W76 warhead, which it estimates will cost over $3 billion. The extensive changes NNSA is making include adding a new Arming, Fuzing & Firing (AF&F) system, which will add a ground burst capability that is more destructive of buried targets than the previous air burst firing system, and fitting the warhead to a new reentry body for placement on the D5 missile, which has much greater accuracy than the previous delivery vehicle. Taken together, these changes give the W76 a hard-target kill capability, effectively changing it from a weapon of deterrence to a possible first-strike nuclear weapon.

In contrast, under Curatorship, NNSA would take a very conservative approach to modifying warheads. Only if laboratory experts could present compelling evidence that a warhead component has degraded, or will soon degrade, and that such degradation could cause a significant loss of safety or reliability, would NNSA replace the affected parts. These replacement parts would truly extend the life of the warhead, without modifying its performance or military characteristics. NNSA currently takes apart approximately eleven warheads of each type per year and examines them under its Surveillance and Evaluation Program. Under Curatorship, NNSA would increase the scope and importance of the Surveillance and Evaluation Program to assure that every component of every warhead design is scrupulously examined and tested each year.

We recommend that NNSA suspend the current Life Extension Programs (LEPs) and that the Obama Administration adopt the Curatorship approach to maintaining the nuclear weapons stockpile. President Obama should issue a Presidential Decision Directive (PDD) prohibiting any change in the military characteristics (MCs) or the Stockpile to Target Sequence (STS) requirements of any nuclear weapon, unless the change is essential for maintaining the safety or reliability of the existing warhead.

We further recommend that no changes of any type be made to existing nuclear weapons, unless there is a compelling reason to do so.

We further recommend that no changes of any type be made to existing nuclear weapons, unless there is a compelling reason to do so. To further that end, we recommend that Congress establish a stringent change control process for nuclear weapons, in legislation, including a requirement for outside review of all changes. Congress should require that both the outside reviewers and the final decision makers weigh the potential benefits of any proposed change against the adverse non-proliferation consequences and the likelihood that changes could, over time, contribute to reduced confidence in the performance of the warhead. Major changes should require separate authorization and funding by Congress.

The change control process could take many forms, but we believe it should include some form of review from outside the weapons laboratories. Independent review might be solicited from the JASON scientific advisory group, the National Academy of Sciences, or a new entity established solely for that purpose.

Shrinking Weapons Research Under Curatorship

Under the Curatorship approach, **we recommend that the NNSA de-emphasize nuclear weapons science and technology and cease its quest for more and more detailed simulations of exploding thermonuclear weapons.** The existing codes are sufficient, in conjunction with limited use of hydrotesting, for the analyses needed to maintain the stockpile as it is. Improved codes have little use except for designing new types of nuclear weapons or verifying the impact of major changes to existing ones. Designing new nuclear weapons would run counter to U.S. commitments under Article VI of the Non-Proliferation Treaty and would set a bad example for the rest of the world. President Obama has already declared that the United States will not design new nuclear weapons. The NNSA's claim that it needs better computer codes to maintain existing weapons is tantamount to Iran's claim that it needs a domestic uranium enrichment capability for nuclear power. Both claims may provide fig leaves for thinly-veiled nuclear weapons development programs.

We recommend that NNSA dramatically reduce its research efforts in several areas, including equation of states studies, dynamic modeling, studies of the physical and chemical properties of Pu and HEU, hydrodynamics experiments, and sub-critical tests. NNSA should continue to validate its codes against existing test data and apply those codes to questions of relevance to the existing stockpile. It should also expand the testing and analysis of components taken from actual warheads in the stockpile to assure that any changes to components due to aging are discovered and analyzed before they become detrimental to nuclear weapons performance. A simple way of putting it is that we recommend an "engineering" rather than a "science-based" approach to stockpile maintenance.

With significantly less weapons R&D under Curatorship, NNSA could shrink its R&D infrastructure. **We recommend reducing the number of facilities and personnel dedicated to nuclear weapons research, development, and testing and consolidating such efforts to Los Alamos National Laboratory (LANL) and Sandia National Laboratory-New Mexico (SNL-NM). In particular, we recommend closing all nuclear weapons R&D facilities at Lawrence Livermore National Laboratory (LLNL) and Sandia National Laboratory-California (SNL-CA) or transferring them to other DOE programs for non-weapons research.**

We recommend closing all nuclear weapons R&D facilities at Lawrence Livermore National Laboratory (LLNL) and Sandia National Laboratory-California (SNL-CA) or transferring them to other DOE programs for non-weapons research.

Under our plan, LLNL would retain a small "red-team" of experts to continue studies and analyses relevant to Curatorship of the existing stockpile and provide peer review for certification actions. DOE would shift LLNL's primary mission from nuclear weapons research to basic science, energy and environmental research, while maintaining strong programs in non-proliferation, safeguards, transparency and verification of warhead dismantlement, intelligence, and nuclear emergency response. Also, under our plan, NNSA would cease, or transfer to SNL-NM, all weapons-related activities at SNL-CA. All other facilities at SNL-CA would be closed or transferred to other DOE offices or to other agencies.

We also recommend that NNSA cease all sub-critical testing and most other nuclear weapons-related tests and experiments at the Nevada Test Site (NTS) and transfer the landlord responsibility for the site to another DOE office or other appropriate entity. Operations at the U1A facility should be suspended and the facility closed. DOE or other agencies could continue to operate other research, development, and testing facilities at NTS, including the Big Explosives Experimental Facility (BEEF) and large gas guns, as user facilities.

Shrinking and Consolidating Weapons Production Activities

Along with NNSA's R&D infrastructure, we recommend shrinking and consolidating NNSA's infrastructure for maintenance and production of nuclear weapons. We base our strategy for shrinking and consolidating nuclear weapons production activities on four guiding principles:

- NNSA should reduce its infrastructure to that needed to support a total stockpile of 500 nuclear weapons, under a Curatorship approach, which stringently minimizes changes to existing warheads.
- NNSA does not need any capability to produce components that are not currently in weapons in the stockpile.
- NNSA should expand its capabilities for surveillance of warheads remaining in the stockpile and retain facilities to replace genuinely "limited life components," and, if necessary, replace any other component when there is evidence of a problem that left unattended could significantly degrade warhead performance or safety.

- NNSA should dismantle excess warheads and consolidate and reduce stockpiles of special nuclear materials, as quickly as possible, to reduce costs and security risks.

Adhering to these principles would result in a much smaller production complex than exists today. Currently, most nuclear weapons production and maintenance activities are carried out at six sites:

- Los Alamos National Laboratory conducts surveillance, production, and other operations on components containing Pu, particularly the plutonium pit or "trigger." It also produces nuclear weapons detonators.
- Y-12 Plant conducts surveillance, production and other operations on components containing uranium.
- Pantex Plant disassembles/assembles warheads for dismantlement, surveillance, or refurbishment, stores excess pits awaiting dismantlement, and produces high explosives.
- Kansas City Plant produces or procures 85 percent of nonnuclear components for nuclear weapons.
- Savannah River Site processes tritium and refills tritium reservoirs.
- Sandia National Laboratory-New Mexico conducts surveillance on most nonnuclear components and produces neutron generators and other parts.

We believe that a 500-warhead stockpile, with stringent constraints on modifying those warheads, could be more than adequately supported by only three sites.

The other locations—LLNL, Nevada Test Site, SNL-CA—primarily conduct supporting nuclear weapons research, development, and testing, but they also perform some surveillance work.

We believe that a 500-warhead stockpile, with stringent constraints on modifying those warheads, could be more than adequately supported by only three sites. Moreover, because nuclear weapons activities would be sharply curtailed, each of those three sites should experience a net reduction in workload, with the possible exception of a short-term increase in dismantlements at Pantex.

Under our plan: LANL would be responsible for nuclear-related operations, (primaries, secondaries, and tritium); SNL-NM would produce or procure most nonnuclear components and, as it has been doing, integrate weapon functions; and Pantex would have responsibility for chemical high explosives and for warhead disassembly/assembly operations, with an increased focus on dismantlements. All three sites would conduct surveillance on various components. In addition, supporting research and analysis, devoted primarily to peer review of important warhead issues, would continue at LLNL. The timing of consolidation from six production sites (out of eight sites in all) to three and the sizing of any new facilities that might be needed to accomplish the consolidation is difficult to specify. Both depend on the timing of stockpile reductions to the 500-warhead level and beyond. If the vision of a world free of nuclear weapons is realized soon, it might be cheaper merely to wind down activities at the existing sites, without ever relocating any operations. On the other hand, if stockpile reductions proceed on a gradual glide path over twenty years or more, as is more likely, there would be substantial environmental, security, and cost benefits in consolidating to three sites.

For planning purposes, we assume that the U.S. reduces its stockpile to 500 total nuclear warheads, beginning now and concluding between 2015 and 2020, and that consolidation to three sites is completed shortly after the stockpile is reduced to 500 warheads. **Accordingly, we recommend that NNSA begin the planning needed to shrink and consolidate all production, surveillance, and disassembly/reassembly activities to LANL, SNL-NM, and Pantex and prepare for a smaller complex by cancelling or deferring construction of several large new facilities, including:**

- **the Uranium Processing Facility (UPF) at Y-12,**
- **a new nonnuclear components manufacturing complex in Kansas City,**
- **the "Nuclear Facility" (NF) for the Chemistry and Metallurgy Research Building Replacement (CMRR) Project at LANL,**
- **the Weapons Engineering Science and Technology (WEST) facility, scheduled for construction at LLNL beginning in 2010,**
- **the proposed annex to the High Explosives Application Facility (HEAF) at LLNL,**
- **the Pit Disassembly and Conversion Facility (PDCF) planned for SRS,**
- **the Mixed Oxide (MOX) fuel fabrication plant at SRS, and**
- **the Waste Solidification Building (WSB) planned for SRS.**

Until the pace of arms reductions is clearer, NNSA should make no decisions to build new facilities or relocate facilities that it might need to consolidate production activities, with one exception. **We recommend that NNSA study the alternatives for transferring essential nonnuclear component fabrication activities from KCP to SNL-NM, LANL, or the private sector, with a view toward closing KCP by 2015.**

In addition, we recommend that NNSA should:

- **Remove all Category I and II amounts of special nuclear material (SNM) from LLNL by the end of 2010 and consolidate SNM to fewer locations at the sites that retain significant quantities.**
- **Cancel plans for expanding pit production capacity beyond the currently sanctioned 20 pits per year, but maintain a capability to fabricate one or two plutonium pits annually at LANL. Maintain additional production capacity at LANL on cold standby, with the ability to resume production of up to 20 pits per year should a generic defect be discovered. As a rule, but only if necessary, rely on pit "reuse" at Pantex rather than new production at LANL.**
- **Increase the pace of dismantling retired warheads at Pantex from today's rate of 300-400 per year to 800-1,000 per year, or more, consistent with maintaining safety and without building major new facilities.**

- **Continue storing dismantled pits at Pantex and perform a new site-wide Environmental Impact Statement for Pantex to examine whether the safe storage limit can be increased from 20,000 to 25,000 pits.**
- **Declare all plutonium outside of warheads in the stockpile plus a working inventory of 500 kg as excess to national security needs.**
- **Place plutonium disposition activities in the United States on hold pending a bottom up review of all reasonable alternatives. The disposition option(s) chosen should be transparent and should facilitate future international verification of Pu disposition under a treaty advancing the elimination of all nuclear weapons.**
- **Dismantle excess canned subassemblies (CSAs) in existing facilities at Y-12 as rapidly as possible, consistent with safe operations, which we believe could be 1,000 or more per year.**
- **Declare all HEU outside of warheads in the stockpile, a working inventory of 2,000 kg, and a 50-year reserve held to fuel US naval vessels as excess to national security needs.**
- **Relocate residual HEU-related stockpile surveillance and production activities from Y-12 to LANL after the stockpile is reduced to 500 or fewer warheads.**
- **Cease all tritium production and extraction activities by removing all Tritium Producing Burnable Absorber Rods (TPBARs) from the Watts Bar nuclear power plant and closing the Tritium Extraction Facility at SRS after extracting the tritium from those TPBARs.**
- **Relocate all residual support for tritium reservoirs (unloading, purification, recycling, and reloading) from SRS to the Weapons Engineering Tritium Facility (WETF) at LANL after the stockpile is reduced below 1,000 warheads.**

TABLE 1. **Summary of Site-Specific Recommendations**

Site	Short Term Steps	Longer-Term Plans
Los Alamos National Lab (LANL)	• Significantly reduce nuclear weapons R&D, in conformance with a Curatorship approach, and encourage mission diversification. • Cancel the CMRR-NF Project and upgrades for LANSCE. • Expand surveillance and testing of existing components. • Cancel plans for expanded pit production. Maintain a capability to produce 1 or 2 pits/yr with additional capacity in cold standby to produce up to 20/yr in 12–18 months if needed. • Retain a residual capability to design and certify nuclear components, if needed.	• Relocate support for tritium reservoirs from SRS to the WETF at LANL when the stockpile is reduced below 1,000 warheads. • Transfer residual HEU activities from Y-12 to LANL after the stockpile is reduced to 500 warheads.
Lawrence Livermore National Lab (LLNL)	• Remove all Category I and II SNM from LLNL by the end of 2010. • Close out SNM processing and handling, except for limited surveillance activities. • Close most of Superblock, including Buildings 332 and 334. • Close all nuclear weapons R&D facilities or transfer them to other missions. • Close Site 300 or transfer it for use to other missions. • Cancel plans for new weapons-related facilities, including an annex to HEAF and a new WEST facility. • Retain independent teams of experts to analyze warhead safety and reliability issues relevant to the current stockpile. • Peer review recertification of warheads and components and potential changes to them.	• Increase lab activities in basic science, energy and environmental research, while maintaining strong programs in non-proliferation, safeguards, transparency and verification of warhead dismantlement, intelligence, and nuclear emergency response. • By 2012, LLNL will no longer be considered part of the nuclear weapons complex administered by NNSA.
Sandia Lab New Mexico (SNL-NM)	• Limit experimental facilities primarily to surveillance and environmental testing of existing components. • Maintain cradle to grave responsibility for design, testing, and recertification of nearly all existing nonnuclear components. • Fabricate or procure new and replacement components, as needed, as responsibilities transfer from the KCP. • Retain a residual capability to design and certify nonnuclear components and perform weapons integration, if needed.	• Remain the predominant site for all engineering, surveillance, production, and dismantlement of nonnuclear components. • Host future facilities needed for environmental testing of components as part of the surveillance program. • Continue residual production and maintenance of neutron generators, including tritium loading of neutron target tubes.
Sandia Lab California (SNL-CA)	• Close out all NNSA activities. Some facilities may continue operating for other missions under other entities and some activities, including surveillance, may transfer to other NNSA sites.	• By 2012, SNL-CA will no longer be considered part of the nuclear weapons complex administered by NNSA.

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Site	Short Term Steps	Longer-Term Plans
Nevada Test Site (NTS)	• Cease sub-critical testing and close the U1A facility. • BEEF, large gas guns, and some other facilities could continue as user facilities with new owners. • Transfer site landlord responsibility from NNSA to another DOE office or other appropriate entity.	• By 2012, NTS will no longer be considered part of the nuclear weapons complex administered by NNSA.
Pantex Plant	• Begin process to increase storage capacity from 20,000 to 25,000 pits. • Close pit storage bunkers in Zone 4 and transfer pits to more secure, underground storage on the site. • Continue operation as the sole facility for routine disassembly/assembly of nuclear weapons. • Consolidate all high explosive production and fabrication to Pantex.	• Increase dismantlement rate to 800–1,000 warheads per year.
Y-12 Facility	• Cancel the Uranium Processing Facility (UPF). • Maintain a capability to fabricate no more than 20 canned sub-assemblies (CSAs) per year. • Move all HEU, except for processing inventories, into HEUMF by the end of 2011. • Blend down HEU to 20% U-235 at existing facilities, new facilities in HEUMF, or B&W-owned facilities. • Expand surveillance of CSAs. • Continue to supply enriched uranium to meet the fuel needs of the U.S. Navy.	• Increase dismantlement rate for CSAs to at least 1,000 per year. • Transfer all production and surveillance activities (except for dismantlements) to LANL after the stockpile reaches 500 warheads. • Complete all dismantlements by 2025, at which point Y-12 will no longer be considered part of the nuclear weapons complex administered by NNSA. • Continue operating as a uranium and HEU processing and storage center. • Downblend all excess HEU to LEU by 2030.
Kansas City Plant (KCP)	• Do not build new plant. • Downsize in place and begin shifting missions to SNL-NM and LANL.	• All NNSA activities cease by the end of 2015. No longer considered part of the nuclear weapons complex.
Savannah River Site (SRS)	• Cancel the PDCF. • Place the MOX fuel plant and the Waste Solidification Building on hold. • Close the Tritium Extraction Facility after removing tritium from remaining TPBARs.	• Transfer all support for tritium reservoirs from SRS to LANL, as the stockpile is reduced toward 500 warheads (between 2015 and 2020), at which time SRS will no longer be considered part of the nuclear weapons complex administered by NNSA.

Security Issues

The potential impact of a terrorist attack using nuclear weapons on U.S. soil is too horrific to permit the ineffective security at DOE's nuclear weapons facilities that has persisted for many years. Experts warn that the threat of nuclear terrorism is growing. There are three main threats from nuclear terrorism on U.S. soil:

- The creation of an improvised nuclear device on site, by suicidal terrorists, which could be as easy as dropping one slightly sub-critical piece of HEU on another.
- Intruders' use of conventional explosives on site to create a radiological dispersal device, also known as a dirty bomb.
- The theft of nuclear materials in order to create a crude nuclear weapon off-site, which could be used to devastate a U.S. city.

Numerous security lapses at sites in the nuclear weapons complex are well-documented and are summarized in Chapter 7 of our report. We believe that DOE has not done enough to address the deficiencies these lapses demonstrate and to reduce security risks throughout the weapons complex. We have three principal recommendations for improving security.

We recommend that DOE more rapidly reduce the number of places where Category I and Category II (weapons-grade and weapons-quantities) of SNM are stored. Consolidation is not a new idea. In May 2004, DOE endorsed consolidation of nuclear materials at fewer sites, and in fewer, more secure buildings within existing sites. Our proposals, outlined in Chapters 5 and 6 of this report, would consolidate SNM much more rapidly and extensively than under NNSA's plan.

We recommend that DOE more rapidly reduce the amount of SNM in the complex and around the world, with special attention paid to HEU. NNSA's plan for Complex Transformation does not declare any additional HEU as excess or set any downblending goals. HEU is more valuable to terrorists than any other nuclear material, because it is relatively easy to assemble into a crude nuclear weapon. However, at great cost and risk, NNSA continues to store 400 MT of HEU in a wooden storage building and four other World War II era buildings at Y-12. We would significantly speed up the downblending of excess HEU by using existing facilities at Y-12, by adding downblending capability to the HEUMF, and by making greater use of private sector downblending capabilities at Babcock and Wilcox (B&W) Company's Nuclear Fuel Services plant in Tennessee and its Nuclear Products Division in Lynchburg, VA.

We recommend that DOE federalize its protective forces. Unlike firefighters and other first responders, DOE's protective force officers do not receive benefits to ensure that they and their families are cared for in the event of a serious injury or death. This lack of first responder benefits dampens the protective force officers' willingness to accept high levels of risk, and raises a question about whether they will stay and fight if bullets fly. A federal force would also be easier to select, vet, train, equip, and control, which would lead to better response.

Cost Savings Under Our Plan

Our plan would reduce NNSA's spending on nuclear weapons by $2.3 billion in 2010 compared to the Obama Administration's recently released 2010 budget request of $6.3 billion. To his credit, the Obama budget request is itself $660 million less than the Bush Administration's projection for 2010. Our projected budget for 2015 would cut another $1.35 billion from our 2010 spending level and we would reduce spending by yet another $556 million in 2020.

Under our plan, NNSA spending on nuclear weapons in 2020 would be about $2.14 billion in FY09 dollars, which is about one-third what it is today. More importantly, our plan will greatly reduce nuclear threats from adversaries abroad, as well as from terrorists anywhere in the world, and will reduce the risk of nuclear accidents. In addition, the U.S. would, by example, provide solid leadership in global nonproliferation efforts, pointing toward a world without nuclear weapons.

CHAPTER 1

What Are Nuclear Weapons For?

The world of today is very different from that of the Cold War period. The superpower competition, which drove the deployment of tens of thousands of nuclear warheads, no longer exists. The United States and Russia no longer view each other as adversaries. Nevertheless, the nuclear weapons policy and strategy of both nations has changed little. The United States and Russia have significantly fewer nuclear weapons than they did two decades ago, but their combined nuclear arsenals still numbers roughly 20,000 warheads. No other nation, including China, is reported to have more than 300.

Under the 2002 Strategic Offensive Reductions Treaty (SORT), also called the Moscow Treaty, the U.S. and Russia have each committed to reducing the number of "operationally deployed strategic nuclear warheads" to less than 2,200 by the end of 2012. However, as the term in quotes indicates, reserve warheads, spares, and non-strategic warheads do not count toward that limit. The United States reached the 2,200-warhead level in February 2009 and Russia currently has about 2,700 operationally deployed warheads, but both nations' deployed weapons are backed up by thousands of additional reserve weapons and retired weapons awaiting dismantlement.

Independent arms control experts estimate that the total U.S. stockpile numbers approximately 5,200 warheads, of which 2,200 strategic and 500 tactical warheads (including 200 of the latter in Europe) are operationally deployed. An additional 4,200 intact warheads are no longer in the Department of Defense stockpile, but remain intact while awaiting dismantlement. Thus, the United States is estimated to possess approximately 9,400 warheads in all categories (see table).[7] A similar table for Russia would likely reveal an even larger number of reserve and retired, but intact, weapons, numbering in the neighborhood of 15,000.

7 FAS Strategic Security Blog. www.fas.org/blog/ssp/2009/02/sort.php#more-770.

TABLE 2. **U.S. Nuclear Warheads 2009**

Wahead Category	Number of Warheads
Operationally deployed strategic*	2,200
Operational deployed tactical	500 (200 in Europe)
Total Operationally Deployed	**2,700**
Reserve (active and inactive)	2,500
Total Stockpile	**5,200**
Retired (awaiting dismantlement**	4,200
Total Inventory	**9,400**

* Under the 2002 Moscow Treaty, the United States defines "operationally deployed strategic warheads" as "reentry vehicles on intercontinental ballistic missiles (ICBMs) in their launchers, reentry vehicles on submarine-launched ballistic missiles (SLBMs) in their launchers on board submarines, and nuclear armaments loaded on heavy bombers or stored in weapons storage areas of heavy bomber bases."

** Under current plans, approximately 350 warheads are dismantled each year and the backlog of retired warheads scheduled to be dismantled by 2022.

The continued existence of large nuclear weapon stockpiles in the United States, and in other countries, does not increase our security, but instead makes it more precarious.

These large stockpiles serve no useful purpose. Indeed, maintaining them is counterproductive. New threats have arisen, which present greater danger to U.S. security than a deliberate large-scale nuclear attack by Russia. Terrorists or rogue elements within governments might gain access to nuclear weapons or the fissile materials needed to make them. Nuclear-armed states embroiled in regional conflicts or internal strife could use their nuclear weapons or lose control of them. And, nuclear-tipped missiles maintained on high alert could be launched accidentally. The continued existence of large nuclear weapon stockpiles in the United States, and in other countries, does not increase our security, but instead makes it more precarious. The time for a new approach to nuclear weapons is long overdue. Countering nuclear proliferation and terrorism and reducing nuclear arsenals must become the central focus of U.S. nuclear weapons policy and strategy. The United States should take the lead in reducing the number of nuclear weapons, in eliminating their use as projections of superpower strength, and in devaluing nuclear weapons as instruments of national security.

The underpinning of the nuclear weapons policy and strategy recommended here is a vision of a world free of nuclear weapons. That vision, articulated by Presidents Reagan and Gorbachev at Reykjavik, Iceland in 1986, was brought back into the political spotlight through essays in the *Wall Street Journal* in January 2007 and January 2008 by former Secretaries of State George Schultz and Henry Kissinger, former Secretary of Defense William Perry, and Senator Sam Nunn. Since then, numerous leaders from around the world, including President Obama, have expressed their support for the concept and there have been a number of international meetings to discuss it.

In December 2008, one hundred world leaders, including former U.S. and Soviet presidents Jimmy Carter and Mikhail Gorbachev, joined to form the "Global Zero

Campaign to Eliminate Nuclear Weapons." The goal of Global Zero is to "combine high-level policy work with global public outreach to achieve a binding agreement to eliminate all nuclear weapons through phased and verified reductions."[8] There is no question that this is a long-term effort. However, the world will be a safer, more secure, less hostile place when the vision of a world free of nuclear weapons is realized. Nuclear weapons deny the target population's essential humanity. They arouse feelings of anxiety, fear, and hostility, which can be more dangerous than the threats against which the weapons are directed.

Many steps remain before all nuclear weapons can be eliminated. Some steps, which appear doable in the near term, are discussed in Chapters 2 and 3. However, it may be many years before the last nuclear weapon is destroyed. The question remains, what are U.S. nuclear weapons for today? If our recommendations are followed, the United States will maintain a small but credible nuclear deterrent, until no other nation has nuclear weapons. Nuclear weapons will serve no other purpose. While we acknowledge the current reality of nuclear deterrence, we do not believe that nuclear deterrence is a legitimate or even a stable long-term position. Rather, we believe that continued reliance on nuclear weapons is morally unacceptable and dangerous. We recommend that the United States pursue a strategy that will lead to the verified and enduring elimination of nuclear weapons throughout the world as quickly as possible.

The term "weapons of mass destruction (WMD)," which lumps chemical and biological weapons with nuclear weapons, blurs the very real distinction we see between them.

This report does not prescribe the political and military security arrangements that should replace nuclear deterrence. Instead, we focus on nearer-term changes. We outline a transitional nuclear deterrent doctrine and the weapons stockpile needed to support it. We also propose a maintenance strategy and nuclear weapons complex for supporting a much smaller stockpile. Our plan points the United States in a new direction, positioning it to conduct negotiations with other nations on building the global institutional arrangements that will be required to supplant nuclear deterrence and pave the way toward eliminating nuclear weapons.

The immense destructive power of nuclear weapons sets them apart from any other type of weapon. The term "weapons of mass destruction (WMD)," which lumps chemical and biological weapons with nuclear weapons, blurs the very real distinction we see between them. The immense indiscriminant damage that would accompany the use of a nuclear weapon makes them unique. While we also view the prospective use of chemical or biological weapons as morally reprehensible, the effects of their use are different in scale and their production and use is already banned by international agreement. We believe that military means other than the threat of nuclear preemption or retaliation can and must suffice to address them. We recommend that the strategic posture of the United States eliminate any reference to the use of nuclear weapons in retaliation to (or in preemption of) other nations' use of chemical or biological weapons or to the generalized threat of "weapons of mass destruction."

Continued reliance by some nations on nuclear weapons, even solely to deter nuclear attack, preserves a discriminatory world order of nuclear haves and have nots. Inevitably, more of the have-nots will feel it is in their national security interest to

8 www.globalzero.org.

acquire their own nuclear weapons or position themselves to do so in a relatively short period of time. As more nations acquire nuclear weapons, the possibility that an international conflict will lead to their use increases exponentially. In addition, the spread of nuclear weapons around the world dramatically increases the possibility that a nuclear weapon, or the materials needed to fabricate one, will fall into the hands of terrorists or a state-sponsor of terrorism.

In the near term, it is unlikely that we can eliminate the risk that more nations will acquire nuclear weapons. However, the assertive use of nuclear threats—as was the policy of the Bush Administration—is the wrong way to go about preventing the emergence of new nuclear weapons states. The existence of a huge U.S. nuclear arsenal has not deterred any potentially hostile nation from acquiring nuclear weapons. Threats of preemptive or preventive nuclear strikes on smaller opponents stoke fears of political coercion and conventional military attack under the cover of a nuclear umbrella. These fears feed, rather than quench, the desire for national nuclear deterrents. A world free of nuclear weapons offers the greatest hope of reducing nuclear insecurity and achieving the coordinated international action that is necessary to prevent other nations from acquiring nuclear weapons. Until that can be achieved, it is in the interest of the United States to reduce the rhetoric and change the doctrine regarding potential first use of nuclear weapons.

The United States should eliminate nuclear threats completely from its global military posture and forego integrating the potential use of nuclear weapons with strategies for use of conventional force.

The nuclear security politics of the Cold War consisted of attempting to "reassure" friends and foes alike that the U.S. would resort to the use of nuclear weapons to defend its allies from all forms of aggression. Now, to halt the global spread of nuclear weapons, the U.S. and other nuclear weapons states must do the opposite. They must work together to convince all nations, regardless of their ideological hue, that they will never become targets of nuclear attack if they adhere faithfully to the requirements of the Non-Proliferation Treaty (NPT) and refrain from acquiring nuclear weapons or assisting others to do so.

The United States should eliminate nuclear threats completely from its global military posture and forego integrating the potential use of nuclear weapons with strategies for use of conventional force. The United States must live up to its democratic ideals, defending its interests primarily by engaging other nations through negotiation and reciprocal accommodation, without invoking a nuclear "ace-in-the-hole."

The United States must pursue a nuclear weapons policy directed at preventing the proliferation of nuclear weapons and weapons-usable material. We must lead in creating a global norm in which no new nation feels a need for its own nuclear deterrent and nations already possessing nuclear weapons join us in radical stockpile reductions and deemphasizing the strategic importance of nuclear weapons. Furthermore, the U.S. must respect the principles of the UN Charter and its constraints on the permissible uses of unilateral military force. This policy must reject any notion of an "exceptional" U.S. privilege, beyond the inherent right to self-defense enshrined in the Charter, to engage in the unilateral use of military force to further its interests or extinguish perceived threats anywhere on the globe.

Other than the use of nuclear weapons by others, the United States is not confronted by any credible threat to its security, or to that of its allies, which might require a threat of nuclear escalation to counter it. Therefore, the President and the Congress should declare, without qualification, that the United States will not be the first nation to use nuclear weapons in any future conflict. This "no first use" policy should be reflected in our nuclear force structure and readiness posture. U.S. nuclear forces should neither be structured nor postured for preemptive attacks against another nation's nuclear forces. It should be the declared policy of the United States that its nuclear forces are only for the purpose of deterring a nuclear attack. Since many fewer nuclear weapons are needed for such a "minimum deterrence" strategy, President Obama should begin to implement large reductions in U.S. nuclear forces. Furthermore, the U.S. by its actions, as well as its words, must seek to devalue nuclear weapons as instruments of national security, while fostering the establishment of global and regional security arrangements to facilitate their complete elimination.

The nuclear weapons posture of the United States exerts a significant influence on nuclear weapons programs in other countries. For example, we know from the history of nuclear weapons espionage and proliferation that foreign nuclear establishments closely follow technical and policy developments regarding U.S. nuclear weapons and the U.S. nuclear weapons complex. This is yet another reason for adopting the new paradigm for sustaining the U.S. nuclear deterrent outlined in this report, which limits changes to nuclear weapons.

Proliferation is also driven by regional anxieties and conflicts that are not directly linked to U.S. nuclear or conventional military capabilities. Regional tensions are a significant driver of nuclear weapons development in South Asia, the Middle East, and on the Korean Peninsula. Resolving tension in those regions must be seen as an important aspect of the strategic posture and nuclear weapons strategy of our nation. This requires adherence to a set of principles that will detach nuclear forces and threats of preemption from the process of resolving political and territorial disputes. Only then can negotiations reach beyond issues of national survival and attempt to reconcile the specific conflicting objectives that are causing tension. Regional military imbalances should be dealt with through cooperative security negotiations and arrangements to reduce such threats, or if necessary by adjustments in our own and allied conventional forces, not by the threatened use of nuclear forces or strategies for preemptive or preventive nuclear attacks.

In an ideal world, the question, "what are nuclear weapons for?" would be moot. There would be no nuclear weapons. As we move toward that vision, the United States should view its nuclear weapons for one purpose and one purpose only—to deter the use of nuclear weapons by others. The Department of Defense and the National Nuclear Security Administration (NNSA)[9] should structure U.S. nuclear forces and the weapons complex accordingly.

9 NNSA is the semiautonomous agency with the U.S. Department of Energy (DOE) that builds, modifies, maintains, and eventually dismantles U.S. nuclear weapons.

CHAPTER 2
Proposed Readiness Posture and Force Structure

We strongly support the vision of a world free of nuclear weapons as the ultimate goal of U.S. nuclear weapons policy. We recommend that President Obama clearly articulate that vision in a major speech. Similarly, Congress should establish, in legislation, the pursuit of a world free of nuclear weapons as the cornerstone of U.S. nuclear policy and the guiding principle for decisions regarding nuclear weapons and the future of the U.S. arsenal.

In Chapter 3, we discuss several steps, which can be taken in the short term (in addition to near term reductions in the number of nuclear weapons), to foster this vision. However, before the vision can be realized, all nations with nuclear weapons must first agree on an international mechanism for verifying the elimination of their weapons, and all nuclear nations must be willing to accept additional measures to limit access to nuclear explosive materials and the equipment capable of producing them. That will take some time. In the interim, we are left with the task of defining a nuclear force level for the United States that can lead the world on the path to zero, but also provide sufficient deterrence against the use of nuclear weapons by others along the way.

Congress should establish, in legislation, the pursuit of a world free of nuclear weapons as the cornerstone of U.S. nuclear policy.

The Cold War rationale for a stockpile of thousands of nuclear weapons no longer exists. Those numbers were based on assuming massive force-on-force exchanges between two hostile superpowers bent on achieving some hypothetical advantage by destroying the other side's capacity for nuclear war fighting. Such thinking was questionable then and is ludicrous today. Neither Russia, nor China, nor any other nation with a substantial nuclear arsenal, can be characterized today as an "enemy" of the United States. More importantly, no nation's nuclear weapons present a plausible threat to this country's ability to retaliate in kind to a nuclear attack upon the United States or our allies. That statement would hold even if the United States had substantially fewer nuclear weapons than it has today.

International terrorism is a serious challenge to our national security, but deterring or responding to the threat of a terrorist's use of nuclear weapons is simply not a relevant factor in the sizing of the U.S. nuclear arsenal. Terrorists are unlikely to be deterred by the threat of a U.S. counterstrike with nuclear weapons, even if an attack could be sourced to them. Even if they could be so deterred, there would be no benefit in having more than a few tens of warheads to deter or respond to any conceivable terrorist threat. As already noted, preemptive nuclear threats against terrorist organizations or hostile states bent on acquiring nuclear weapons are more likely to spur rather than discourage their interest in acquiring nuclear weapons.

Begin Reducing the Stockpile toward 500 Nuclear Weapons

What then is a reasonable basis on which to size the U.S. nuclear weapons stockpile? Based on the size of British, French, and Chinese nuclear forces, which are all estimated to be at or below 300 operational warheads, we recommend that the target for the next round of U.S. and Russian nuclear force reductions should be 500 total warheads each, including tactical nuclear weapons and any non-deployed warheads, spares, and reserves. All other U.S. and Russian nuclear weapons should be transferred from the custody of military forces to their respective nuclear weapons establishments. There, they should be placed in reciprocally verified secure storage, pending dismantlement and irreversible disposition of their fissile materials.

We recognize that the number 500 may appear somewhat arbitrary. However, we view getting to 500 total warheads each as a vital confidence-building step that is not complicated by the need to address the arsenal sizes of the other nuclear weapons powers. Once that step is completed, the U.S. and Russia should engage other nations in multilateral negotiations to reduce all nuclear arsenals further.

Russia is the only nation with a stockpile greater than that of the United States. Both nations' arsenals remain at least an order of magnitude larger than all other nuclear powers. In its 2001 "Nuclear Posture Review," the Bush Administration declared that it would no longer size its nuclear forces as if Russia were a threat. In reality, it continued to do so, planning first to deploy the maximum force allowed under the START I Treaty and later the SORT Treaty, which still allowed several times more nuclear weapons than the collective stockpiles of all other countries in the world, except Russia. While Russia is no longer an enemy of the United States, our nuclear force plans must still take into account the reality of Russian nuclear forces. The United States must retain sufficient nuclear weapons to deter a nuclear attack in the event of a dramatic change in the political situation in Russia. However, that does not mean that the number of U.S. nuclear weapons must be the same as Russia's.

We would prefer to see a verifiable treaty with Russia mandating reciprocal reductions before the United States makes any further significant reductions in its nuclear stockpile. The prospect for extending/replacing the Strategic Arms Reduction Treaty (START) between the U.S. and Russia is discussed in Chapter 3.[10] Such a treaty would not only provide the U.S. assurance that Russia will match U.S. reductions, but it would also lay the groundwork for the verification and transparency measures needed for other nations to join in moving toward the elimination of all nuclear weapons.

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10 The Strategic Arms Reduction Treaty (START) was signed in July 1991 and entered into force in December 1994. It required the Soviet Union (now Russia) and the United States to reduce and limit their strategic delivery vehicles to 1,600 each and their strategic warheads to about 7,500 each. The warhead limits have been overtaken by the SORT Treaty, but the limit on delivery vehicles is still in effect. More importantly, the START Treaty includes strict verification measures, which will expire at the end of 2009 if the treaty is not renewed. The original START Treaty (often referred to as START I) was followed by the signing of a START II Treaty in January 1993, which limited the use of multiple warheads on ICBMs, but that treaty never entered into force. Negotiations on a START III Treaty, with a goal of limiting strategic warheads on each side to 2,000–2,500 each, were conducted during the second half of the Clinton Administration, but never concluded. Those negotiations were superseded by the legally nonbinding limits of the SORT Treaty in 2002, which expire on December 31, 2012.

On the other hand, we believe that U.S. nuclear forces remain much larger than needed to deter a nuclear attack by Russia, or any other nation, and remain sufficiently survivable regardless of the size of the opposing force. Thus, even if U.S./Russian conclusion of a new START treaty is delayed, the U.S. should set an example by unilaterally reducing the size of its nuclear stockpile toward 500 total warheads. At the same time, it should continue to encourage similar reductions by Russia, and pursue negotiations toward a binding agreement between our two nations to reach the 500-warhead level. As a precaution, the U.S. should not dismantle all excess warheads, until a treaty is concluded with Russia or Russia transparently follows the U.S. lead in reducing its stockpile.[11] If the U.S. did so, it could lose leverage in negotiations with Russia for an agreement to verify the irreversible destruction of excess nuclear warheads, which is essential for achieving the longer-term goal of a world free of nuclear weapons.

We believe that U.S. nuclear forces remain much larger than needed to deter a nuclear attack by Russia, or any other nation, and remain sufficiently survivable regardless of the size of the opposing force.

During the campaign, Senator Obama stated, "As President, I will immediately stand down all nuclear forces to be reduced under the Moscow Treaty and urge Russia to do the same."[12] We believe the U.S. could go further and safely reduce its stockpile to less than half the level planned under the Moscow Treaty, before evaluating the extent to which Russia is following suit, either with or without a treaty.

The planning assumption in this report for sizing the U.S. nuclear weapons complex and for funding to maintain nuclear weapons is that the U.S. reaches the 500-warhead level between 2015 and 2020. However, that level might be reached sooner than 2015, if Russia significantly reduces its stockpile from the SORT limits, with or without a new treaty between our two nations.

There is precedent for Russia following the U.S. lead in reducing nuclear weapons or removing them from alert status. In September 1991, the first President Bush ordered that all 450 Minuteman II missiles and the missiles on 10 Poseidon submarines be deactivated. Those forces were scheduled to be removed under START I, which at that time had been signed but not ratified by the United States or Russia. At the same time, President Bush ordered the removal of all tactical nuclear weapons from U.S. naval vessels, which numbered about 350 warheads, the withdrawal of all land-based tactical weapons stationed outside the United States, and the removal of all nuclear bombers from alert status. Within ten days, Soviet President Mikhail Gorbachev announced that his nation would remove 500 silo-based missiles and the missiles on six of its ballistic missile submarines. He also announced the removal of all tactical nuclear weapons deployed on Soviet naval vessels, removal of all ground force tactical weapons stationed outside of Russia, and that Soviet bombers would stand down from high alert. The major reciprocal reductions in tactical nuclear weapons and the stand down of nuclear bombers from high alert took place without any formal agreement between the two nations.

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11 At triple today's pace of dismantlement, there would still be thousands of warheads awaiting dismantlement for the next decade in any event.

12 "Arms Control and the 2008 Election," Arms Control Association, September 24, 2008, www.armscontrol.org/2008election.

As U.S. warheads are removed from the active stockpile, they should be turned over from the custody of the Department of Defense to that of the National Nuclear Security Administration. NNSA should remove the tritium gas reservoirs, batteries, and neutron generators from those warheads and place them in secure storage pending dismantlement. While they await dismantlement, warheads should not be supplied with tritium or refurbished in any way. An inherent "hedge" under this strategy is that it will take some time to dismantle the thousands of recently and soon-to-be-retired warheads as the U.S. shrinks its deployed and reserve stockpiles. Under the George W. Bush Administration, the NNSA dismantled fewer than 350 warheads per year.[13] We propose increasing the pace of dismantlements to at least 800–1,000 per year. Even at the increased rate, more than 5,000 warheads would be awaiting dismantlement in 2015 if the active stockpile is reduced to 500 warheads by that date. While those warheads would serve as an inherent hedge against a sudden and dramatic shift in the world order, the U.S. should make no advance preparations or plans for returning those warheads to the active stockpile.

Relax the Readiness Posture of U.S. Nuclear Weapons

Maintaining a high alert status places a continuing burden on command and control systems to correctly identify and respond to a real attack, while never mistaking peaceful rocket launches or military flight tests for an attack in progress.

As the U.S. draws down its nuclear stockpile, it should redeploy the remaining nuclear forces in a manner that is not postured for a preemptive strike or a "prompt second strike" against another nation's nuclear forces. Deterrence requires an assured capability to respond in kind to a nuclear attack, but that response does not need to be immediate to be an effective deterrent. The United States and Russia each maintain roughly 2,000 nuclear weapons on land- and sea-based missiles on ready alert. Under a 1994 agreement between Presidents Clinton and Yeltsin, neither nation now officially maintains its nuclear missiles targeted on the opposing nation. However, that agreement has no real effect. Missiles can be supplied with targeting information and launched within minutes.

Maintaining nuclear weapons on a ready alert status is a carryover from the Cold War. In fact, a recent report found that U.S. strategic submarine patrols continue at near the Cold War tempo.[14] This high level of alert needlessly feeds an adversarial posture between two nations that generally are on otherwise cordial terms. It also elevates the seeming importance of nuclear weapons in our strategic policy and represents an unnecessary risk of mistaken, accidental, or unauthorized launch of a nuclear weapon. Maintaining a high alert status places a continuing burden on command and control systems to correctly identify and respond to a real attack, while never mistaking peaceful rocket launches or military flight tests for an attack in progress. On at least one occasion, in 1995, Russia began preparing to launch nuclear weapons against the United

13 "Weapons Stockpile Secrecy and Confusion," Hans M. Kristensen, *FAS Strategic Security Blog*, October 21, 2008, www.fas.org/blog/ssp/2008/10/stockpile.php.

14 Hans M. Kristensen. *U.S. Strategic Submarine Patrols Continue at Near Cold War Tempo.* FAS Strategic Security Blog, www.fas.org/blog/ssp/2009/03/usssbn.php.

States under the mistaken belief that a rocket launched off the coast of Norway to study the aurora borealis came from an American Trident submarine.[15]

The U.S. and Russia supposedly maintain nuclear weapons in a launch on warning status to protect against a massive nuclear strike by one of them against the other, which would limit the second nation's ability to retaliate. The idea of such a "bolt-from-the-blue" strike in today's world is preposterous. Reference to it should not be used to justify a continued launch-on-warning or launch-under-attack posture for our nuclear forces. The stake that Russia and China now have in the U.S. and its allies as economic partners render any such attack pointless, self-defeating, and of near vanishing likelihood.

Furthermore, no conceivable attack could harm U.S. nuclear forces sufficiently to forestall a devastating retaliation. U.S. ballistic missile submarines at sea are for all practical purposes undetectable and therefore invulnerable. Large numbers of land-based missiles would also survive all but the largest scale attack. The negative consequences of even the admittedly low risk of inadvertent or unauthorized launch of a nuclear weapon outweigh the risk of a deliberate nuclear first strike from Russia, or any other nation, based on their belief that it would not be followed by a devastating retaliation from this nation's surviving nuclear forces. In addition, should a future crisis occur in which the potential launch of nuclear weapons might be contemplated, de-alerting would allow for more rational deliberations, before either side takes steps that could lead to a nuclear apocalypse. De-alerting would also reduce world tension and help engender international support for a stronger non-proliferation regime.

Truly reducing the alert status of nuclear-tipped missiles requires steps well beyond simply changing the targeting instructions of those missiles. A 2003 study by the RAND Corporation[16] provides an extensive discussion of the advantages and disadvantages of measures to reduce the alert status of nuclear weapons, including:

- physically removing warheads from the missiles;
- removing batteries or other key electronics from missiles, warheads or guidance systems;
- placing large weights over the covers of missile silos or otherwise disabling the covers of silo-based missiles or the launching mechanisms of mobile missiles;
- disabling missile launch tubes on submarines; and
- keeping submarines beyond the range from which their missiles can reach targets of concern.

As with reducing the number of nuclear weapons, we believe that the United States can begin de-alerting its missile forces without prior assurance of Russian reciprocity.

15 See *Norwegian Rocket Incident,* Wikipedia, http://en.wikipedia.org/wiki/Norwegian_rocket_incident.

16 *Beyond the Nuclear Shadow: A Phased Approach for Improving Nuclear Safety and U.S. Russian Relations,* David E. Mosher, et al, Rand Corporation, 2003, p. 180, www.rand.org/pubs/monograph_reports/MR1666/index.html.

However, as the number of nuclear weapons is reduced, transparency and verification become more important. To maintain leverage in treaty negotiations on the necessary transparency measures, full de-alerting of U.S. nuclear forces should await reciprocal steps by Russia.

De-alerting a significant portion of U.S. missiles unilaterally could help ease Russian concerns about the potential vulnerability of its strategic forces and help that nation follow the U.S. lead in further reducing and de-alerting its nuclear forces. While we may view an attack by the United States on Russia as unthinkable, strategic analysts there have been acculturated to fear such an attack. Russia's higher proportion of land-based nuclear forces is technically more vulnerable to a first strike than U.S. forces, which are predominantly based at sea. Russia's submarines are less quiet than U.S. submarines and they do not operate over as wide an area. In addition, Russia's early warning system has significant deficiencies. Easing Russia's concern about the potential vulnerability of its strategic forces would give them the latitude to adopt a safer nuclear weapons posture of their own, reducing the chances of an accidental, or unauthorized Russian missile launch toward the U.S.

At least three other nations with nuclear weapons already maintain their forces in reduced states of readiness. China stores its warheads separately from their delivery vehicles and keeps its missiles unfueled. Britain has not provided details of its readiness posture, but has stated that it would take days rather than minutes to launch its missiles.[17] And, Pakistan reportedly keeps the nuclear and nonnuclear portions of its warheads separate from each other and from its delivery systems.

The Structure of a 500-Warhead Stockpile

There are many ways that the U.S. might structure a deterrent force of 500 warheads. With smaller forces, the British choose to rely on submarine launched ballistic missiles (SLBMs) only; the French have a mixture of SLBMs and aircraft deliverable bombs; and the Chinese have warheads that can be delivered by land-based missiles and aircraft. They are developing an SLBM, even though their stockpile numbers no more than 250 warheads.[18]

To determine the maximum size of the nuclear weapons complex that the U.S. needs to support 500 warheads, we conservatively assume that this country continues to include nuclear capable land-based missiles (ICBMs), SLBMs, cruise missiles, and bombers in its arsenal as it reduces to the 500-warhead level. We further assume that the U.S. retains some of each strategic system that is included in the Bush plan for 2012, but retires all tactical weapons. We believe there are no foreseeable threats to U.S. security that would require the U.S. to design any new warheads or to modify the military characteristics of existing warheads. That point is discussed in detail in Chapter 5. A representative nuclear weapons force structure meeting those assumptions might include:

17 Ibid. p. 90.

18 "Chinese Nuclear Forces," Robert S. Norris and Hans M. Kristensen, Nuclear Notebook, *Bulletin of the Atomic Scientists*, July/August 2008, p. 42.

- 288 warheads (a mixture of W-76s and W-88s) on 144 SLBMs (2 warheads/missile) deployed on 6 submarines (of which only 3 would be deployed at any given time);
- 80 warheads on single–warhead Minuteman ICBMs, with a mixture of W78 and W87 warheads; and
- 132 air-delivered weapons (e.g. 80 B61-7, B61-11, and B83 bombs and 52 W80-1 air-launched cruise missiles (ALCMs).

As discussed above, none of the bombs or cruise missiles would be loaded onto aircraft. Moreover, at least a portion of the warheads on SLBMs or ICBMs would be de-alerted and might be detached and stored separately from the missiles.

Our plan for maintenance of the stockpile, detailed in Chapter 5, calls for examining at least eleven units of each type of warhead every year, as is currently required. Assuming there are as many as seven warhead types in the stockpile and a turn-around time for surveillance of eight months, about ten percent of the warheads in the stockpile could be undergoing surveillance or maintenance at any time and be unavailable for deployment. In addition, half of the submarine force might be in port, in transit or training, or under repair at any time. That would still leave an "operationally deployed" force exceeding that of any other nation, except the current Russian force, which we expect would be reduced in parallel. We believe this level to be more than sufficient for the constrained mission of minimum deterrence.

Our maintenance plan also calls for destructive examination of one warhead of each type per year. For some time after the stockpile is reduced to 500 warheads, this requirement could be met from "retired" warheads of each type awaiting dismantlement, which have been deliberately assigned a "shelf-life" role approximating the environmental conditions in the deployed stockpile. Unless there is further progress on approaching a world free of nuclear weapons or the annual destructive examination protocol is modified the stockpile would eventually begin to lose up to seven warheads each year. If necessary, the lost warheads might be replaced by newly produced units. Our plan for the weapons complex would provide for a contingent capability to produce such replacement warheads, but we do not anticipate a need to do so.

The above force structure, which would maintain all existing warhead types, is a very expensive approach to a 500-warhead stockpile (see Appendix A). It would be less costly if the U.S. chose to deploy a force with fewer delivery systems and warhead types. For example, the U.S. could meet the 500-warhead level with a force based entirely on SLBMs. Such a force might consist of 432 warheads on 144 three-warhead SLBMs, deployed on six submarines, with the remainder of the allowable warheads used as maintenance spares and for rotation into the fleet to replace warheads withdrawn for surveillance testing. A deterrent based solely on SLBMs was considered during the Carter Administration.[19] The savings to the Department of Defense, in eliminating two legs of the strategic triad, would be huge. In addition, fewer resources would be needed in the weapons complex to maintain such a stockpile, which could consist solely of W76 and W88 warheads.

19 "Minimum Deterrence," Jeffrey Lewis., *Bulletin of the Atomic Scientists*, July/August 2008, p. 38.

In the 2008 Defense Authorization Act, Congress established a Commission on the Strategic Posture of the United States and instructed it to produce a comprehensive review of the U.S. strategic posture and to include in its report (expected in April 2009) a "qualitative analysis, including force-on-force exchange modeling, to calculate the effectiveness of the strategy [i.e. the number and type of nuclear weapons] under various scenarios." Our report addresses most of the questions that Congress raised. However, we do not present a force-on-force exchange model, because we see this analytical requirement as a relic of the past. It is symptomatic of the old think that drove U.S. and Soviet nuclear forces to absurd levels. The U.S. nuclear deterrent should not be postured for force-on force exchanges, but rather for intrinsic survivability for days or weeks after the initiation of a conflict. We believe that either of the force structures we describe could meet that requirement. In fact, a wide range of force structures with 500 warheads could meet the requirement for a credible, survivable deterrent. The details of how the U.S. structures its nuclear forces, within the limit of 500 warheads, are not as important as reducing the overall numbers.

CHAPTER 3

Additional Steps to Reduce the Threat of Nuclear Weapons

In today's world, the continuing proliferation of nuclear weapons, materials, and technology poses a more serious threat to the security of the United States than a deliberate large-scale nuclear attack. The U.S. must fundamentally alter its nuclear security policy to address the new threats more effectively. Steadfast, unified, and effective international cooperation is necessary to address proliferation, but international efforts have been weak and fragmented. A major reason for the lack of international cooperation against nuclear proliferation is that many non-weapons states view the nuclear weapons stockpiles of the Permanent Five (U.S., Russia, Great Britain, France and China), and the more recent arsenals that have arisen outside of the Non-Proliferation Treaty (India, Pakistan, and Israel), as more immediate threats to their security than further horizontal proliferation. Nations both fear and covet the special status that a nuclear arsenal seems to confer on its owner. They are reluctant to take stronger steps against proliferation, until the United States, Russia, and others take stronger steps to reduce their nuclear arsenals and strictly confine the use of their nuclear forces, and the threats they pose to international security.

Under the UN-sponsored nuclear Non-Proliferation Treaty (NPT), which entered into force in 1970, more than 185 nations have foresworn development of nuclear weapons in return for a pledge (in Article VI of the Treaty) by the United States, the other nuclear powers, and indeed all treaty signatories,

> *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.*[20]

That pledge was strengthened during the NPT Review Conference at the United Nations in April and May of 2000. All the nations participating, including the United States, agreed to thirteen "practical steps" to strengthen Article VI, including,

> *An unequivocal undertaking by the nuclear weapons States to accomplish the total elimination of their nuclear arsenals leading to nuclear disarmament to which all States parties are committed under Article VI.*[21]

The NPT is a bargain between the five nuclear weapons states (also referred to as the P-5, because they are the "permanent" members of the UN Security Council)

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20 Non-Proliferation Treaty (NPT), Article VI.

21 Final Document of the 2000 NPT Review Conference.

and the nonnuclear weapon states party to the treaty—the vast preponderance of the world's nations. Regrettably, the nuclear weapons states have not lived up to their side of the bargain. The resulting frustration impedes international cooperation in combating the threats of proliferation and nuclear terrorism. Indeed, during the 2005 UN Conference to review progress under the NPT, not a single measure was taken against North Korea or Iran to inhibit their efforts at obtaining nuclear weapons and not a single measure was agreed upon to strengthen international controls over nuclear materials and technology. Rather, arguments over the agenda—whether disarmament or non-proliferation should take priority in the discussions—occupied the entire week-long conference.

One important measure that the Obama Administration can take immediately to support the NPT and begin to restore international cooperation against proliferation is to affirm its support for the thirteen practical steps set forth in the Final Document of the 2000 NPT Review Conference.

As long as the US and Russia fail to reduce dramatically their nuclear arsenals and to engage the other nuclear weapons states in good faith negotiations directed toward elimination of nuclear arsenals, they frustrate improved international cooperation in non-proliferation and, thereby, endanger their own security. Weak international cooperation allows Iran, North Korea, and perhaps other nations to continue nuclear weapons development and weakens efforts to eliminate clandestine trafficking in nuclear materials and equipment.

As George Schultz et al appreciate, the vision of a world free of nuclear weapons is an essential element in gaining international cooperation against proliferation. In their January 2008 statement in the Wall Street Journal, they noted,

> *Progress must be facilitated by a clear statement of our ultimate goal. Indeed this is the only way to build the kind of international trust and broad cooperation that will be required to effectively address today's threats. Without the vision of moving forward toward zero, we will not find the essential cooperation required to stop our downward spiral.*[22]

One important measure that the Obama Administration can take immediately to support the NPT and begin to restore international cooperation against proliferation is to affirm its support for the thirteen practical steps set forth in the Final Document of the 2000 NPT Review Conference. Many of those are reflected in the recommendations in this report. However, statements alone are not enough. The measures discussed in the previous chapter and others discussed below are concrete actions the United States can take in furtherance of the thirteen practical steps. Only if the U.S. takes rapid action and makes real progress on these measures will it have any hope of gaining the international cooperation needed to deny Iran access to nuclear weapons, to dial back the North Korea weapons program, and to keep nuclear materials out of the hands of terrorists.

Reviewing the key steps already mentioned here, we recommend that the Obama Administration:

1. Declare that the only purpose of the U.S. nuclear weapons stockpile is to deter the use of nuclear weapons by other countries;

22 "Toward a Nuclear-Free World," George P. Schultz, William J Perry, Henry A. Kissinger, and Sam Nunn, *The Wall Street Journal*, Jan. 15, 2008, p. A13, http://online.wsj.com/public/article_print/SB120036422673589947.html.

2. Engage Russia in negotiations with the dual goals of reducing the alert levels of nuclear forces and reducing the nuclear stockpiles in each nation to 500 total weapons (including spares);
3. Immediately begin reducing its nuclear weapons stockpile and de-alerting a portion of its missile force, without waiting for the completion of formal treaty negotiations with Russia;
4. Unequivocally declare that the United States will not be the first to use nuclear weapons under any circumstance;
5. Remove all U.S. nuclear weapons based on foreign soil and decommission nuclear warheads and bombs associated with short- and theater-range delivery systems; and
6. Halt all development of new nuclear warheads and refrain from making any changes to the military characteristics of existing warheads.

Taken together, these measures will begin to devalue nuclear weapons as instruments of national security, reduce threats to other nations, and improve U.S. credibility regarding non-proliferation. The case for the first three recommendations has already been given in Chapter 2, the fourth and fifth are elaborated on below, along with additional steps that the United States should take to reduce the threat of nuclear weapons. The sixth recommendation and numerous other recommendations for managing the U.S. nuclear weapons stockpile and shrinking and consolidating the weapons production complex are discussed extensively in Chapters 5 and 6.

Declare a No First Use Policy

Offering a public declaration that the United States, under a specified range of circumstances, will not be the first to use a nuclear weapon against a nonnuclear weapon state has come to be known as a "negative security assurance." The converse promise, to come to the aid of a nation if it is attacked or threatened by another state with nuclear weapons, is called a positive security assurance. The United States and other nuclear powers have proclaimed each type over the years. However, no international treaty codifies any negative security assurances, despite repeated calls for such by nonnuclear weapon states and UN resolutions. Binding negative security assurances would help reduce the "nuclear insecurity" of nonnuclear weapons states and lessen one of the incentives for nations to develop their own nuclear weapons.

In 1978, President Carter's Secretary of State, Cyrus Vance, told a special session of the United Nations,

> *The United States will not use nuclear weapons against any non-nuclear weapons state party to the NPT or any comparable internationally binding commitment not to acquire nuclear explosive devices, except in the case of an attack on the United States, its territories or armed forces, or its allies, by such a state, or associated with a nuclear-weapon state in carrying out or sustaining the attack.*[23]

23 Statement of Secretary of State Vance, *Department of State Bulletin,* August 1978, p. 52.

That limited negative security assurance leaves room for the U.S. to use nuclear weapons in response to a conventional attack by a nonnuclear state, if another nuclear-armed state is implicated in the attack. Succeeding Presidential Administrations have nominally endorsed, but also further qualified that formulation.[24] In 1996, the Clinton Administration weakened the negative guarantee by stating that attacks by other weapons of mass destruction [i.e. chemical and biological weapons] would be justifying conditions for nuclear retaliation.[25] The Bush Administration undermined even these weak assurances in its 2001 Nuclear Posture Review, by claiming a right to use nuclear weapons to preempt the use of biological or chemical weapons.[26] By doing so, the Bush Administration transformed a statement meant to assure NPT member states that they do not need nuclear weapons into an incentive for nations to develop nuclear weapons to deter the U.S. from launching a preemptive attack. Indeed, while the United States did not use nuclear weapons this time, the Bush Administration's justification for invading Iraq, to preempt the development of suspected "weapons of mass destruction," may have strengthened Iran's commitment to develop a nuclear capability for its own defense.

China is the only one of the original nuclear weapon states that stands by a categorical assurance that it will not be the first to use or threaten to use nuclear weapons.

China is the only one of the original nuclear weapon states that stands by a categorical assurance that it will not be the first to use or threaten to use nuclear weapons. China underscores that assurance in its deployment practices, which would require days, if not weeks, to ready its nuclear forces for use. Russia, France, and the United Kingdom have all included similar caveats to those of the United States in their promises not to use nuclear weapons against nonnuclear states. An unequivocal declaration by the United States that it will not be the first to use nuclear weapons, combined with clear actions to back up that declaration, could help reduce the incentives for new nations to pursue nuclear weapons technology. Such a step would be even more effective if all five original nuclear powers issued it collectively or, at least, if Russia, France, and the United Kingdom followed China and the U.S. with similar declarations.

Rather than calming world tensions, U.S. politicians routinely fan the flames of nuclear insecurity by hinting at the use of nuclear weapons for particular purposes.

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24 "Carter's 1978 Declaration and the Significance of Security Assurances," John Steinbruner, *Arms Control Today,* Oct. 2008, p. 57.

25 Ibid.

26 "U.S. military forces … must have the capability to defend against WMD-armed adversaries, including in appropriate cases through preemptive measures. This requires capabilities to detect and destroy an adversary's WMD assets before these weapons are used." – *National Strategy to Combat Weapons of Mass Destruction*, The White House, Dec. 2002. The Bush Administration's July 2001 Report to Congress on "Defeat of Hard and Deeply Buried Targets" argued that "nuclear weapons have a unique ability to destroy both agent containers and CBW agents. Lethality is optimized if the fireball is proximate to the target …Given improved accuracy and the ability to penetrate the material layers overlaying a facility, it is possible to employ a much lower-yield weapon to achieve the needed neutralization." Its December 2001 *Nuclear Posture Review* cited "limitations in the present nuclear force: ..." "moderate delivery accuracy, limited earth penetrator capability, high-yield warheads, and limited retargeting capability," and argued "new capabilities must be developed to: defeat emerging threats such as hard and deeply buried targets; find and attack mobile and relocatable targets, defeat chemical or biological agents, and improve accuracy to limit collateral damage."

The phrase "no option is off the table," has become code for a thinly-veiled threat that the U.S. might use nuclear weapons to achieve limited military objectives. *This practice must stop.* U.S. officials should strive to devalue nuclear weapons as instruments of security, and reassure nations that do not possess them, rather than make threats regarding their use. We recommend that the strategic posture of the United States eliminate any reference to the use of nuclear weapons in retaliation to (or in preemption of) other nations' use of chemical or biological weapons or to the generalized threat of weapons of mass destruction. The United States should eliminate even veiled threats to use nuclear weapons from its global military posture.

The United States should eliminate even veiled threats to use nuclear weapons from its global military posture.

We recommend that the President and the Congress declare, without qualification, that the United States will not be the first nation to use nuclear weapons in any future conflict. Congress should enact a strong negative security assurance into U.S. law, making it clear that the only legitimate use of nuclear weapons is to deter their use by others and to respond in kind to an attack in which nuclear weapons are used.

Remove U.S. Nuclear Weapons from Foreign Bases

The United States has offered positive security assurances to NATO members and to other allies by extending the protection of its nuclear deterrent umbrella to those nations. In several cases, allies believed that the presence of U.S. nuclear weapons on their territory provided additional guarantees that the United States would come to their defense if they were attacked. As long as Europe faced a large, menacing Warsaw Pact, several nations wanted those weapons to be available for use on the battlefield to slow or stop a massive conventional attack. At one time, the United States had thousands of nuclear weapons deployed in as many as 23 nations and 5 overseas U.S. territories.[27] That number has now been reduced to less than 300 nuclear gravity bombs in six European countries—Belgium, Germany, Holland, Italy, Turkey, and the United Kingdom.[28]

The concept that nuclear weapons must now be forward deployed to slow or stop a massive conventional attack is outdated. Furthermore, there is little credence to claims that U.S. nuclear weapons are needed on foreign territory to guarantee that the United States would come to the defense of its allies. Today, U.S. nuclear weapons based in other countries serve no useful military or political purpose, but do require continuing supervision, training, and expenditures to remain invulnerable to attack or theft. Forward basing has become more of a liability than an asset.

In addition to the above measures, we recommend that the United States:

- Ratify the Comprehensive Test Ban Treaty;
- Negotiate a Fissile Materials Production Cutoff Treaty;

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27 "Deployments by Country, 1951–1977," Robert S. Norris, William M. Arkin, William Burr, Nuclear Notebook, *Bulletin of Atomic Scientists,* Nov./Dec. 1999. http://thebulletin.metapress.com/content/d661v3675t623824/fulltext.pdf.

28 "Status of U.S. Nuclear Weapons in Europe 2008," Hans Kristensen, www.fas.org/programs/ssp/nukes/_images/Europe2008.pdf.

- Reduce stores of separated plutonium (Pu) and highly enriched uranium (HEU) around the world;
- Increase transparency regarding U.S. nuclear weapons;
- Extend START and negotiate a follow-on treaty; and
- Prepare to go beyond the 500-warhead level.

Each of these measures supports one or more of the thirteen practical steps agreed to at the 2000 NPT Review Conference.

Ratify the Comprehensive Test Ban Treaty

The United States should ratify and seek early entry into force of the Comprehensive Test Ban Treaty (CTBT). Universal adherence to a CTBT is important both for limiting the proliferation of nuclear weapons and for slowing the development and improvement of nuclear weapon systems in those nations already possessing them, particularly the development of more powerful multi-stage thermonuclear weapon systems by those nations possessing only single-stage atomic weapons.

The United States was a driving force behind the negotiations that led to the conclusion of the CTBT in 1996. President Clinton was the first world leader to sign it. However, in October 1999, needing 67 votes in favor to achieve a two-thirds majority, the Senate failed to ratify the CTBT by a vote of 51-48. Treaty opponents claimed that it was unverifiable and that the United States could not indefinitely maintain the safety, security, and reliability of its nuclear weapons stockpile without testing. The Bush Administration did not seek Senate reconsideration of the Treaty, but did continue the U.S. moratorium on nuclear testing, which the U.S. initially entered at the behest of Congress in 1992.

The CTBT has now been signed by 180 states and ratified by 146. However, before it can enter into force, it must be ratified by all 44 countries that possessed nuclear research or power reactors in 1996. Of those 44 states, three—India, Pakistan, and North Korea—have not signed the treaty. A further six states—the United States, China, Egypt, Indonesia, Iran, and Israel—have signed, but not yet ratified the treaty.

The United States joined Russia in a moratorium on nuclear weapons tests in 1992. Since 1996, when China became the last of the five recognized nuclear weapons states to conduct a test, only India and Pakistan, in 1998, and North Korea, in 2006, have tested nuclear weapons. Ratification of the CTBT by the United States would send a strong message to the world regarding its new strategic posture and would greatly strengthen the NPT. China has stated it would ratify the CTBT when the U.S. does so. With all five permanent members of the Security Council on board, parties to the treaty could bring stronger pressure on the remaining holdouts.

Concerns about effective verification of the CTBT were questionable in 1999 when the Senate rejected the treaty. Since then, verification techniques have improved and detection networks have been expanded. Worldwide systems can now reliably detect tests below levels that would be necessary for any potential proliferant or advanced nuclear weapons state seeking to confirm the performance of a new nuclear weapon.[29] Additional means of verification would become available once the treaty enters into force. The CTBT's verification regime includes an extensive international monitoring system employing: seismological stations, radionuclide and noble gases detectors, hydroacoustic monitoring for sound waves caused by a nuclear explosion in the ocean, and infrasound monitoring of low frequency sound waves in the atmosphere. Most importantly, the treaty provides for confidence-building measures and on-site inspections of suspected test areas to resolve any ambiguities regarding suspicious events.

We recommend that the Obama Administration move promptly to resubmit the CTBT to the Senate for its advice and consent to ratification.

We recommend that the Obama Administration move promptly to resubmit the CTBT to the Senate for its advice and consent to ratification, as the new President has said he would. In addition, the Administration should affirm its intent to stand by the testing moratorium and should maintain the U.S. nuclear weapons stockpile in a manner that will reduce the possibility that uncertainties arising from excessive modifications to stockpile designs will create pressure to resume testing in the future. We believe that the U.S. can maintain the reliability and safety of its nuclear weapons stockpile indefinitely, without testing, especially if the Obama Administration changes its predecessor's approach to maintaining the stockpile. Those changes are discussed in Chapter 5. The benefits of a CTBT far outweigh any risk to the reliability of the U.S. stockpile. Furthermore, in the unlikely event that a test is needed to protect this nation's security, the treaty includes a provision that allows for withdrawal if it is in the supreme interest of a nation to do so.

While ratifying the CTBT is important, it would be a mistake for the Obama Administration to strike a deal with the weapons labs to give them more resources and leeway for modifying or improving nuclear weapons in return for their support for the treaty, as some have suggested. Increasing R&D spending on nuclear weapons technology or improving nuclear weapons would send the wrong message to the world regarding the continuing importance of these weapons in U.S. security policy, open the U.S. to charges of nuclear hypocrisy, and undercut many of the political benefits of ratifying the CTBT.

Negotiate a Fissile Materials Production Cutoff Treaty

The U.S. should also take steps to stimulate the stalled international negotiations toward a verifiable Fissile Materials Production Cutoff Treaty (FMCT). The concept of a treaty to cut off the production of fissile material for nuclear weapons has been discussed on and off for more than five decades, but there has been little formal progress. Preparations to begin formal negotiations on a treaty, in the UN Conference on Disarmament, are deadlocked over two issues—whether to include existing stocks of fissile material in the treaty and whether to require technically credible verification of the treaty's obligations. The Bush Administration supported a FMCT, but refused to include existing stocks of fissile materials in the discussions and maintained

29 "The Comprehensive Test Ban Treaty: Effectively Verifiable," David Hafemeister, *Arms Control Today*, October 2008, www.armscontrol.org/act/2008_10/Hafemeister.

that a FMCT could not be effectively verified. In an apparent reversal of the Bush Administration position, the White House website now states, "Obama and Biden will negotiate a verifiable global ban on the production of new nuclear weapons material."[30] However, the new Administration has given no further details.

We recommend that the U.S. seek to jump-start negotiations on an FMCT at the UN Conference on Disarmament by agreeing to begin the negotiations with no preconditions. Once treaty negotiations begin, the U.S. should seek a verifiable treaty that addresses existing stocks of fissile materials as well as new production. Pending a treaty, the U.S. should, without delay, show its good faith by reaffirming that it will not produce any fissile materials for weapons purposes.

We further recommend that all separated civil and excess military plutonium in the United States (including non-weapons grade) be made available, in non-weapons form or otherwise protecting weapons design information, for IAEA safeguards, except for material in warheads in the active stockpile or in a 500 kg working inventory. The working inventory would be sufficient for NNSA to produce as many as 20 pits per year for five years, without having to withdraw any weapons from the active inventory to obtain pits for remanufacturing, should the Government decide to replace pits in existing warheads. Similarly, we recommend that all HEU in the United States also be made available for IAEA safeguards, except that in warheads and in a 2,000 kg working inventory for replacement warheads,[31] or in the pipeline for use as fuel for naval vessels.[32]

Reduce Stores of Separated Pu and HEU around the World

Beyond placing its civil and excess military fissile material under safeguards, the U.S. should seek to reduce significantly the amount of separated Pu and HEU both in this country and around the world, with the ultimate goal of eliminating all such materials in concert with the vision of a world free of nuclear weapons. The most urgent objectives in this regard are the global elimination of civil and poorly secured military stocks of HEU. The U.S. and Russia have cooperated for more than fifteen years to improve significantly the security of civil and some military stockpiles of fissile materials that were at risk after the collapse of the Soviet Union. In addition, more than 345 metric tons of HEU from Russian nuclear weapons and 100 metric tons from American weapons have been blended down for use as fuel for civil nuclear reactors. However, more work remains to be done in both of those areas.[33]

30 www.whitehouse.gov/agenda/foreign_policy.

31 2,000 kg is roughly the amount contained in 100 canned subassemblies. NNSA might choose to store most of its working inventory in the form of existing canned subassemblies of various designs.

32 HEU reserved for future use in naval vessels could also be placed under IAEA safeguards with a provision that it might be withdrawn from safeguards for use as fuel for naval vessels. However, the U.S. should strive to modify its naval reactors to run on 20% enriched uranium, so the HEU could be blended down to that level before it is removed from safeguards.

33 "Securing the Bomb 2008," Matthew Bunn, Project on Managing the Atom and Nuclear Threat Initiative, Nov. 18, 2008.

The U.S. and Russia have exchanged information regarding the amounts of HEU and plutonium they consider excess to their weapons needs. They are also nominally engaged in parallel programs to dispose of portions of those excess stockpiles. However, progress in disposing of excess weapons plutonium has been very slow. The programs in each country to blend down HEU from weapons into fuel for nuclear reactors could also move faster. The two nations have yet to share any information on the total amounts of Pu and HEU that they have produced or now possess or to begin discussions on permanently capping and reducing their fissile material stockpiles available for use in weapons. At the very least, they need to begin exchanging information and providing additional transparency regarding the amount of fissile material that each side has produced over the past seven decades and where that material now is. That information will become increasingly important as the number of nuclear warheads that each side possesses declines. If the uncertainty in accounting for fissile materials becomes a significant fraction of remaining military stockpiles, further nuclear arms reductions could grind to a halt. Bilateral information exchanges on fissile materials between the U.S. and Russia are also important to prepare for an international fissile materials cutoff treaty.

About 130 mostly small research reactors around the world are still fueled by HEU, despite the fact that technology exists to fuel all but a handful of them with LEU, without any reduction in their capabilities. Many of those facilities do not meet basic International Atomic Energy Agency security recommendations and only a small percentage have security upgrades adequate to protect against demonstrated terrorist and criminal capabilities.[34] We recommend that the Obama Administration place greater emphasis and more resources on securing all fissile materials and, in particular, on reducing the use of HEU in civil reactors and research facilities throughout the world. Early indications are that this is indeed the Administration's plan.

Increase Transparency Regarding U.S. Nuclear Weapons

Classifying much basic information about the U.S. stockpile … serves no legitimate national security objective.

We recommend that the Obama Administration declassify all information pertaining to U.S. nuclear weapons, the public release of which would not weaken our national security. Classifying much basic information about the U.S. stockpile, such as the numbers and schedules for each type of weapon being retained, refurbished, or retired from the stockpile, serves no legitimate national security objective. On the other hand, it limits public debate about U.S. nuclear weapons policies and complicates informed decision making by the Congress. Furthermore, releasing information about U.S. nuclear weapons would be a significant confidence building measure, which could spur arms control negotiations, especially if other nations follow with similar releases of information about their nuclear weapons.

We recommend that the Obama Administration declassify and release the following information:

- The numbers and types of nuclear weapons currently in the U.S. stockpile and plans for the future;

34 Ibid.

- The numbers and types of warheads awaiting dismantlement and past, present and projected rates of dismantlement by warhead type;
- Basic information regarding each type of nuclear weapon in the stockpile or awaiting dismantlement, such as their yield and when they were built, modified, or refurbished;
- The aggregate amounts of Pu, HEU, and tritium contained in: (a) nuclear weapons in the active and reserve stockpiles (b) material stockpiles reserved for use in nuclear weapons, including material in components and weapons awaiting dismantlement (c) stockpiles reserved for other uses (e.g. naval propulsion and radioisotope power sources) and (d) amounts declared excess to weapons and other military uses and made available for disposition or civil use;
- General information on the history and types of problems or concerns that have arisen in the stockpile since the end of the Cold War and how they were resolved; and
- Plans and schedules for maintenance and Life Extension Programs (LEPs), including what components are to be changed, the reason(s) for the change(s), analysis of how change(s) can be avoided, and cost estimates.

The information in the last two bullets is key to having an informed public debate on issues such as how best to maintain the future reliability and safety of the stockpile, without nuclear testing. Detailed information about potential problems or any significant, current vulnerability in U.S. nuclear weapons must of course remain classified, but there is much general information about U.S. maintenance history and practices that need not remain secret and would better inform national debate over the role of nuclear weapons and the best use of taxpayer dollars.

Extend START and Negotiate a Follow-on Treaty

The bilateral U.S.-Russia Strategic Arms Reduction Treaty (START) expires at the end of 2009. The implied limits on warheads under START I, which were agreed to in 1989, have been overtaken by the warhead limits in the Moscow Treaty. However, START I also limits strategic delivery vehicles and contains important transparency and verification measures, which will be lost if that treaty is not extended.

Russia and the United States have had some recent exchanges regarding extending/replacing START, but are not yet engaged in substantive negotiations. In October 2008, the Bush Administration sent Moscow a draft of a new START agreement. One promising element of that draft is that it reportedly would set legally binding limits on the number of nuclear warheads in each country's arsenal. Whether those limits would apply to total nuclear weapon stockpiles, or to some "operationally deployed" subset, as in the Moscow Treaty, is not yet known.[35] However, the Bush draft would remove the limits on delivery vehicles, which have been a mainstay of the

35 "US Makes New Proposals to Russia on Missile Defense, Strategic Arms," David Gollust, Voice of America, U.S. State Department, Nov. 6, 2008, www.voanews.com/english/2008-11-06-voa57.cfm.

B-52 Stratofortress Boneyard in Tucson, Arizona. Retired warheads and delivery vehicles would be dismantled under our plan.

START Treaty. The Bush Administration had previously been disdainful of including verification measure in any arms control treaties. It is not known whether the Bush Administration's October 2008 draft of START provides for verification.

In February 2009, the Obama Administration announced its intent to seek a limit of 1,000 warheads in the next round of START negotiations. It is unclear what exactly that figure represents, but it appears that the Administration is referring to the counting rules of the 2002 Moscow Treaty, which apply to only "operationally deployed strategic warheads." That would allow each side to retain thousands of additional warheads. Quick agreement on an interim ceiling of 1,000 operationally deployed strategic warheads, combined with a reduced number of strategic nuclear delivery vehicles within the current START framework, is a good first step. However, this should be merely a stepping-stone to a comprehensive verifiable treaty with a ceiling of 500 *total* warheads in the active and reserve stockpiles of each nation.

On March 3, 2009, Reuters reported that Russia wants to replace, rather than extend, the START agreement and that it wants the United States to agree to limits on delivery vehicles in the new agreement.[36] No numbers have been reported regarding the Russian position.

36 "Russia wants US to limit nuclear delivery vehicles," Guy Faulconbridge, Reuters. March 3, 2009, http://in.reuters.com/article/worldNews/idINIndia-38296020090302.

We recommend that the U.S. and Russia strengthen the verification measures of START I and include new transparency measures.

START I has a stringent transparency and verification regime including detailed data exchange, extensive notifications, twelve types of on-site inspection, and continuous monitoring activities designed to help verify that the signatories are complying with their treaty obligations. It is important that those provisions not be lost. However, we do not believe it is possible to negotiate a new START agreement in a matter of months, which would fully reflect the reductions in nuclear weapons and delivery vehicles that we support. Therefore, we recommend that the Obama Administration make every effort to extend the START Treaty with Russia, before it expires at the end of 2009, with only modest reductions from the SORT levels, so the important measures in the existing treaty are not lost. If Russia agrees, the extended treaty could reflect President Obama's stated intent to seek a limit of 1,000 warheads, regardless of whether that limit refers to total warheads or only operationally deployed strategic warheads. It should also include some limit on delivery vehicles.

At the same time, the U.S. and Russia should speed up negotiations for a follow-on treaty.

Improved transparency regarding the nuclear weapons programs of all nations will be essential for going beyond the 500-warhead level.

The U.S. goal in those negotiations should be a verifiable treaty with a limit of 500 total warheads in the active and reserve stockpiles of each nation and with commensurate reductions in delivery vehicles for strategic weapons. Furthermore, we recommend that the U.S. and Russia strengthen the verification measures of START I and include new transparency measures, which will not only facilitate bilateral verification, but will begin to provide assurance to nations outside of the bilateral treaty that the two countries are making real progress toward deep and irreversible reductions in their nuclear arsenals.

As the number of nuclear weapons is reduced, it will become increasingly important to introduce such enhanced transparency measures not only for nuclear warheads and delivery vehicles, but for fissile materials as well. Improved transparency regarding the nuclear weapons programs of all nations will be essential for going beyond the 500-warhead level.

Prepare to Go Beyond the 500-Warhead Level[37]

It is not too early to begin considering how to reduce nuclear weapons beyond the 500-warhead level. Deeper cuts are likely to require a verifiable, multilateral treaty involving not only the U.S. and Russia but also France, Britain, and China. Eventually, India, Pakistan, Israel, and any other nation that has nuclear weapons, will need to join in first limiting and then reducing the size of their nuclear arsenals, if the trajectory toward global elimination is to be maintained. As national stockpiles approach zero, a new international treaty will be needed to supplement or replace the NPT in order to prevent the introduction of new nuclear weapons in any nation.

37 For an excellent discussion of the issues involved in reducing to very low levels of nuclear weapons, see "The Future of U.S. Nuclear Weapons Policy," Committee on International Security and Arms Control, The National Academy of Sciences, National Academy Press, Washington, D.C. 1997.

We think it is fine for the next round or two of nuclear weapons cuts to be based on a combination of unilateral initiatives and bilateral agreements between the U.S. and Russia. However, we recommend that at least three years before either of them is scheduled to reach the level of 500 warheads, the United States and Russia should include France, Britain, and China in discussions on multilateral monitoring arrangements to provide transparency on the number of warheads and delivery vehicles that each of those five nations possess. Those discussions should eventually lead to a binding, verifiable treaty specifying the next round of significant reductions that each of those five nations should make to their nuclear forces, including warheads and delivery vehicles.

The final steps toward eliminating nuclear weapons will be increasingly difficult. One possible interim step, prior to their elimination, could be for nations to place a small number of remaining nuclear weapons (perhaps up to 100) under international control through the authority of the UN Security Council or some other body. It is not clear where those weapons might be located or how they would be controlled. However, the warheads could be stored separately from their delivery vehicles. In addition, the nuclear components of warheads and the nonnuclear components needed to initiate an explosion might also be separated. Of course, strict verification measures would have to be in place well before then to help determine that nations have not retained secret stockpiles.

CHAPTER 4

The Nuclear Weapons Complex

The National Nuclear Security Administration (NNSA), a semi-autonomous arm of the U.S. Department of Energy (DOE), has operational responsibility for maintaining the U.S. nuclear weapons stockpile. In partnership with the Department of Defense, NNSA is responsible for assuring that the United States has a safe, secure, and reliable nuclear deterrent. NNSA also dismantles nuclear weapons after they are removed from service. In the past, the same organization designed, built, and tested new nuclear weapons, but the United States has not developed a completely new nuclear weapon in nearly two decades.

NNSA carries out its nuclear weapons related mission through a program it calls Stockpile Stewardship. Under Stockpile Stewardship, NNSA performs research to better understand and predict the performance of nuclear weapons, conducts surveillance and testing to examine their condition, and modifies and refurbishes existing nuclear weapons to improve their performance and extend their lifetime.

NNSA conducts its activities at eight major sites around the country, which are collectively referred to as the nuclear weapons complex. The eight sites are:

- Los Alamos National Laboratory (LANL) in Los Alamos, NM;
- Lawrence Livermore National Laboratory (LLNL) in Livermore, CA;
- Sandia National Laboratory (SNL), which has facilities in Albuquerque, NM and Livermore, CA;
- The Pantex Plant near Amarillo, TX;
- The Y-12 Site in Oak Ridge, TN;
- The Nevada Test Site (NTS) near Las Vegas, NV;
- The Kansas City Plant (KCP), in Kansas City, MO; and
- The Savannah River Site (SRS) near Aiken, SC.

NNSA also conducts flight tests of nuclear weapons at the Tonopah Test Range near Tonopah, NV, which is managed by SNL.

After two and one-half years of work, NNSA released a *Final Supplemental Programmatic Environmental Impact Statement (SPEIS) on Complex Transformation* in October 2008. According to NNSA, the SPEIS “analyzes the potential environmental impacts of reasonable alternatives to continue transformation of the nuclear weapons complex to be smaller, more responsive, efficient, and secure in order to

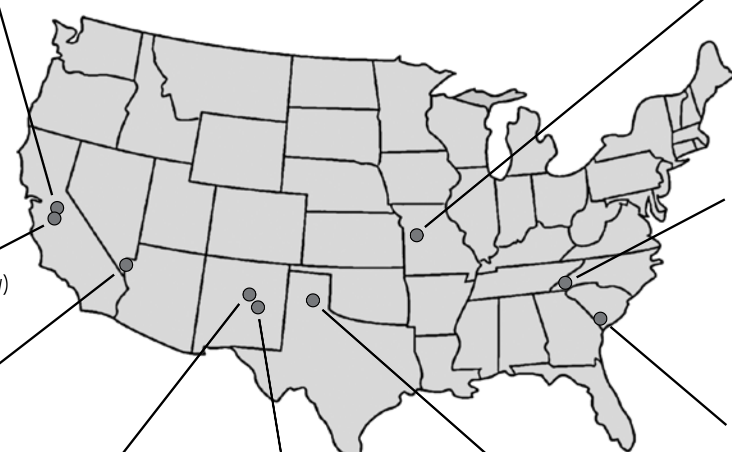
Nuclear Weapons Complex Consolidation Policy Network

Our Plan for Shrinking the Complex from Eight Sites to Three by 2025

Lawrence Livermore National Lab
Current Activities/Capabilities:
Nuclear Design/Engineering
Plutonium R&D
High Explosives R&D
Tritium R&D
Hydrotesting
Weapons Env. Testing
Our Plan:
Transferred out of weapons programs by 2012.

Sandia - CA
(see NM Site below)

Nevada Test Site
Current Activities/Capabilities:
Underground Test Readiness
High Explosives Testing
Hydrotesting
Our Plan:
Transferred out of weapons programs by 2012.



Kansas City Plant
Current Activities/Capabilities:
Non-nuclear Components Production
Our Plan:
Weapons activities end by 2015.

Y-12 National Security Complex
Current Activities/Capabilities:
Production and Dismantlement of Secondaries
HEU Operations
Our Plan:
Weapons activities end by 2025.

Savannah River Site
Current Activities/Capabilities:
Tritium Extraction, Loading, Unloading
Tritium R&D
Our Plan:
Weapons activities end by 2020.

Los Alamos National Lab
Current Activities/Capabilities:
Nuclear Design/Engineering
Plutonium R&D and Pit Production
Assembly/Disassembly of Secondaries
Tritium Operations
Some Non-nuclear Components
High Explosives R&D
Hydrotesting
Weapons Env. Testing
Our Plan:
Reduce weapons/plutonium R&D.
Pit production capability put on cold standby.
Replace tritium in the residual stockpile.
Transfer high explosives R&D to Pantex.
Reduce Weapons Env. Testing.
Maintain capabilities for surveillance and certification.

Sandia National Laboratories
Current Activities/Capabilities:
Non-nuclear Design/Engineering
Some Non-nuclear Component Production
Explosive Components R&D
Major Weapons Env. Testing
Our Plan:
End weapons activities in CA.
Reduce weapons R & D in NM.
Maintain capabilities for surveillance and certification.
Fabricate more types of nonnuclear replacement parts for fewer weapons.

Pantex Plant
Current Activities/Capabilities:
Weapons Assembly/Disassembly
High Explosives R&D and Production
Weapons Dismantlement
Plutonium Pit Storage
Our Plan:
Increase weapons dismantlement.
Increase capacity for pit storage.

Residual Capabilities
in a 3-site Nuclear Weapons Complex Supporting 500 Warheads

[Note: In "Environmental Testing" the Labs subject nuclear weapons to extremes of temperature, vibration, shock and radiation to mimic the conditions of delivery to the target and ensure their performance during a nuclear war.]

April 2009

FIGURE 1: The Nuclear Weapons Complex today and following consolidation to support a stockpile of 500 or fewer nuclear weapons.

meet national security requirements."[38] On December 19, 2008, NNSA published two "Records of Decision" in the Federal Register setting forth its plans for Complex Transformation. According to NNSA, those decisions will result in a smaller and more efficient weapons complex.

However, under NNSA's plan, nuclear weapons activities would continue indefinitely at all eight existing sites. We believe that NNSA's plan, which was based on continuing support for a stockpile of several thousand weapons and the saber-rattling strategy of the Bush Administration's 2001 Nuclear Posture Review for employing them, was woefully outdated before it was even published. In Chapters 5 and 6 of this report, we present a plan for a smaller, more secure, less costly complex to support the nuclear weapons stockpile as it is reduced to 500 weapons and beyond.

Our complex would be: 1) steeply reduced in scale; 2) an interim step toward a nuclear weapons free world; and 3) would result in no net increase in nuclear weapons activities or funding at any of the three remaining sites. Shrinking and consolidating the nuclear weapons complex would demonstrate U.S. leadership toward a world free of nuclear weapons and would save taxpayers billions of dollars.

While we are confident in the merits of our plan, we strongly emphasize that due process needs to be followed before it can be implemented. For example, there has to be analysis and public review of such a "major federal action" under the National Environmental Policy Act to insure that potential environmental impacts are properly considered, mitigated, or best of all avoided. Environmental justice issues and Tribal concerns must also be met, the latter on a government-to-government basis as needed. We believe these important concerns can be satisfactorily met, because shrinking the nuclear weapons complex, made possible by a dramatically reduced and technologically stable stockpile, should result in reducing the overall level of activity at each of the three remaining sites (with the possible exception of a short-term increase in dismantlements at Pantex). Another way of saying this is that existing capacity at the three remaining sites could adequately meet the residual workload, as an interim step toward total, global nuclear disarmament. We reiterate, before any major missions are transferred from one site to another within the weapons complex there must be due process involving all potentially impacted communities.

The rest of this chapter provides descriptive summaries of the facilities and activities at each of the sites in today's nuclear weapons complex and presents NNSA's plans under Complex Transformation for each site. The following chapters give details on our proposed changes.

Los Alamos National Laboratory

Description and Current Mission

Los Alamos National Laboratory (LANL) in northern New Mexico was founded to conduct the Manhattan Project's nuclear weapons research during World War II. Preliminary studies to develop the first nuclear weapons were conducted at

38 Final SPEIS on Complex Transformation, op. cit. cover sheet.

universities across the country. The difficulties in managing a secret project scattered in many locations indicated the need for a centralized laboratory dedicated to that purpose. Manhattan Project scientific director J. Robert Oppenheimer along with General Leslie Groves and physicist Ernest Lawrence decided on the location. Originally known as "Site Y," the Lab has also been called the Los Alamos Laboratory and Los Alamos Scientific Laboratory.

The work of the Manhattan Project culminated in the July 1945 Trinity Test near Alamogordo, New Mexico, followed in August by the HEU bomb dropped on Hiroshima, and the plutonium bomb dropped on Nagasaki. Following WWII the Lab continued to develop nuclear weapons, including thermonuclear weapons—the modern "H-bombs."

LANL's total annual budget is $2.1 billion, of which two-thirds is dedicated to nuclear weapons research and production programs.

The University of California managed LANL for most of the Lab's history. However, in 2003, the Department of Energy opened the management contract up to other bidders. In June of 2006, management of the Lab was taken over by Los Alamos National Security, LLC, a for-profit corporation of partners that include the University of California, Bechtel Corporation, Washington Group International, and the Babcock and Wilcox Technical Services Group. The Lab has approximately 11,000 employees, including subcontractors, of which 6,100 are involved in nuclear weapons activities. LANL's total annual budget is $2.1 billion, of which two-thirds is dedicated to nuclear weapons research and production programs.

The Laboratory currently:

- conducts research, design, and development of nuclear weapons;
- provides assessments and certification of stockpiled weapons;
- maintains production capabilities for limited quantities of plutonium pits for delivery to the stockpile;
- maintains capabilities for R&D and fabrication of enriched uranium, depleted uranium, and other uranium isotope mixtures for hydrotests and joint test assemblies and fabrication of components for secondary assemblies;
- manufactures nuclear weapon detonators for the stockpile;
- conducts tritium R&D;
- conducts hydrodynamic testing;
- conducts high explosives R&D;
- conducts environmental testing of nuclear weapons to determine their survivability in hostile conditions they may experience; and
- designs and tests advanced technology concepts.

Major Facilities at LANL[39]

The **Chemistry and Metallurgy Research (CMR) Building** was built in 1952 and is LANL's largest facility (550,000 sq-ft). However, it is now only 50% operational because of safety and contamination concerns. It is located in the densely populated Technical Area-3, and directly supports nuclear programs at TA-55, particularly plutonium pit production. CMR operations include analytical chemistry involving destructive and nondestructive analysis; materials characterization; and actinide R&D that may include separation of medical isotopes from targets and processing of neutron sources. In February 2004, the NNSA decided to replace the CMR Building with a new CMR Replacement (CMRR) Facility at TA-55 and to completely vacate and demolish the old CMR Building, for which a firm date has still not yet been set.

The **Plutonium Facility-4 (PF-4)** in TA-55 is the only fully functioning plutonium facility used for pit manufacturing in the U.S. nuclear weapons complex. Its capabilities include plutonium casting, fabrication, and machining; plutonium recovery; analytical chemistry; metal preparation; and destructive and nondestructive analysis in support of surveillance and certification. An SNM storage vault is also located at TA-55. In close proximity to PF-4 is the CMRR radiological light lab and office building, currently under construction. The proposed CMRR Nuclear Facility, if built, would also be located in TA-55 adjacent to PF-4.

Also within TA-3, **Sigma Complex** hosts research, development, and characterization of materials; fabrication from metals, ceramics, salts, beryllium, enriched uranium, depleted uranium, and other uranium isotope mixtures; analysis and fabrication of tritium reservoirs; fabrication of nonnuclear components for hydrotests and joint test assemblies; and fabrication of components for pits and secondary assemblies.

The **Nicholas C. Metropolis Center for Modeling and Simulation** serves the Accelerated Strategic Computing Initiative. This facility houses extremely fast supercomputers, high-speed networks, visualization centers, and interactive data analysis.

The **Dual Axis Radiographic Hydrodynamic Test Facility (DARHT)** is used to perform nonnuclear hydrodynamic experiments to study and measure the implosion process of plutonium pits. In May 2008, NNSA announced that DARHT was fully operational, but there have been continuing difficulties, delays, and cost overruns in getting the second axis online. The second axis must function to produce stereoscopic views. Hydrotesting has always played a pivotal role in verifying nuclear weapons designs.

The Los Alamos Neutron Science Center (LANSCE) hosts a high intensity proton linear accelerator and the **Weapons Neutron Research** facility, where high energy, unmoderated neutrons and protons are used for weapons-related and other basic and applied research. Also at LANSCE is the **Lujan Center**, which employs moderated spallation neutrons for research and engineering in condensed matter science.

39 Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico (SWEIS) (DOE/EIS-0380), U.S. Department of Energy (DOE), NNSA, May 2008, www.doeal.gov/laso/NEPASWEIS.aspx.

High Explosives Processing facilities spread across several Technical Areas are used to evaluate explosives from weapons returned from the stockpile; develop and characterize new explosive materials; develop waste treatment methods; and fabricate materials and parts for hydrodynamic tests.

Firing sites for explosive tests at several Technical Areas are used to conduct explosive experiments and studies using depleted uranium in dynamic experiments and hydrodynamic tests.

Tritium operations at the **Weapons Engineering Tritium Facility (WETF)** include high-pressure gas filling and processing and testing operations for boost gas systems for nuclear weapons. The facility supports the surveillance of gas delivery systems in the current stockpile and studies the aging of these systems.

Located in several Technical Areas, the **Bioscience Facilities** conduct research into detecting and countering biological threats; modeling disease management, infection and immune response; surveillance of disease spread; protein engineering; theoretical science for development of new vaccines, and genome-scale measurements and analysis. A newly completed BioSafety Level-3 facility, which would handle select bioweapons agents such as anthrax and plague, has sat idle since January 2004 as the result of a lawsuit filed by Nuclear Watch NM and Tri-Valley CAREs.

The **Target Fabrication Facility** at TA-35 conducts target material characterization and technology development for weapons production and laser fusion research.

Located in TA-48, the **Radiochemistry Facility** conducts radiological and chemical analyses of samples. It also produces medical isotopes.

The **Material Sciences Laboratory** at TA-3 develops and improves materials formulation and chemical processing technologies and performs mechanical testing, research, synthesis, and characterization of materials.

The **Radioactive Liquid Waste Treatment Facility (RLWTF)** treats transuranic and low-level radioactive liquid wastes generated at LANL facilities, the majority of which come from the CMR Building and the plutonium pit production facility. The RLWTF also manages the final disposition of these treated wastes. Its effluents have seriously contaminated perched aquifers in Mortandad Canyon.

Area G, in operation since 1957 in TA-54, is the Lab's largest disposal area. The Lab claims that only low-level radioactive wastes (LLW) have been dumped there since the mid-1980s. Nevertheless, it is slated for closure by 2015 under a State-issued solid hazardous waste permit, for which cleanup remedies still have to be selected. Future LLW disposal may occur just west of the present dump site.

LANL in NNSA's "Complex Transformation"

Under Complex Transformation, LANL's mission will include plutonium R&D, pit production, detonator production, hydrodynamic explosive testing, supercomputing, materials research, and materials qualification in extreme environments. NNSA claims that the capabilities of the planned CMRR-Nuclear Facility and the existing Sigma Facility are required for possible increased manufacturing workloads. Capabilities that would be eliminated or reduced under NNSA's Complex Transformation plan include tritium operations and major environmental testing of nuclear weapons.[40]

Lawrence Livermore National Laboratory

Description and Current Mission

The Lawrence Livermore National Laboratory (LLNL) is one of two laboratories that has designed every nuclear weapon in the U.S. arsenal. It was founded in 1952, at the behest of Edward Teller and Ernest O. Lawrence, to speed the development of the Hydrogen Bomb, and, more broadly, to provide competition for weapons designers at New Mexico's Los Alamos Lab.

LLNL consists of two physical sites. The Main Site is housed on 820 acres in Livermore, California, about 40 miles east of San Francisco, and Site 300 is located on 7,000 acres between Livermore and Tracy, California, in a hilly area near Interstate 580.

The University of California managed LLNL for most of its history. Since 2007, following the first open bidding process for the Lab's management contract, it has been operated by Lawrence Livermore National Security, LLC, which is a consortium consisting of Bechtel National, University of California, Babcock and Wilcox, Washington Division of URS Corporation, and Battelle. LLNL employs about 8,000 people, of which 4,500 directly support NNSA weapons activities.

Nuclear weapons activities comprised 86 percent of the DOE's Fiscal Year 2009 budget request for the Lab.

Nuclear weapons development and related activities remain the principal focus at the LLNL. Nuclear weapons activities comprised 86 percent of the DOE's Fiscal Year 2009 budget request for the Lab. The Ten Year Site Plan describes LLNL's mission as national security, which it defines principally as nuclear weapons stockpile stewardship. The major goals listed are to "extend the life of selected weapons," and "develop replacement warheads that will enable Complex Transformation."

The major LLNL goal in nonproliferation and homeland security is to address the "challenge of expanding global need for civilian nuclear power and its associated infrastructure while restricting the spread of nuclear materials and weapons knowledge."

NNSA's Complex Transformation plan elevates LLNL's role in research and development of the high explosives component of nuclear weapons, making it the "High Explosives Research & Development Center" for the complex. In support of this expanded mission, LLNL submitted a fiscal year 2010 line-item budget request for a new "High Explosives Application Facility (HEAF) annex." Complex Transformation also designates LLNL as a "Center of Excellence" for "Nuclear Design and Engineering." Consequently, LLNL requested fiscal year 2010 funds to

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40 Los Alamos National Laboratory FY2009–2018 Ten-Year Site Plan, LA-UR 08-08038, NNSA, September 2008, p. 11, http://nnsa.energy.gov/infrastructure/Ten-year_site_plan.htm.

begin construction of a 60,000 sq-ft "Weapons Engineering Science and Technology" facility, to be followed in two years by an additional 60,000 sq-ft of new construction for a "Materials Science Modernization Facility."

The Laboratory currently:

- conducts research, design, and development of nuclear weapons;
- provides assessments and certification of stockpiled weapons;
- conducts tritium R&D;
- conducts hydrodynamic testing;
- conducts high explosives R&D;
- conducts environmental testing of nuclear weapons to determine their survivability under varied conditions;
- operates laser facilities;
- is developing capability to fabricate fusion and fission targets for the National Ignition Facility laser;
- designs and tests advanced technology concepts; and
- conducts biodefense experiments.

Major Current and Planned Facilities

Located in the "**Superblock**" at the LLNL Main Site, the **Plutonium Facility** was constructed in 1961 and expanded in 1977. Historical activities included fabricating bomb cores for full-scale nuclear tests and assemblies for subcritical nuclear experiments at the NTS. In its March 2005 Site Wide Environmental Impact Statement, LLNL proposed testing new plutonium bomb core casting techniques in the facility. In November 2005, the administrative limit for plutonium at LLNL was raised from 1,500 pounds to 3,080 pounds. In 2008, LLNL protective forces failed to secure the site's plutonium in a force-on-force test designed to simulate a terrorist attack. Under mounting pressure, NNSA announced it would remove all weapons usable quantities of Pu and HEU by the end of 2012.

Also located in the Superblock, the **Tritium Facility's** historical activities included the filling of components for full-scale nuclear tests and for other, on-site experiments. In November 2005, the administrative limit for tritium at LLNL was raised from 30 to 35 grams. In 2003, LLNL began the "**Tritium Facility Modernization Project**." That project is slated to add thousands of square feet and result in the completion of an actinide capability in the tritium facility to enable production of plutonium as well as hydrogen targets for the National Ignition Facility.

Located at the LLNL Main Site, the **National Ignition Facility** (NIF) is a 192-beam, stadium-sized laser intended to compress deuterium-tritium targets to energies, temperatures and other conditions that exist in stars and the later stages of an exploding nuclear weapon. Funded as a weapons activity, NIF construction and related

R&D have cost about $5 billion. In a November 2005 Record of Decision, NNSA added experiments with fissile and fissionable materials (e.g., plutonium, highly enriched uranium, and thorium-232) to the fusion fuel experiments already planned. Construction of a neutron spectrometer to distinguish fission from fusion-generated neutrons was undertaken. Fusion ignition experiments are scheduled to begin in 2010.

The **Livermore Computing and Terascale Computing Facility,** at the Main Site, houses terascale computers, which support the NNSA Advanced Simulation and Computing (ASC) program, including ASC Purple and BlueGene/L.

Located at the LLNL Main Site, the **High Explosives Application Facility** (HEAF) supports "all aspects" of high explosives, from research and development to material characterization to performance testing and safety experiments. HEAF supports the **Energetic Materials Center**, which conducts R&D of explosives, pyrotechnics, and propellants. According to the LLNL Ten Year Site Plan, a new **HEAF Annex** to support Complex Transformation is scheduled to be constructed at the Main Site to fabricate "one-of-a kind explosive parts" and a "scale-up of synthesis and formulation processes" for HEAF. This would likely require a higher explosive limit than currently allowed.

The planned **Weapons Engineering Science & Technology** (WEST) facility would encompass 60,000 sq-ft. Its proposed a mission is to support LLNL's role as a "Center of Excellence for Nuclear Design and Engineering" under Complex Transformation. The anticipated start of construction is 2010 and completion is scheduled for 2016. Its total estimated cost is "to be determined."

A proposed **Materials Science Modernization Facility** is also intended to support LLNL's role as a "Center of Excellence for Nuclear Design and Engineering." It, too, would cover 60,000 sq-ft. The anticipated start date for construction is in 2012, with completion scheduled for 2018. According to LLNL's latest site plan, its total estimated cost is also "to be determined."

In 2008, an advanced bio-warfare agent research facility began operations at LLNL. The **Biosafety Level-3 facility** is intended to house up to 50 liters of "select agents" historically used in bio-weapons, conduct genetic modifications, and carry out lethality experiments on small animals. The facility is currently the subject of federal litigation brought by Tri-Valley CAREs.

Site 300 is primarily a high explosives testing range. NNSA and its predecessors have conducted thousands of hydrodynamic detonations here since 1955, which have included wrapping high-explosives around depleted uranium (replacing plutonium in the core of the test weapon) and tritium, in addition to other materials. Still operational at Site 300 are several open-air "firing tables" for hydrodynamic tests and the **Contained Firing Facility**.

The LLNL Main Site was placed on the Environmental Protection Agency's (EPA) "Superfund" list of contaminated sites requiring priority cleanup in 1987. Site 300 earned its own place on the national "Superfund" list in 1990.

Sandia National Laboratories

Description and Mission per NNSA Plans

The Sandia National Laboratory in Albuquerque, NM (SNL-NM) is a direct descendant of the original Manhattan Project. Sandia is responsible for the nonnuclear engineering that ensures that nuclear explosive designs become deliverable weapons. The facility is operated by Sandia Corporation, a wholly owned subsidiary of the Lockheed Martin Corporation, and currently employs about 4,000 people in support of NNSA activities.

Sandia has design and engineering responsibility for more than 90 percent of the 3,000 to 6,500 components that enable the nuclear explosive designs of the Los Alamos and Lawrence Livermore National Laboratories to become deliverable weapons.[41] These components, most of which are produced or procured at the Kansas City Plant, include arming, fuzing, and firing systems; neutron generators that initiate the nuclear chain reaction; tritium gas transfer systems; and "surety" systems that prevent unauthorized use. Sandia also oversees the mating of nuclear warheads to their bomber or missile delivery systems.

Sandia is responsible for the nonnuclear engineering that ensures that nuclear explosive designs become deliverable weapons.

Other Sandia missions involve research and development of high explosives and environmental testing, including "weapons effects testing" which ensures that nuclear weapons components and systems are "hardened" to perform reliably in severely radioactive battlefield environments. Sandia tests complete nuclear weapon assemblies to make sure they will be able to withstand the extreme environments of vibration, temperature, and radiation during their "Stockpile to Target Sequence."

Sandia acquired some production activities, such as for neutron generators, in the initial round of post-Cold War consolidation of the nuclear weapons complex. In 2005, Sandia also assumed the mission of loading tritium into these neutron generators. Because tritium has a short half-life, components containing tritium must be periodically replenished or replaced.

Sandia's total institutional funding based on the FY09 DOE budget request and projection including Work for Others is $2.269 billion**.** Of that, $1.14 billion is for NNSA activities. Sandia's budget for "Work-for-Others," such as counter-terrorism initiatives with the Department of Homeland Security, DoD and the law enforcement/intelligence community is $835 million.[42]

Major Facilities at Sandia in New Mexico

Technical Area (TA)-I at SNL-NM includes the main administrative offices and a group of laboratories. Most of the activities at TA-I relate to the design, research, and development of weapon systems and limited production of weapons systems components. The facilities located at TA-I include the **Advanced Manufacturing Process Laboratory**, the **Microelectronics Development Laboratory**, the **Microsystems**

41 Sandia National Labs Annual Report 2008, Sandia Corporation, July 2008, p. 7, www.sandia.gov/forward/forward.cgi?loc=2008_annual_pdf.

42 http://www.sandia.gov/about/faq.

and Engineering Sciences Applications Complex, the **Neutron Generator Facility**, the **Processing and Environmental Technology Laboratory**, and the **Joint Computational Engineering Laboratory**.

The **Advanced Manufacturing Process Laboratory (AMPL)** develops and uses advanced manufacturing processes for production of weapon components in support of Sandia's Directed Stockpile Work. AMPL can fabricate complex 3D microstructures in a wide variety of materials using meso-scale and miniature machining processes.

The primary mission of **Microelectronics Development Laboratory** is development and application of radiation hardened integrated circuit technologies for weapons and space systems. The recently constructed **Microsystems and Engineering Sciences Applications (MESA) Complex** is a $462 million project Sandia calls the "cornerstone of 21st century weapons development."[43] MESA consists of facilities that design, develop, manufacture in low volumes, integrate, and qualify microsystems for nuclear weapons and other national security needs. The facilities in the MESA Complex support Directed Stockpile Work.[44] At MESA, microsystems are created using integrated circuit fabrication techniques to make devices such as on-board processors, micro actuators, gears, and action arms fabricated from silicon compounds.[45] Sandia states this is an essential activity for the Stockpile Life Extension Process and for compliance with new national security initiatives. The three buildings that comprise the MESA project will house 648 researchers in 391,000 sq-ft. One is a microfabrication facility, another a micro laboratory, and the third is a new Integrated Weapons Engineering Transformation Facility that, according to the FY09 Sandia Ten Year Site Plan, will support an integrated modern weapons engineering capability to meet current and future missions of nuclear stockpile maintenance and weapon development.

TA-II hosts the **Explosive Components Facility, the Hazardous Waste Management Facility, the Facilities Command Center, the Solid Waste Transfer Facility,** and the **Construction and Demolition Recycle Center**. The Explosive Component Facility, sitting on 22 acres of TA-II, includes over 100,000 square feet of laboratories for R&D work on explosives.

The largest of the technical areas, TA-III is the site of large-scale tests and engineering activities such as sled tracks, centrifuges and the **Thermal Test Complex**, which require safety or security buffers. Other facilities in TA-III include the **Radioactive and Mixed Waste Management Facility, the Chemical Waste Landfill, the Mixed Waste Landfill, and the Corrective Action Management Unit.**

TA-IV houses facilities used to conduct R&D activities in inertial confinement fusion, pulsed power, and nuclear particle acceleration. Facilities located in TA-IV

43 Sandia National Labs Annual Report 2002–2003, Sandia Corporation, December 2002, p. 18, http://materials.sandia.gov/news/publications/annual/pdf/ar2002-2003.pdf.

44 NNSA states that the goal of the Directed Stockpile Work (DSW) program is to provide the nation with a credible nuclear deterrent by ensuring that U.S. nuclear weapons stockpile is safe, secure, and reliable.

45 http://mesa.sandia.gov/mesa.

include the **Z Accelerator, the Advanced Pulsed Power Development Laboratory, the Radiographic Integrated Test Stand, the Tera-Electron-Volt Energy Superconducting Linear Accelerator, the High Energy Radiation Megavolt Electron Source III, the Saturn Accelerator, the Repetitive High Energy Pulsed Power Accelerator, the High Power Microwave Laboratory, and the Short-Pulse High Intensity Nanosecond X Radiator**. Many of these facilities are used to conduct radiation effects testing to support stockpile stewardship as well as serving the campaigns for Dynamic Materials Properties, Inertial Confinement Fusion and High Yield, Nuclear Survivability, and Weapons Systems Engineering Certification.

NNSA Defense Programs nuclear facilities are located at TA-V and routinely handle radioactive materials. TA-V houses the **Gamma Irradiation Facility, the Annular Core Research Reactor, the Hot Cell Facility, and the Auxiliary Hot Cell Facility**. The Annular Core Research Reactor (ACRR) is a water-moderated pool-type research reactor capable of pulse and steady state operations. The ACRR has a dry irradiation cavity constructed such that experiment package models can be easily placed in the reactor. The ACRR is primarily used for testing electronics, materials, and fissile components for vulnerability to neutrons in order to certify the weapon components and systems.

Several remote test areas are located east and southeast of TA-III and within the canyons and foothills of the United States Forest Service withdrawn area (Lurance Canyon and Coyote Canyon). These areas are used for explosive ordnance testing, rocket firing experiments, and open-burn thermal tests.

Sandia also operates the Tonopah Test Range near Tonopah, Nevada, for flight-testing of gravity weapons and delivery systems.

Sandia in NNSA's "Complex Transformation"

In the Record of Decision on Complex Transformation, NNSA states it will consolidate major Environmental Testing at SNL-NM and will only conduct test operations involving Category I/II special nuclear materials infrequently during particular campaigns. High explosives R&D, hydrodynamic testing, and weapons support activities will continue at SNL/CA. However, four environmental testing facilities at SNL-NM will close: the Pulsed Reactor, the Low Dose Rate Gamma Irradiation Facility, the Auxiliary Hot Cell Facility, and the Centrifuge Complex. The Environmental Test Complex at SNL-CA will also be closed. The footprint of SNL operations at the Tonopah Test Range will be reduced and testing will proceed there on a campaign basis.

Sandia National Laboratories – California

Sandia Labs' second biggest site is located in California adjacent to the Lawrence Livermore National Laboratory (LLNL) to allow closer collaboration with that lab. SNL-CA engineers work on nonnuclear component design and systems integration (which includes mating to delivery systems) for LLNL responsibility nuclear weapons: the B83, W80, and W87.

SNL-CA activities also involve engineering Gas Transfer Systems for tritium and Joint Test Assemblies for in-flight testing of disarmed nuclear weapons. Major facilities at SNL-CA include the **Micro and Nano Technologies Laboratory, the Distributed Information Systems Laboratory, and the Combustion Research Facility.** The last of which, primarily does work for programs other than weapons activity.

In its draft Complex Transformation proposal, NNSA indicated it planned to shift SNL-CA out of the nuclear weapons programs to another unnamed federal program. NNSA rejected this idea in its final Complex Transformation plan.

Pantex Plant

Description and Mission per NNSA Plans

The Pantex Plant is located on 16,000 acres in the panhandle of Texas (hence "Pantex"), approximately 17 miles northeast of Amarillo. The facility is operated by Babcock & Wilcox Technical Services Pantex and currently employs about 3,300 people in support of NNSA activities.

Although there have been no completely new weapon designs assembled since 1991, technicians at Pantex continue to disassemble and reassemble existing weapons in connection with NNSA programs to evaluate, repair, modify, and certify them.

Built by the U.S. Army in 1942, the site was originally a munitions plant for artillery shells and bombs. At the end of World War II, the Plant closed but was subsequently refurbished in 1951 to perform final nuclear weapons assembly work. Between 1965 and 1975, the Atomic Energy Commission (DOE's predecessor) consolidated various assembly, modification, and high explosive missions at Pantex from other sites in the nuclear weapons complex, leaving it as the only production plant in the United States where nuclear weapons are fully assembled and disassembled. Nuclear policy decisions and international treaties in the 1990s led to the requirement for Pantex to dismantle a portion of the large Cold War nuclear weapons stockpile. Plutonium pits from these dismantled weapons are currently stored at Pantex.

Although the majority of operations occur on just 2,000 acres, the Department of Energy owns 10,380 acres at the Pantex Plant itself and another 1,077 acres called Pantex Lake about two miles away. An additional 5,800 acres of land south of the main Plant is leased from Texas Tech University as a safety and security buffer.[46]

Pantex is the principal facility in the U.S. nuclear weapons complex for the handling of nuclear weapons in their entirety. Although there have been no completely new weapon designs assembled since 1991, technicians at Pantex continue to disassemble and reassemble existing weapons in connection with NNSA programs to evaluate, repair, modify, and certify them. Under the Life Extension Program (LEP), Pantex disassembles nuclear weapons and reassembles them using new and in some cases redesigned components. Pantex stores approximately 4,000 plutonium pits as a "strategic reserve" and 14,000 pits in all, including excess pits that are awaiting final disposition. Pantex is currently authorized to store up to 20,000 pits. Pantex is also

46 Pantex Plant FY 2009–2018 Ten-Year Site Plan, Revision 2, August 22, 2008, http://nnsa.energy.gov/infrastructure/Ten-year_site_plan.htm.

responsible for manufacturing, testing, and qualifying explosives and explosive components for NNSA's nuclear weapons programs.

Major Facilities at Pantex

Many of Pantex's buildings are between 30 and 60 years old and were designed prior to the current mission. Although there have been new facilities constructed, the total site footprint has remained near 3 million sq-ft.

Pantex has several numbered functional areas. Zone 12 is the weapons assembly/disassembly area. Operations in its **Nuclear Explosive Bays** include the complete assembly/disassembly of nuclear weapons containing insensitive high explosives (IHE), the partial assembly/disassembly of weapons containing conventional high explosives (HE),[47] and the testing and storage of tritium reservoirs. **Nuclear Explosive Cells** provide testing or support facilities for weapons and weapons components that contain special nuclear material. Also in Zone 12 are **Pit Vaults** that provide temporary staging for weapon components that contain radioactive or special nuclear materials such as plutonium pits, canned subassemblies (the nuclear weapons "secondaries"), radioisotopic thermoelectric generators,[48] and tritium reservoirs.

Zone 11 has **Explosives Manufacturing** buildings totaling 113,450 sq-ft that are used to produce the main HE charges for nuclear weapons and to conduct HE research and development. There are also 46 **Explosives Staging** structures used to store all types of HE and IHE, occupying approximately 63,300 square feet. Key facilities for **Testing and Evaluation** of both HE and IHE, including test firing of explosives and non-destructive evaluation of explosives, total approximately 68,200 square feet.

The **Nuclear Staging Facilities** storage magazines are located in the western part of Zone 4. These magazines, originally built for storing conventional munitions, are now used for interim storage of complete nuclear weapons, weapons components and other material. The total storage area is 71,362 square feet. There are also other functional areas in Zone 4 such as an explosives test firing facility and a burning ground for disposing of explosive materials.

The **Weapons Evaluation Test Laboratory (WETL)**, operated by the Sandia Labs, has been located at Pantex since 1966. WETL evaluates weapon subsystems in a laboratory environment in order to detect potential defects in stockpiled weapons.

At the **Special Nuclear Material Requalification Facility** NNSA plans to use non-intrusive processes to recertify up to 350 plutonium pits for reuse annually,[49] some of which may be modified before being returned to the stockpile. The Plant itself has

47 Conventional HE was used in older weapons and, because it is lighter and more compact than IHE, is used in the sub-launched warheads (i.e. the W76 and the W88).

48 Nuclear "batteries" powered by the decay heat of plutonium-238, used as a power source in nuclear weapons and other applications.

49 Supplemental Analysis for the Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components, U.S. DOE, February 2003, p. 1–6, http://gc.energy.gov/NEPA/nepa_documents/sa/EIS0225-SA-03/chapter1.pdf.

boasted how pit reuse is much less expensive and environmentally damaging than the production of new pits.

Pantex in NNSA's "Complex Transformation"

NNSA's Complex Transformation plan calls for continued use of Pantex for warhead assembly and disassembly and adds some non-destructive surveillance work now done at LLNL. Pantex is also to be the "Center of Excellence" for high explosives production and machining. Category I/II SNM are to be consolidated to Zone 12 so Zone 4 can be closed. NNSA plans to reduce Pantex's security perimeter by 45% and the total building footprint by 25%. NNSA projects that the Plant's workforce level will be reduced by 5% to 10% over the next decade.

NNSA proposes to construct several new facilities at Pantex. A **new underground storage facility** for plutonium pits is intended to improve security and reduce costs. A new **Weapons Surveillance facility** for non-destructive weapon and pit surveillance is planned to supplement the existing WETL. In addition, the **High Explosive Component Fabrication and Qualification Facility** would replace World War II-era facilities. Finally, a **new high explosive pressing facility** would support the projected workload for the ongoing W76 LEP and pending LEPs (the W78 and W88) over the next 10 years.

Nevada Test Site

Description and Mission per NNSA Plans

The U.S. has not performed a full-scale nuclear weapon test since 1992, but NNSA maintains the ability to conduct one within 36 months.

The Nevada Test Site (NTS) is 65 miles northwest of Las Vegas, NV, at its closest point, and occupies a 1,350 sq-mi area. The facility is operated by National Security Technologies, LLC, which is a joint venture between Northrop Grumman Corporation, AECOM, CH2M Hill, and Nuclear Fuel Services. NNSA is the DOE "landlord" for the entire NTS, but other DOE offices operate facilities there. NNSA has about 3.4 million sq-ft of building space at the NTS and employs about 2,085 personnel in weapons-related activities. According to the 2009 Budget, NNSA plans to spend $274 million for nuclear weapons activities at the NTS in 2009.[50]

Historically, NTS was used for testing nuclear weapons—first aboveground and later underground. The U.S. has not performed a full-scale nuclear weapon test since 1992, but NNSA maintains the ability to conduct one within 36 months. According to NNSA, it must exercise its capability for nuclear testing by conducting subcritical experiments. These are experiments that result in a small amount of nuclear fission, but in which no self-sustaining nuclear chain reaction occurs. Through these and other experiments, at NTS and elsewhere, NNSA submits nuclear and nonnuclear materials to high pressures and temperatures to gather data for improving its computer simulation models.

50 Actual NNSA weapons-related spending at NTS was higher, since most personnel and equipment for teams that performed experiments at NTS user facilities was charged to the weapons laboratories or production sites from which the personnel were detailed.

NNSA also stores Category I/II quantities of special nuclear materials (SNM)—quantities of Pu or HEU of high (Category I) or moderate (Category II) strategic significance—from prior weapons programs at NTS. NTS also has facilities to dispose of low-level radioactive waste from throughout the weapons complex. In addition, NNSA maintains a capability at NTS to dispose of a damaged nuclear weapon or an improvised nuclear device should it come into possession of one.

NNSA's December 19, 2008 Record of Decision (ROD) on Complex Transformation would make NTS a "Center of Excellence for High-Hazard Testing and Experimentation." NNSA plans to transfer several existing facilities to NTS from other sites including the Annular Core Research Reactor[51], the Aerial Cable Facility,[52] a high velocity sled track from SNL-NM, and test facilities from the Hardened Engineering Test Building at LLNL. NNSA has already relocated a large pulsed power facility (Atlas) from LANL to NTS, which it operated briefly and then shut down, and is in the process of moving several critical assemblies from SNL-NM and LANL to NTS. The preferred option in NNSA's *Final SPEIS on Complex Transformation* calls for the agency eventually to relocate all hydrodynamic testing from LLNL and LANL to new facilities at NTS, but NNSA did not consider that issue in detail it its environmental analysis, and thus may not take any implementing actions in that direction until it does. In addition, NNSA plans to move large quantities of SNM from SNL-NM and LLNL and temporarily store it at NTS, while it builds permanent storage facilities elsewhere.

Major NNSA Facilities at NTS

The **U1a Complex** is a deep underground laboratory consisting of horizontal tunnels, each about one-half mile in length. NNSA uses U1a primarily for subcritical experiments, which are experiments with very small amounts of nuclear yield, but for which there is no sustained nuclear chain reaction.

Joint Actinide Shock Physics Experimental Research (JASPER) is a two-stage gas gun in which a projectile is fired at a target that usually contains special nuclear material. NNSA uses the JASPER to study the properties of plutonium and other materials at high temperatures and pressure and to collect data on materials' response to the intense conditions created.

The **Big Explosives Experimental Facility (BEEF)** is by far the largest explosive testing facility in the complex. It is used for hydrodynamic tests, weapons physics experiments, development of shaped-charges, and "render-safe" experiments, which study how to disarm nuclear weapons of unknown design. It is certified for explosions of up to 70,000 lbs of TNT.

Atlas is a large capacitor bank for electrical pulse power experiments that can deposit considerable electrical energy into a cylindrical metal shell. This produces an intense

51 The Annular Core Research Reactor is a pool-type research reactor at SNL-NM that is used for neutron vulnerability testing and certification of weapon systems components.

52 The Aerial Cable Test facility at SNL-NM is used for gravity drop and accelerated pull-down tests in support of bomb qualification tests, (including nuclear earth-penetrators), weapons development activities, and certification of shipping containers.

magnetic field that implodes the shell, directing a high-pressure pulse onto targets inside of it. In 1995, NNSA billed Atlas as one of three "critical" facilities in its plan for stockpile stewardship. But, after completion at LANL in August 2000, this facility operated only briefly before it was disassembled in 2002 and shipped to the NTS, where in 2005 it was reassembled at a cost of $21 million, and used for only 10 experiments before being "mothballed" by NNSA in March 2006.

The **Device Assembly Facility (DAF)** was built in the 1980s to assemble nuclear devices for testing at the NTS. However, the U.S. stopped nuclear testing before the facility could become operational. The DAF is a collection of more than 30 individual steel-reinforced buildings connected by a rectangular corridor. The entire complex is below grade, covered with compacted earth, and spans an area of 120,000 sq-ft. Its remote location and underground design make it the most secure facility in the NNSA complex. However, it is a facility in search of a mission. NNSA currently fabricates targets and test equipment for subcritical experiments at the DAF and stores SNM removed from other sites. In addition, NNSA is moving several critical assemblies from TA-18 at LANL to the DAF to create a **Criticality Experiments Facility (CEF)**.

Y-12 National Security Complex

Description and Mission per NNSA Plans

The Y-12 National Security Complex (Y-12) is in Oak Ridge, Tennessee, about 15 miles from Knoxville, and dates from the World War II Manhattan Project. The facility is primarily operated by Babcock and Wilcox Technical Services Y-12, LLC, but Wackenhut Corporation is contracted to provide security. Y-12 employs approximately 3,800 people in support of NNSA activities.[53] The total Y-12 Site footprint is 7.6 million sq-ft, with a 10-year plan to reduce the footprint to 3 million sq-ft by 2028. According to the 2009 Budget, NNSA planned to spend $843 million for nuclear weapons activities at Y-12 in 2009.

Under NNSA's plans for Complex Transformation, Y-12 would be the "Uranium Center of Excellence." Y-12 contains the world's largest repository of highly enriched uranium (HEU) in metal form, storing approximately 400 MT of the material—enough for about 14,000 nuclear warheads. While Y-12 refers to itself as the "Fort Knox" for storage and management of HEU, there are a number of security risks posed by the site. Roughly 700,000 people live within a 100-mile radius of the facility.[54] The 811-acre compound—over three miles long and half a mile wide—is nestled in a valley between two ridges. Because of its location, Y-12 is a difficult site to defend. Attackers could use the surrounding forested high ground to help gain control of the facility. Most of the HEU at Y-12 is stored in five World War II-era

53 Y-12 National Security Complex Ten-Year Site Plan FY 2009–2018, NNSA, August 2008, http://nnsa.energy.gov/infrastructure/documents/Y-12_TYSP_2009-2018_final.pdf.

54 "U.S. Nuclear Weapons Complex: Y-12 and Oak Ridge National Laboratory at High Risk," Project On Government Oversight, October 16, 2006, www.pogo.org/pogo-files/reports/nuclear-security-safety/Y-12/nss-y12-20061016.html.

buildings. During NNSA's 2007 force-on-force security test, the mock adversaries were successful in a theft scenario; meaning they were successful in removing mock SNM from Y-12.

During NNSA's 2007 force-on-force security test, the mock adversaries were successful in a theft scenario; meaning they were successful in removing mock

In addition to storing uranium at Y-12, NNSA also manufactures, evaluates, and tests the uranium nuclear weapons components and canned subassemblies, which includes heavy metal cases and secondaries.[55] The mission for these components and canned subassemblies, and the number produced, is not publicly available.[56] Complex Transformation sets a future production target for canned subassemblies at Y-12 of about 125 per year, but the number could be increased to an annual rate of 200.[57] Y-12 also conducts component dismantlement, storage, and disposition of surplus nuclear materials. Additionally, Y-12 supplies HEU for use in naval reactors and research reactors. The *Complex Transformation SPEIS* would continue these activities at Y-12.[58]

Major NNSA Facilities at Y-12

In 2008, Y-12 completed a long-overdue project to build a storage facility called the **Highly Enriched Uranium Materials Facility (HEUMF)** to store the majority of the weapons-quantities of HEU currently housed in the five above-ground storage buildings. NNSA expects to begin moving HEU into HEUMF in 2010 and to move all HEU, except for processing inventories, into HEUMF by the end of 2011. Without an aggressive plan to downblend the hundreds of metric tons of excess HEU that is to be stored at HEUMF, there is little room for other functions in the facility. In its December 2008 Record of Decision, the NNSA announced its decision to build a large **Uranium Processing Facility (UPF)** adjacent to the HEUMF to house the remainder of the HEU mission. UPF is not scheduled to be completed until 2018.[59] Details about the mission of UPF are sketchy, as DOE vaguely states that it will have a "modern highly-enriched uranium production capability."[60]

55 A secondary is imploded by the plutonium primary of a nuclear weapon to create the thermonuclear explosion. See http://nnsa.energy.gov/defense_programs/documents/Final_SPEIS_Summary.pdf.

56 "For security reasons, it is not possible for us to discuss or provide information on the number of canned sub assemblies produced at Y-12, either on an annual or historic basis," Y-12 spokesman Steven Wyatt said. "Production of canned subassemblies at Y-12," Frank Munger, Atomic City Underground, December 10, 2008, http://blogs.knoxnews.com/knx/munger/2008/12/production_of_canned_subassemb.html#more.

57 "Weapons planning in Oak Ridge," Frank Munger, Atomic City Underground, February 29, 2008, http://blogs.knoxnews.com/knx/munger/2008/02/y12_secondaries_and_the_upf.html.

58 Final CT SPEIS Summary, NNSA, October 2008, p. S-72, http://nnsa.energy.gov/defense_programs/documents/Final_SPEIS_Summary.pdf.

59 The UPF, currently in the design phase, will also be an above-ground structure. The DOE Inspector General and POGO have both been critical of the above-ground design on both cost and security grounds.

60 Final CT SPEIS Summary, NNSA, October 2008, http://nnsa.energy.gov/defense_programs/documents/Final_SPEIS_Summary.pdf.

Kansas City Plant

Description and Mission per NNSA Plans

The Kansas City Plant (KCP) has most of its operations in Missouri, with satellite facilities in Arkansas and New Mexico. The main facility is located on 122 acres of the 300-acre Bannister Federal Complex (BFC), 12 miles south of downtown Kansas City, Missouri. The BFC is owned by the U.S. General Services Administration (GSA), which leases the KCP portion to NNSA. The facility is operated by Honeywell Federal Manufacturing & Technologies and employs approximately 2,400 people in support of NNSA activities.

The Kansas City Plant was built during World War II to assemble engines for Navy fighter planes. After the war, the Atomic Energy Commission contracted the Bendix Corporation to manage production of nonnuclear components for nuclear weapons at the Plant. The KCP has been the primary site for conducting that mission ever since.

In addition to making nuclear weapons parts for NNSA, the KCP makes parts for other DOE offices, DoD, other government agencies, and the United Kingdom. The Plant produces or procures 85 percent of all components that make up a nuclear warhead, including firing and arming systems, radars, guidance systems, reservoirs for tritium, foams, and adhesives. KCP states that it now has its busiest workload in 20 years. Much of this work is for "Life Extension Programs" for existing nuclear weapons.

NNSA has about 2 million sq. ft. of space dedicated to nuclear weapons components production at KCP and employs about 3,000 people in those activities. According to the 2009 Budget, NNSA planned to spend $478 million for nuclear weapons activities at the KCP in 2009.

Major Kansas City Plant Facilities

According to its FY09 Ten Year Site Plan, the **Bannister Federal Complex** contains facilities for printed wiring assembly, fabrication, final assembly, plastics machining, mechanical welding, and electromechanical assembly.

Additional facilities that are managed by Honeywell in New Mexico under the contract for KCP include: the **NC-135 Compound**, which supports engineering research and development and the assembly or repair of communications equipment; the **Air Park Facility**, which develops and supports training programs for NNSA's Office of Secure Transportation; and the **Craddock Modification Center** which builds and equips Safe Secure Trailers and Safeguards Transporters.

Along with Sandia-NM, these three facilities are all located on Kirtland AFB, which has been recently designated by the DoD Secretary as the Air Force Nuclear Weapons Center of Excellence for all nuclear weapons systems activities. In addition, Honeywell/KCP also runs a "Los Alamos Office" that manufactures detonator assemblies for nuclear weapons and fiber-optic sensors for hydrodynamic testing.

The Kansas City Plant in NNSA's Complex Transformation

Under Complex Transformation, NNSA plans to move the main site of the KCP from the Bannister Federal Complex to a new 1.5 million sq-ft facility, construction of which is expected to cost about half a billion dollars. The proposed plant would be sited within Kansas City limits and developed by private sector financing. It would be leased to GSA, which in turn would sublease it to NNSA at a cost of roughly $1 billion over twenty years. Kirtland Operations would also relocate to a new 306,949 sq-ft facility to be constructed by a private developer in Albuquerque and leased by the GSA to the NNSA.

Of the eight active NNSA nuclear weapons sites, KCP was the only site to be excluded from consideration in the Complex Transformation Supplemental Programmatic Environmental Impact Statement.

During the proposed transition period, the old KCP facility at the Bannister Federal Complex would remain in operation as activities are moved to the newly leased space in 2012. According to the FY09 Ten Year Site Plan, "Capabilities that are commercially available will be outsourced where possible and remaining in-house capabilities will be properly sized for the anticipated production rates of future weapon programs."

Of the eight active NNSA nuclear weapons sites, KCP was the only site to be excluded from consideration in the *Complex Transformation Supplemental Programmatic Environmental Impact Statement.* NNSA argued that decisions made elsewhere in the nuclear weapons complex would not affect KCP, and vice versa. However, NNSA's own language in successive KCP Ten-Year Site Plans strongly rebuts that argument. Moreover, the 1996 Stockpile Stewardship and Management PEIS, to which the present Complex Transformation study is technically a supplement, actively considered consolidating KCP missions to SNL-NM.

The 1996 decision not to consolidate was made because of the claimed expense and environmental liabilities of building new facilities at Sandia. That argument is mooted by the fact that NNSA now plans to move to a new facility, albeit one only eight miles away from the old plant. Further, NNSA apparently plans to make that move without comprehensive cleanup of the old Plant, which is heavily contaminated with PCBs and industrial solvents. Some of the contributing organizations to this report have sued NNSA and GSA claiming that the "environmental assessment" of the new Plant was inadequate because it did not consider cleanup of the old Plant as a necessary "connected action" under the National Environmental Policy Act."[61]

Savannah River Site

The Savannah River Site (SRS) occupies some 300 sq-mi of south-central South Carolina along the Savannah River between the towns of Barnwell and Aiken. The city of Augusta, Georgia is fifteen miles northwest of the site. The facility is operated by Savannah River Nuclear Solutions, LLC, a consortium headed by Flour Daniel, Northrop Grumman, and Honeywell. It employs about 9,000 people, of which 1,400 support NNSA activities. This huge reservation was established by eminent domain

61 For more, see Plaintiffs' October 2008 complaint at www.nukewatch.org/KCNukePlant/KCP_FiledComplaint10-8-08.pdf.

in November 1950 and construction was largely completed by 1956. At its peak, the plant included five heavy-water-moderated production reactors; fabrication facilities for enriched-uranium driver fuel and targets for plutonium and tritium production; a heavy water plant; a tritium extraction, purification, and reservoir-loading complex; and two chemical separation plants.[62] Over a 35-year period, the plant produced all of the tritium and a portion of the plutonium used in the U.S. nuclear weapons stockpile.

Following the end of the Cold War, production of weapons materials ceased and the remaining production reactors were shut down. Tritium purification and loading operations have continued, but the main mission of SRS for the past two decades has been nuclear waste management and environmental cleanup. The cleanup of SRS has already cost tens of billions of dollars and no end is yet in sight.

In the late 1990s, SRS acquired a new mission that remains controversial—"disposition" of 34 metric tons of excess weapons-grade plutonium by converting it into plutonium-uranium mixed oxide (MOX) fuel for use in commercial nuclear reactors. Use of this technology in the civil sector creates inventories of separated plutonium potentially usable in weapons, and thus has significant negative implications for nuclear security and non-proliferation. A **Mixed Oxide (MOX) Fuel Fabrication Facility (MFFF)** is currently under construction at SRS, which is slated to cost at least $5 billion. Operation of the MFFF will require weapons plutonium feedstock that has been converted from metallic to oxide form. This in turn will require construction of a **Pit Disassembly and Conversion Facility (PDCF)**, currently estimated to cost $2 billion.

Over a 35-year period, the plant produced all of the tritium and a portion of the plutonium used in the U.S. nuclear weapons stockpile.

The reprocessing, waste management, and environmental remediation missions at SRS are under the direction of the DOE's Environmental Management Program, while the MOX disposition effort falls within the purview of NNSA's Defense Nuclear Nonproliferation Program. The only activities at SRS that continue to support the nuclear weapons stockpile, and therefore remain a part of NNSA's nuclear weapons complex, involve extraction, purification, and loading of tritium, a radioactive isotope of hydrogen that is used to "boost" the performance of the plutonium pit primaries in nuclear weapons.

The recently modernized SRS Tritium Facilities consist of an interconnected set of production, processing, support, and administrative buildings located within a 25-acre compound in the H-Area.

The **New Manufacturing Building** is the reservoir loading and unloading facility. This underground facility has been in operation since 1993 and houses the gas processing systems necessary to remove, separate, and purify hydrogen isotope gas streams (primarily recycled from active or retired nuclear weapons). The desired mix of isotopes is then reloaded into reservoirs destined to be put back into weapons in the active stockpile.

62 The role of SRS during the Cold War is described in some detail in Nuclear Weapons Databook, Volume III, U.S. Nuclear Warhead Facility Profiles, T.B. Cochran et. al., Natural Resources Defense Council, p. 92–124.

Manufacturing Building No. 3 is primarily used for reservoir finishing, quality assurance activities, and shipping and receiving of reservoirs. This building also houses an analytical laboratory, an inert reservoir loading facility, and other support activities.

The **Pressure Testing Facility** is the Helium-3 (He-3) processing facility. This facility is nearing the end of its useful life. He-3 processing is scheduled to be relocated into the New Manufacturing Building.

The **Material Testing Facility**, completed in 2004, contains environmental chambers and ovens, which support the reservoir storage program, and a metallurgical laboratory used for analysis of tritium-contaminated components.

The **Reclamation Building** is a contaminated machine shop used to reclaim reservoirs that were returned from the field. During this process, the existing fill stem is removed and replaced with a new stem. The reservoir is subsequently inspected and returned to "War Reserve" status.

Production of tritium now occurs off-site, in "Tritium Producing Burnable Absorber Rods" (TPBARs) that are irradiated in the cores of TVA's Watts Bar nuclear reactors. The irradiated TPBARs are shipped from Tennessee to the SRS H-Area Tritium Facilities, where they are processed in the **Tritium Extraction Facility (TEF)**, which was completed in November 2006. This facility has two parts—the **Remote Handling Building,** where tritium is extracted from the TPBARs by heating them in furnaces, and a **Processing Building,** where the gas is purified before being transferred to the New Manufacturing Building for reservoir loading.

NNSA also performs surveillance on gas transfer systems at SRS. This includes extensive testing and metallographic evaluation. Reservoirs are then reloaded, re-inspected, and shipped to either DoD sites for exchange operations involving active stockpile weapons, or to NNSA's Pantex Plant for installation in weapons undergoing Life Extension Programs.

Under Complex Transformation, NNSA is planning to continue all current activities at SRS, to transfer tritium R&D activities from other sites to SRS, and to expand operations in support of reactor-based disposition of excess plutonium. NNSA's plan includes building both the PDCF and a new **Waste Solidification Building** (to treat waste from the MFFF and the PDCF) at SRS.

CHAPTER 5

Curatorship: A New Strategy for Maintaining The Nuclear Weapons Stockpile

In 1992, the U.S. Congress cut off funding for nuclear test explosions unless certain conditions were met. This led the United States into negotiations on a Comprehensive Test Ban Treaty and an immediate moratorium on underground testing of nuclear weapons, which continues today. In 1993, Congress directed NNSA's predecessor, DOE's Office of Defense Programs, to initiate a modest program, called "Stockpile Stewardship," for maintaining nuclear warheads in the absence of testing. Fearful that its traditional nuclear weapons research programs, which were heavily tied to testing and development of new warheads, would be cut drastically, Defense Programs defined Stockpile Stewardship as requiring it to replace nuclear testing with the enormously technically challenging goal of using computers to model precisely the behavior of exploding nuclear weapons. This new goal required vast new experimental and computational capabilities. As a result, rather than experiencing serious post Cold-War consolidation and funding cuts, the Defense Programs/NNSA weapons R &D complex actually prospered. Appropriations for nuclear weapons activities soared, from a low of $3.2 billion in 1995 to over $6.6 billion in FY 2005. While the growth has flattened out, NNSA spending on the activities and facilities of the nuclear weapons complex remains around $6.4 billion per year.

The more confident the weapons labs have become in their modeling capabilities, the more they have been tempted to modify the nuclear weapons in the stockpile.

While it has been enormously costly, NNSA has made considerable progress in its efforts to model nuclear weapons explosions. NNSA now claims its modeling and simulation capabilities are sufficient not only to maintain existing weapons, but also to design and certify certain new nuclear weapons, without underground nuclear testing.

There is a fatal flaw in this strategy. The more confident the weapons labs have become in their modeling capabilities, the more they have been tempted to modify the nuclear weapons in the stockpile. However, computer simulations cannot provide the same level of confidence in modified warheads that was provided for the original warheads through full-scale nuclear tests. Over time, *if changes continue to be introduced into warheads*, the level of confidence in the stockpile will inevitably diminish. NNSA officials themselves have repeatedly stated their concern that as changes accumulate in existing warheads, it will become increasingly difficult for the laboratories to certify their performance. However, instead of adopting a policy and process to scrupulously avoid changes, NNSA proposed designing a completely new, so-called

"Reliable Replacement Warhead" (RRW), which would only compound the problem. Without nuclear testing, questions will always remain about the performance of any new warhead, particularly one that is outside of the existing "design envelope" of test-proven designs. Furthermore, designing and producing a new warhead is a provocative act that runs counter to U.S. commitments under the NPT.

We recommend a more conservative approach to maintaining the existing test-certified stockpile, which is based on adhering to the original design parameters and characteristics of the nuclear explosive package. A key to this approach is our conclusion that there is no need for the United States to design any new nuclear weapons or to make performance or safety-enhancing modifications to existing ones. Presidents Clinton and Bush, on the advice of their Secretaries of Defense and Energy, have repeatedly certified that the nuclear weapons in the current stockpile are safe and reliable. We would continue and strengthen that record by ensuring that those safe and reliable warheads are not changed in any way unless there is a well documented finding that corrective action is needed to fix a component or condition that could significantly degrade the performance or safety of the warhead and that no compensating measures are feasible.

Presidents Clinton and Bush, on the advice of their Secretaries of Defense and Energy, have repeatedly certified that the nuclear weapons in the current stockpile are safe and reliable.

We call our methodology "Curatorship." Just as a museum curator maintains artistic treasures and occasionally restores them to their original condition, so too would NNSA and DoD maintain nuclear weapons to their original design and condition, with occasional restorations. NNSA's role in maintaining nuclear weapons would focus on scrupulous surveillance and examination of warheads to determine if any component has changed in any manner that might degrade the safety or performance of the warhead. If so, it would restore that part as closely as possible to its original condition when the warhead was first certified to enter the stockpile. If that were not possible, NNSA could craft a replacement part conforming as closely as possible to the performance specifications of the original component. With changes to warheads strictly controlled, confidence in the performance of the remaining warheads would be higher than under Stockpile Stewardship, but the monetary cost and the loss of international credibility regarding nuclear proliferation would be much lower under Curatorship.

No New Nuclear Weapons or Changes to Existing Ones

The current U.S. nuclear weapons stockpile is diverse, resilient, and more than sufficient for any conceivable nuclear deterrent mission. Its broad range of capabilities could be preserved in our proposed 500-warhead stockpile. Depending on which weapons the Government chooses to keep, a 500-warhead stockpile could include as many as seven types of strategic warheads and four kinds of delivery vehicles—land-based ballistic missiles; submarine-based ballistic missiles; aircraft; and cruise missiles. Such a stockpile would retain considerable flexibility for responding to new security demands should they arise. Warheads in the current stockpile have explosive yields that vary from 0.3 kilotons to 1,200 kilotons. None of that diversity need be lost at the 500-warhead level, but on cost-effectiveness grounds, some reduction in the number of warhead types retained in the stockpile may well be warranted. U.S.

nuclear warheads can explode at various heights above the ground, on impact with the ground, with a delay after ground impact, and even after penetrating several feet into the ground to attack underground bunkers. With the exception of an improved earth-penetrating warhead, which Congress has emphatically rejected, the Defense Department has not identified any new capability that it proposes to add to the existing stockpile.

It is impossible to conclude categorically that there will never be any new threat against which a new type of nuclear weapon might be useful. However, in a time when there is a political imperative for the U.S. and other nuclear nations to devalue nuclear weapons, as a precursor to their eventual elimination, it is very difficult to foresee a new threat that would compel the U.S. to respond by designing a new nuclear weapon. The Curatorship approach would not preclude designing a new warhead, should the President and the Congress decide to do so in the future. Rather, it would suspend research on new nuclear weapons technologies and efforts to develop new warheads, pending identification of a new threat justifying such activities.

Existing U.S. nuclear weapons are extremely safe, secure, and reliable. An accidental nuclear explosion of a U.S. weapon is precluded by its inherent design. To initiate a nuclear explosion, the chemical high explosive, which surrounds the weapon's plutonium pit, must first explode and compact the pit in a highly symmetrical manner. This requires the explosive to detonate in at least two specific places simultaneously. All U.S. nuclear weapons are certified to be "one-point safe." One-point safe means that if the chemical explosive were accidentally detonated, at the worst possible place, there would be no nuclear yield greater than the equivalent of two kilograms of high explosive. Designers conducted numerous underground tests of one-point safety in which they detonated weapons at their most sensitive points under a variety of conditions. Over the past decade, the weapons labs have repeatedly checked and verified the one-point safety of U.S. warheads using the modeling and simulation methods developed in the Stockpile Stewardship program. Even if a projectile is shot into a nuclear weapon or some other shock to the system initiates a chemical explosion, it is exceedingly unlikely that there would be any nuclear explosion.

The chemical explosive in most types of U.S. nuclear weapons is so-called "Insensitive High Explosive" (IHE). IHE can withstand severe shocks without exploding, which lowers the risk that a chemical explosion might disperse plutonium and other hazardous materials over a wide area. The only U.S. nuclear warheads without IHE are the W-76 and W-88 warheads on submarine-launched ballistic missiles (SLBM), and the W-78 on Minuteman III ICBMs. Little would be gained by redesigning those warheads to function with IHE. The SLBMs use a very energetic propellant, which is relatively easy to detonate. Any accident that causes the missile propellant to detonate would likely break the warhead apart and scatter plutonium, regardless of whether the warhead contains IHE. All W-78s could easily be replaced by the more modern W-87, which has IHE, as the stockpile is reduced in size. Furthermore, procedural changes, including the removal of all nuclear weapons from aircraft in peacetime and loading/unloading missiles without their warheads mounted aboard, have significantly reduced the risk from warheads that lack the most modern safety features.

Proponents of developing new warheads have claimed that over time, as nuclear warheads age, their safety and reliability might degrade. However, safety can only improve with age. Extensive tests have shown that the chemical high explosive becomes more stable and predictable as it ages, further reducing the risk of accidental explosions. Surprisingly, key measures of performance, such as detonation-front velocities have also been shown to improve systematically with age.[63]

To prevent accidental or unauthorized initiation of a weapon's normal firing systems, U.S. nuclear weapons have so-called enhanced nuclear detonation safety (ENDS) systems. The ENDS system typically includes at least one "weak link" and two "strong links." All of them must be closed in order to arm and fire the warhead. The weak link is normally closed, but is designed to fail (open), like a circuit breaker, and prevent power from reaching the detonators in an abnormal environment, such as lightening, fire, or physical shock. The strong links generally isolate the systems that arm the warhead and fire the detonators from their power sources using devices such as motorized switches or mechanisms that physically interfere with the implosion until the proper arming sequence is followed. One strong link, called a Permissive Action Link (PAL), requires that the weapon receive properly coded electronic signals. Two different codes must be received simultaneously. This is the "two man rule," which ensures that an individual acting alone cannot arm a nuclear weapon. The other strong link can be closed only by a particular environmental event or sequence of events that would occur during the normal delivery of the warhead. Such events may be a deceleration force, a temperature, or a pressure that would normally occur only during delivery. Thus, if terrorists were somehow to obtain a U.S. nuclear warhead, they could not detonate it without first making complex internal adjustments. In the unlikely event that the terrorists were capable of making the necessary adjustments, the time required would provide a substantial opportunity for the U.S. to recover or destroy the weapon.

Even though nuclear weapons are extremely safe and secure, it is possible to do even better. The NNSA and the Department of Defense can and should make additional operational improvements in how nuclear weapons are handled and protected that would improve their safety and security. One significant measure would be to reduce the alert status under which the military maintains many nuclear weapons. If the alert status were reduced, the frequency of handling live weapons, including loading, unloading, and transporting them would be greatly reduced as would the opportunities for their exposure to accidents or hostile actions. And obviously, other things being equal, the fewer nuclear weapons there are, the less chance there is of a safety or security lapse.

Proponents of weapons development claim that they can design and fabricate new warheads that would be safer and more secure than existing weapons. That may be true, but the relevant question is whether the marginal improvements to safety and security, which NNSA may make through design changes, are worth the substantial negative effects that weapons development programs have on our national security.

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63 "Science-Based Stockpile Stewardship," Dr. Raymond Jeanloz, Physics Today, December 2000, p. 5, www.physicstoday.org/pt/vol-53/iss-12/p44.html.

It is also worth noting that new warheads may just as well wind up being less safe and reliable than existing warheads. Designing and building new nuclear warheads without testing them is risky, even with the sophisticated models of the Stockpile Stewardship Program. As Hoover Institution fellow, Sidney Drell, and former U.S. Ambassador, James E. Goodby, have stated, "It takes an extraordinary flight of imagination to postulate a modern new arsenal composed of such untested designs that would be more reliable, safe, and effective than the current U.S. arsenal based on more than 1,000 tests since 1945."[64]

The latest argument from weapons designers is that we need to improve the "surety" of existing weapons. Surety is a single word that incorporates the safety, security, and control of nuclear weapons. Proposals that strive for near absolute surety designed into the weapon itself should be viewed with deep skepticism. We believe that surety is simply the justification *du jour* for more weapons development. Built-in surety mechanisms, such as a mechanism to destroy a warhead remotely on command, may have potential utility in some very low probability theft scenarios. On the other hand, they may have a higher probability for affecting the pit implosion process in unexpected ways. Such new systems could severely degrade confidence in reliability. Arguably, only a full-scale nuclear test could truly resolve confidence issues regarding some built-in surety measures. Moreover, when it comes to keeping U.S. nuclear weapons secure, there will always be a need for "guards, guns and gates" that should never be qualitatively diminished (although we do hope to dramatically lower security costs by having far fewer nuclear weapons and storage sites, less separated fissile material, and smaller areas to guard). Furthermore, development of new and potentially improved warheads, whether the improvement is limited to surety or includes new yields and missions, is counter to U.S. non-proliferation goals.

Behind the superficially appealing promise of higher levels of nuclear warhead "surety" lies a thinly disguised effort by weapons advocates to circumvent obligations inherent in the NPT and the CTBT to abandon the technological competition in nuclear armaments. Improved "surety" is but one of several technological trap doors leading to reinvigoration of the nuclear arms race, which would restore prestige and resources to the nuclear weapons laboratories, but only at the cost of diminishing national and international security.

How Would Curatorship Differ From Stockpile Stewardship?

Curatorship would fundamentally change how the weapons laboratories go about their business.

Curatorship would fundamentally change how the weapons laboratories go about their business. The biggest difference would be that the numerous changes that NNSA makes to nuclear weapons each year would be strictly limited.

A key activity for maintaining nuclear weapons under Stockpile Stewardship is the so-called Life-Extension Program (LEP). NNSA, in cooperation with the DoD, has taken an aggressive approach to LEPs. In practice, "life extension" has become

64 "What are Nuclear Weapons For? Recommendations for Restructuring U.S. Strategic Nuclear Forces," Sidney Drell and James Goodby, an Arms Control Association Report, October 2007, p. 20.

a misnomer for nearly complete rebuild and upgrade of a warhead system that is nowhere near the end of its life. Under the Life Extension Program, NNSA and DoD have jointly reexamined the performance features, specifically military characteristics and stockpile-to-target sequence requirements, of almost all U.S. weapons designs and reevaluated the design of every component in those weapons against revised requirements. The two agencies have authorized hundreds of changes to nuclear weapons, adding new components and modifying weapons' military characteristics. Few, if any, of the replacements were required to extend the life of aging components. Rather, NNSA and DoD have chosen to make weapons lighter, more rugged, more tamper proof, and more resistant to radiation. In addition, NNSA installed new components that improved design margins, added arming and fuzing options, improved targeting flexibility and effectiveness, and put in advanced tritium delivery systems.

Under LEPs, DOE is seeking to upgrade every type of nuclear warhead in the planned arsenal. Upgrades have already been done on the W87 and B61 weapons. NNSA is now ramping up the LEP for the most numerous weapon in the stockpile, the sub-launched W76, which it estimates will cost over $3 billion. The planned modifications are so extensive that the weapon is being given a new number: the W76-1/Mk4A (the latter refers to its modified reentry vehicle). Under the W76 LEP, NNSA is replacing organics in the primary; replacing detonators; replacing chemical high explosives; refurbishing the secondary; adding a new Arming, Fuzing & Firing (AF&F) system, a new gas reservoir, a new gas transfer support system, a new lightning arrestor connector and making numerous other alterations to components that still function adequately.[65] The change to the AF&F system alone is creating a weapon with significantly improved military capability over the old version. While the old fuze permitted targeting of only soft targets via air bursts, the new AF&F system would add a ground burst capability, which delivers much greater damage to underground facilities. In addition, a new reentry body and other modifications would allow the W76 to be delivered by the D5 missile, which has much greater accuracy than the previous delivery vehicle. Taken together, these changes give the W76 a hard target kill capability against missile silos, command and control centers, etc. for the first time.

With the exception of replacing some organic adhesives, few, if any, of the changes under the W76 LEP address age-related problems that would require fixing under the Curatorship option. The Bush Administration planned to convert 2,400 W76 warheads to W76-1s.[66] Needless to say, the Obama Administration will have to clarify exactly how many W76s, if any, it plans to convert to W76-1's and how many it plans to retire and dismantle under its new proposal for bilateral reductions with Russia to reduce each nation's stockpile to 1,000 nuclear weapons. **We recommend that the existing W76 LEP, and ongoing LEPs for other warheads, be suspended pending institution of the change control process described below that would constrain new Life Extension Programs to replace only components that demonstrably need to be replaced.**

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65 "Administration Increases Submarine Nuclear Warhead Production Plan," Hans M. Kristensen, Federation of American Scientists, www.fas.org/blog/ssp/2007/08/us_tripples_submarine_warhead.php.

66 Ibid.

Recently, following the congressional rejection of funding for the RRW program, officials at the weapons laboratories and with the U.S. Strategic Command have called for expanding the Life Extension Program even further.[67,68] To date, NNSA has refrained from modifying or replacing plutonium pits during an LEP. Under a concept referred to as "extensive reuse LEP" (erLEP), also referred to as a "heavy LEP," that Rubicon would be crossed. NNSA would be allowed to reuse pits from retired warheads to provide "higher system margins" for warheads remaining in the stockpile. NNSA would make additional modifications to those warheads directed at improving their surety. Under the new erLEP concept, NNSA could also modify and reuse secondaries from retired warheads, recycle and reuse difficult to fabricate materials, such as fogbank,[69] and modify and add new electronic components using "modern technologies." It is not clear what changes NNSA wants to make to warheads using these recycled or rebuilt components.

Only if NNSA could present compelling evidence that a warhead component has degraded, or will soon degrade, and that such degradation could cause a significant loss of safety or reliability, would NNSA replace the affected parts.

In contrast, Curatorship would take a very conservative approach to modifying warheads. Only if NNSA could present compelling evidence that a warhead component has degraded, or will soon degrade, and that such degradation could cause a significant loss of safety or reliability, would NNSA replace the affected parts. The replacements would be remanufactured as closely to their original design as possible.[70] These replacement parts would truly extend the life of the warhead, without modifying its performance. NNSA currently takes apart approximately eleven warheads of each type per year and examines them under its Surveillance and Evaluation Program. Under Curatorship, NNSA would increase the scope and importance of the Surveillance and Evaluation Program to assure that sufficient numbers of every component of every warhead design are scrupulously examined and tested each year. The Surveillance and Evaluation program would supplant the Life Extension Program as the predominant mechanism for determining when components are replaced.

Scientists and engineers at the weapon labs are working to develop sensors that they can embed into existing warheads under NNSA's proposed erLEP program. The sensors would monitor each warhead's condition and identify if there is any degradation that might affect its performance. According to the laboratories, such sensors would allow NNSA to reduce its surveillance activities. We believe that reducing surveillance is the wrong way to go. Embedded sensors cannot possibly provide as much information as disassembling a warhead and examining and testing its components.

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67 "Military's RRW Alternative is Warhead Life Extension," Elaine Grossman, Global Security Newswire, Sept. 12, 2008, www.gsn.nti.org/gsn.

68 "Stewarding a Reduced Stockpile," Bruce T. Goodwin and Glenn L. Mara, AAAS Technical Issues Workshop, April 24, 2008, Washington, DC.

69 Fogbank is a codeword for a classified material that is believed to be an aerogel (somewhat like Styrofoam) used in some warheads as interstage material between a nuclear weapon's primary (i.e. the plutonium pit and surrounding high explosives) and its secondary.

70 In some cases, current environmental regulations might not allow exact remanufacture of old components. In others, original specifications have been lost or are incomplete. In those cases, NNSA would attempt to match the performance of the old component as closely as possible. Those cases would require more analysis and testing than exact replacements, but would still be far less costly and introduce much less uncertainty than under the current approach, which allows for major modifications.

Embedding sensors into existing, well-tested warheads could provide new opportunities for component failure. Even worse, it could affect the performance of the warheads in poorly understood ways. We prefer to minimize stringently any changes to the well-tested and certified safe and reliable warheads of the existing stockpile.

Stockpile Stewardship requires a massive R&D enterprise and the use of ever expanding modeling capabilities in a complex process to certify each year that the changing stockpile is safe and reliable. Under Curatorship, continued confidence in the stockpile would be based on an absence of change and reference to the extensive historical testing and certification activities that have already demonstrated existing warheads to be safe and reliable. Absent any observed physical changes to a warhead, or hidden changes in performance that may be inferred from nonnuclear test and evaluation activities, the warhead's continued safety and reliability would be assumed, because of its known testing pedigree. In other words, "If it ain't broke, don't fix it." The key to maintaining the stockpile would be determining whether significant degradation has occurred. NNSA would still need skilled engineers and designers, with good judgment, to examine warheads and to determine if components are degrading and when they must be replaced. NNSA would continue to operate state-of-the-art testing and engineering facilities to examine components. It would retain sufficient scientific and computing capabilities to apply analytical models to questions of weapon safety and reliability using all the knowledge that the NNSA has gained to date through the Stockpile Stewardship Program. NNSA would make use of evolutionary improvements in computing technology to better appraise problems with weapons systems, but it would no longer be the engine for making and funding such improvements.

"If it ain't broke, don't fix it." NNSA would still need skilled engineers and designers, with good judgment, to examine warheads and to determine if components are degrading and when they must be replaced.

On the other hand, NNSA would have no need to continue enhancing its understanding of weapons science or to maintain cutting edge research facilities in a wide range of technologies. Those capabilities are needed primarily to design and certify new components. Under Curatorship, most of NNSA's weapons-related research and experimentation programs would cease and numerous facilities would be closed.

The Curatorship approach to managing the nuclear weapons stockpile builds on an impressive lineage. It stands on basic concepts advocated by Norris Bradbury, Director of the Los Alamos Laboratory (LANL) from 1945–1970, J. Carson Mark, former head of the LANL's Theoretical Division, Richard Garwin, former nuclear weapon designer and current JASON, Ray Kidder, senior staff scientist and former weapons designer at Lawrence Livermore National Laboratory (LLNL) and others.

Curatorship is Better than Stockpile Stewardship

The NNSA is currently engaged in a major effort to rebuild the nuclear weapons complex, the aforementioned Complex Transformation. According to the NNSA, the benefits it is seeking through Complex Transformation include, "improved safety, security, and environmental systems, reduced operating costs, and greater responsiveness to future changes in national security policy."[71] Curatorship would be more

71 Final Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS), DOE/EIS-0236-S4, NNSA, October 2008, p. S-1.

beneficial in all of these areas than any of the alternatives that NNSA considered under Complex Transformation.

Improved Safety – Under Curatorship, and particularly with the stockpile reduced to 500 warheads, there would be far less work involved in maintaining the nation's nuclear deterrent. Thus, NNSA would significantly reduce the scale of plutonium and enriched uranium operations associated with maintenance. By reducing worker exposures and the risks of accidents, a lower workload is inherently safer. In addition, studies of defects in nuclear weapons have shown that many more problems have occurred in new weapons and components than in weapons that have been in the stockpile for a considerable period. Thus, maintaining existing weapons much as they are today, under Curatorship, is more likely to keep them problem free than introducing new components through LEPs or designing new warheads under Stockpile Stewardship. This is a familiar effect common to products as diverse as computer software, automobiles, and nuclear power plants. The reliability of software most often improves with age, as frequent revisions and updates in response to operational experience progressively eliminate sources of error in the code. Similarly, with automobiles, if you want a problem-free vehicle, it is best not to rush out and buy the first year of any new model, particularly if it incorporates substantially new technology.

Improved Security – Security would be improved under Curatorship for the same reasons that safety would be better. Under Curatorship, the weapons complex would be more secure, simply because there would be fewer sensitive activities conducted at fewer sites. There would be fewer R&D facilities requiring protection and less new classified information to be safeguarded against espionage or inadvertent disclosure. There would be fewer contractor employees with access to sensitive facilities and classified information. There would also be fewer shipments of nuclear weapons and components around the country, which offer opportunities to terrorists. In addition, fissile materials would be consolidated to fewer and more secure facilities.

Improved environmental systems – Under the Curatorship approach, NNSA would close numerous facilities and in some cases entire sites that use high explosives, tritium, or other hazardous materials, such as Site 300 at LLNL. Those closures would produce significant environmental benefits and cost savings beyond the alternatives the NNSA is considering under Complex Transformation.

Reduced operating costs – Operating costs would be dramatically reduced under Curatorship, well beyond the obvious savings from reducing the number of nuclear weapons. NNSA currently spends about fifty percent of the Weapons Activities budget on R&D. That is appallingly out of step with any industrial activity in the United States. Large companies in the most research-intensive industries, such as computers and electronics, chemicals, aviation, and biotechnology, spend less than twenty percent of their revenue on R&D. Most spend less than ten percent. With over sixty-five years of experience in designing, producing, and maintaining nuclear weapons, there is no reason for NNSA to spend such a large percentage of its funding on R&D. Under Curatorship, NNSA would devote no more than twenty percent of its Weapons Activities budget to R&D.

Strengthen non-proliferation efforts – Most importantly, Curatorship is superior to the Stockpile Stewardship Program, because it would more closely align with United States' responsibilities under the Non-Proliferation Treaty and the nation's non-proliferation goals. Strengthening non-proliferation is not one of NNSA's goals in Complex Transformation, but it certainly should be. The New Agenda Coalition (NAC), a diverse and influential group of signatory states to the NPT, has called upon the nuclear weapons states to stop modernizing their arsenals.[72] The NAC stated, "Any plans or intentions to develop new types of nuclear weapons or rationalization for their use stand in marked contradiction to the NPT, and undermine the international community's efforts towards improving the security of all states." Whether one agrees with the NAC that improving nuclear weapons is contrary to U.S. NPT obligations (and we believe it is), it is clearly detrimental to U.S. non-proliferation objectives. Stemming the proliferation of nuclear weapons requires the cooperation of all nations. To the extent that the NNSA's development of new and improved nuclear weapons alienates nations such as the New Agenda Coalition, it is undeniably contrary to U.S. non-proliferation goals.

Changes to Nuclear Weapons Should be Stringently Controlled

As noted above, NNSA and DoD have authorized hundreds of changes to nuclear weapons, the vast majority of which were not needed to extend the life of the weapon. The administrative control of nuclear weapon designs is currently under the auspices of the Nuclear Weapons Council (NWC). The NWC is a joint DoD/DOE organization established by Congress in 1987 to coordinate all joint activities regarding the nuclear weapons stockpile. The NWC is chaired by the Under Secretary of Defense for Acquisition, Technology, and Logistics. The other members are the Vice Chairman of the Joint Chiefs of Staff, the Under Secretary of Energy for Nuclear Security (NNSA Administrator), the Under Secretary of Defense for Policy, and the Commander of the U.S. Strategic Command (STRATCOM). Among its activities, the NWC coordinates, determines, and schedules all activities regarding the maintenance and refurbishment of nuclear weapons. Much of that coordination is done in Project Officers Groups (POGs), which are chartered by the NWC with cradle to grave responsibility for each type of nuclear weapon. POGs typically have as many as a dozen members from various DoD organizations, the military services, DOE, NNSA, and the nuclear weapons complex's laboratories and production plants.

The POGs, working with the NNSA laboratories, annually assess each warhead type with regard to its military characteristics (yield, reliability, safety in normal and abnormal environments, nuclear hardness, weight and balance, use control features, and a host of other factors) and its stockpile-to-target sequence requirements for withstanding extremes of temperature, pressure, acceleration and other conditions a warhead might have to withstand throughout its lifetime. These assessments have become forums for examining, not only whether the warhead continues to meet its

72 The membership of the New Agenda Coalition includes: Brazil, Egypt, Ireland, Mexico, New Zealand, South Africa, and Sweden.

existing requirements, but also for considering changes to warheads to improve performance, add new capabilities, or modify components for any reason. Unfortunately, there is little resistance to making changes to warheads in this process. The POGs are simply too immersed in the mission of enhancing their weapon systems and are unable to see the forest for the trees. They have an institutional bias, which leads them to magnify minor questions about warhead performance, to look for potential improvements (including surety improvements), and to recommend modifications, without realizing the long-term problems with that approach.

We believe that a more rigorous and formal change control process is needed. A rigorous change control process is the embodiment of the Curatorship approach.

We believe that a more rigorous and formal change control process is needed. A rigorous change control process is the embodiment of the Curatorship approach. The Administration and the Congress must first declare support for the Curatorship approach of minimizing changes to existing warheads and then establish a change control process to enforce it. We recommend that President Obama issue a Presidential Decision Directive (PDD) prohibiting any change in the military characteristics or the stockpile-to-target sequence requirements of any nuclear weapon, unless the change is essential for maintaining the safety or reliability of the existing warhead. However, announcing a policy to limit changes to warheads, by itself, is not enough. Congress must establish an institutional mechanism to enforce that policy.

Independent experts should review any proposed change to a nuclear weapon (no matter how seemingly minor) and make recommendations to senior Administration officials, who then would have the final say. To further that end, we recommend that Congress establish through legislation a stringent change control process for nuclear weapons, including a requirement for outside review of all changes. Major changes, including any that would alter the military characteristics or the stockpile-to-target sequence of a nuclear weapon in any manner, should require authorization and funding by the Congress as a separate line-item.

The process for independent assessment of proposed changes could take many forms, but we believe it should include some form of review from outside the weapons laboratories. Independent review might be solicited from the JASON scientific advisory group, the National Academy of Sciences, or a new entity established solely for that purpose.

Final decisions, except those requiring separate funding from the Congress, could remain with the Nuclear Weapons Council (NWC), be made by a new Federal nuclear weapons change control board, or be made by an expanded NWC to include senior Executive Branch officials who bring a big picture view of national security. Potential additions to the NWC include the Under Secretary of State for Arms Control and International Security and the President's National Security Advisor. In any event, we recommend that Congress establish the change control process in legislation and require that both outside reviewers and the decision makers weigh the potential benefits of any proposed change against the adverse non-proliferation consequences and the likelihood that the change could, over time, contribute to reduced confidence in the performance the warhead.

The Process for Assessing and Certifying Nuclear Weapons Should be Revised

When President Clinton submitted the Comprehensive Test Ban Treaty to the Senate for ratification in 1995, he enunciated a number of safeguards to assure the Congress that the nuclear stockpile could be maintained without testing. He announced, as "Safeguard F," that

> *if the President is informed by the Secretaries of Energy and Defense, advised by the Nuclear Weapons Council, the directors of the weapons laboratories, and the Commander-in-Chief of Strategic Command that a high-level of confidence in the safety or reliability of a weapon type critical to the nuclear deterrent could no longer be certified, the President, in consultation with the Congress, would be prepared to withdraw from the CTBT under the Supreme National Interest Clause in order to conduct whatever nuclear testing might be required.*

President Clinton also directed the DoD and DOE to conduct a rigorous annual certification process to determine the overall safety and reliability of the stockpile.

Congress formalized this process in section 3141 of the National Defense Authorization Act for Fiscal Year 2003 (P.L. 107-314), which specifies a number of assessments that must be performed each year leading to an annual report on the stockpile to the President and the Congress from the Secretaries of Defense and Energy. The nuclear weapons establishment has responded to these requirements with an elaborate system of technical investigations and the preparation of seven major series of reports, including:

- *Weapons Laboratory Annual Assessment Reports (AARs)*: Prepared for each weapon type by the technical staff of the weapons laboratory responsible for the nuclear explosive package (LANL or LLNL) and their engineering counterpart at SNL.
- *Weapons Laboratory Red Team Reports*: Prepared by a separate "red team" at each weapons laboratory that peer reviews the technical information contained in the laboratory's AARs.
- *Weapons Laboratory Director Reports*: An assessment of the safety, performance, and reliability of the nuclear stockpile to the NWC and the Secretaries of Energy and Defense by the director of each weapons laboratory, based on the AARs and the Red Team reports.
- *Strategic Advisory Group Stockpile Assessment Team (SAGSAT) Report*: Prepared for the STRATCOM Commander, which expresses the SAGSAT's confidence as to whether each warhead type will perform as designed.
- *Commander of STRATCOM Report*: The Commander of STRATCOM's assessment of the safety, performance, reliability and military effectiveness of the nuclear stockpile, submitted to the NWC and the Secretaries of Energy and Defense.
- *POG Reports*: A technical assessment, submitted to the NWC, from each POG on the warhead type for which it is responsible.

- *Report on Stockpile Assessments*: The final package, prepared by the NWC on behalf of the Secretaries of Energy and Defense, which summarizes and transmits the above reports to the President and the Congress.[73]

The assessments in these reports, in actuality, have little to do with certification of the stockpile. According to NNSA and laboratory officials, "once a warhead is certified, it remains certified until it is either decertified or retired."[74] Furthermore, this convoluted process has nothing to do with notifying the President about the need for a nuclear test, which was ostensibly its original purpose. According to agency and congressional officials, "if an issue with a weapon were to arise that required a nuclear test to resolve, the Secretaries of Energy and Defense, the President, and the Congress would be notified immediately and outside of the context of the annual assessment process."[75] What the process has turned into is make-work for dozens of national laboratory scientists and technicians, as well as weapons specialists in NNSA, the NWC, the military services, STRATCOM, and other DoD agencies. It also serves as one more mechanism for the laboratories and the services to propose modifications to U.S. nuclear weapons.

The annual assessment process is a major underpinning for much of the research and development work at the weapons laboratories, which is performed under Stockpile Stewardship. In order to prepare their Annual Assessment Reports, the laboratories use all of their testing and simulation capabilities to quantify estimates of the margins and uncertainties for a host of factors, which they use to determine whether the nuclear explosive package of a nuclear weapon would meet its military characteristics. The labs continue to investigate minute details of nuclear weapons technology, in order to produce new and improved bottom up assessments each year.

This elaborate process of ever improving simulation capabilities and annual reviews is conceivably needed only if there are significant changes to the warheads each year. Under Curatorship, with few, if any, modifications to the well-tested designs in the stockpile, the laboratories would need only to analyze the potential effects of changes due to aging on components, which are identified under the upgraded surveillance program. Existing diagnostic, assessment, and modeling capabilities are sufficient for this task. As is the case now, if the surveillance program and subsequent analysis were to identify a problem that threatened the adequate performance of a weapon in the stockpile, the Nuclear Weapons Council, the Secretaries of Defense and Energy, and the President and Congress would all be informed promptly about the problem.

Thus, recurring annual assessments or certification of the safety and reliability of the stockpile should not be necessary. Nevertheless, to provide additional assurance that the weapons in the stockpile remain safe and reliable, the laboratories and the military services might update the assessment of each weapon system every five years. The assessments could be similar to those required under Section 3141, but would

73 From "Nuclear Weapons: Annual Assessment of the Safety, Performance, and Reliability of the Nation's Stockpile," U.S. Government Accountability Office (GAO-07-243R), February 2, 2007, p. 9.

74 Ibid. p. 6.

75 Ibid. p. 3.

not be as elaborate since they would have to examine only the few changes that were produced by or made in response to aging. One change we recommend to the assessment process is to make the existing Red Teams at LANL, LLNL, and SNL truly independent. The Red Teams review the analyses of those laboratory scientists with direct responsibility for maintaining each warhead. The Red Teams consist primarily of other laboratory personnel who currently report to the same management team as those performing the initial assessments. We recommend that the Red Team members be hired under a separate contract from the management contract of the laboratories at which they are situated and that they report their findings directly to the NNSA, rather than through their laboratory directors.

As is the case now, if any of the laboratory analyses find a significant problem with a weapons system, their report should include a discussion of the options available to resolve the problem. The options should include replacing one or more components with new versions of the original design, replacing components with modified versions, changing weapon handling procedures, changing the military characteristics or stockpile-to-target sequences, retiring specific warheads, replacing warheads with others, and any other compensatory measures that could enable accomplishment of the missions of the nuclear weapon types to which the assessments relate. Only if it concludes that none of those options is feasible, should a laboratory be allowed analyze whether conducting one or more underground nuclear tests might help NNSA resolve the problem.

It is hard for us to imagine a circumstance in which one of the measures listed above could not resolve any problem, without a need to resort to nuclear testing. Nevertheless, to prepare for the remote possibility that a President might request authority from the Congress for NNSA to conduct a nuclear test, we recommend that Congress require any such request to be accompanied by independent analyses from the Central Intelligence Agency (CIA) and the State Department on the effects of a U.S. nuclear weapons test on the CTBT, the NPT, and all other nations possessing nuclear weapons or those which may be seeking to acquire them. Congress could then decide whether the benefits of a nuclear test outweigh the adverse national security consequences of withdrawing from the CTBT and/or breaking the current moratorium on nuclear weapons tests.

How Would Weapons Research, Development, and Testing Change Under Curatorship?

This section provides an overview of the changes we recommend to research, development, and testing facilities and activities in the weapons complex in accordance with the Curatorship approach. Our recommendations regarding production facilities are summarized in Chapter 6.

Under the Curatorship approach, we recommend that the NNSA de-emphasize nuclear weapons science and technology and cease its quest for more and more detailed simulations of exploding thermonuclear weapons. The existing codes are sufficient, in conjunction with limited use of hydrotesting, for the analyses needed to maintain the stockpile as it is. Improved codes have little use except for designing new types of nuclear weapons or verifying the impact of major changes to existing ones. Designing new nuclear weapons would run counter to U.S. commitments under Article VI of the NPT and would set a bad example for the rest of the world. President Obama has already declared that the United States will not design new nuclear weapons. The NNSA's claim that it needs better computer codes to maintain existing weapons is tantamount to Iran's claim that it needs a domestic uranium enrichment capability for nuclear power. Both claims may provide fig leaves for thinly-veiled nuclear weapons development programs.

We recommend that NNSA dramatically reduce its research efforts in several areas, including equation of states studies, dynamic modeling, studies of the physical and chemical properties of Pu and HEU, hydrodynamics experiments, and sub-critical tests. Most of this research has no purpose for anything except improving nuclear weapons. We recommend that NNSA continue validating its codes against existing test data and applying those codes to questions of relevance to the existing stockpile. We would expand the testing and analysis of components taken from actual warheads in the stockpile to assure that any changes to components due to aging are discovered and analyzed before they become detrimental to nuclear weapons performance. This empirical approach to stockpile surveillance and maintenance is far superior and should be prioritized over endless "nuclear weapons science." A simple way of putting it is that we recommend an "engineering" rather than a "science-based" approach to stockpile maintenance.

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With significantly less weapons R&D under Curatorship, NNSA could shrink its R&D infrastructure. We recommend reducing the number of facilities and personnel dedicated to nuclear weapons research, development, and testing and consolidating the remaining efforts to LANL and SNL-NM. In particular, we recommend closing all nuclear weapons R&D facilities at LLNL or transferring them to other DOE programs for non-weapons research. Under our plan, LLNL would retain a small capability to examine surveillance issues and a "red-team" of experts to provide peer review for changes to nuclear weapons and for certification-related actions. The Red Team would report directly to NNSA rather than to LLNL management. Any related experimental investigation, which may be necessary to support that activity, would have to be performed elsewhere.

DOE would shift LLNL's primary mission from nuclear weapons research to basic science and energy research, while maintaining strong programs in non-proliferation, safeguards, transparency and verification of warhead dismantlement, intelligence, and nuclear emergency response.

In addition, we recommend that NNSA cease, or transfer to SNL-NM, all weapons-related activities at SNL-CA. All facilities at SNL-CA would be closed or transferred to other DOE offices or to other agencies.

Furthermore, we recommend that NNSA cease all sub-critical testing and most other nuclear weapons-related tests and experiments at the Nevada Test Site (NTS) and transfer the landlord responsibility for the site to another DOE office or other appropriate entity. Operations at the U1A facility should be suspended and the facility closed. DOE or other agencies could continue to operate other research, development, and testing facilities at NTS, including the Big Explosives Experimental Facility (BEEF) and large gas guns, as user facilities. The NNSA weapons program could use those facilities infrequently, but only for tests that are necessary to resolve problems identified with weapons in the existing stockpile.

The Future of the Lawrence Livermore National Laboratory

Numerous legislators, special commissions, and presidential administrations have recommended shifting the focus of Livermore Lab from nuclear weapons to other missions. Those efforts have come to naught. However, we believe the time is right to make that transition today.

The nation is not well served by maintaining two nuclear weapons design laboratories (Livermore and Los Alamos). Our plan would stop new weapons development and rely primarily on Los Alamos for the residual activities necessary to caretake nuclear components in a rapidly diminishing arsenal. We would cut Livermore loose from the nuclear weapons complex by 2012 to pursue new missions.

In his Inaugural address, President Barack Obama stressed the urgency of three major crises facing America and the world—energy, climate change, and "green" jobs: "The ways we use energy strengthen our adversaries and threaten our planet," Obama declared. "We will harness the sun and the winds and the soil to fuel our cars and run our factories." And, "We will work tirelessly to lessen the nuclear threat, and roll back the specter of a warming planet."

Since President Obama is determined to address those crises, there is a more realistic political possibility than during past administrations to transition Livermore from nuclear weapons design to non-polluting energy development, global warming research, nonproliferation and environmental technologies. Livermore Lab is uniquely qualified to contribute in all of those areas

In addition to these four major mission areas, under our plan, Livermore Lab would maintain basic science programs. It would also retain a small near-term watchdog role for nuclear weapons, fielding two expert teams, one to peer review weapons certification and one to assist with weapons surveillance and evaluation functions consistent with the Curatorship model.

Livermore Lab already employs the right mix of physicists, other scientists, engineers, materials specialists, and support personnel for these undertakings. Further, Livermore Lab houses current programs in ***all*** of these areas, including global climate modeling. Therefore, the Obama Administration can feasibly build a new and 21st Century-relevant mission for Livermore on the foundation of what today are scientifically well regarded, albeit mostly under-funded, programs.

The remissioning of Livermore Lab could also provide a means for productively utilizing the Sandia, Livermore site, and its engineering expertise. For example, the Combustion Research Facility at Sandia-Livermore is already contributing to cleaner, more efficient engines for numerous applications.

The nation needs its national laboratories devoted to clean energy, environmental restoration, developing a "green" economy, and reducing nuclear dangers more than it needs a new or "improved" nuclear bomb. Transforming Livermore Lab to meet pressing 21st Century challenges is technically feasible. We call on the new Administration and Congress to start now and get the job done by 2012.

Aerial view of Lawrence Livermore National Lab looking west over a residential neighborhood.

Recommendations by Major Classes of Facilities

Following is a summary of our recommendations by major classes of research, development, and testing facilities.

Advanced Simulation and Computing (ASC) – One of the major initial goals of the Stockpile Stewardship program was to improve NNSA's computing capabilities to better model nuclear weapons performance. Today, fifteen years and billions of dollars later, NNSA has gone from one-and two-dimensional codes, which modeled all nuclear explosions as if they were perfectly symmetrical, to three-dimensional codes that can model real-world issues that might affect the performance of aging nuclear weapons, such as cracks and corrosion. NNSA has also incorporated a vast amount of new experimental data into the codes, which reflect observed material properties and more refined extrapolations based on such new observations, rather than ad hoc assumptions. This is believed to have greatly improved the accuracy of the codes, as well as NNSA's confidence in their predictive results. Improved confidence in the codes has led some weapons designers to believe they are good enough to be used to design and certify new nuclear weapons, without full-scale underground nuclear weapons tests. Designers' ability to certify new nuclear weapons, without testing, is controversial.

However, modeling existing weapons of the legacy stockpile is a much easier task. It is easier because the extensive results from nuclear testing of those weapons have been used to baseline the new sophisticated codes. In addition, this original test data had been augmented by an enormous amount of test data from recent hydrodynamic and other tests on the legacy designs.

Consistent with the Curatorship approach, we recommend that NNSA halt all systematic efforts to improve the computer codes it uses to model nuclear explosions. This action would be a major step in abiding by the commitment to halt the arms race under Article VI of the NPT. In addition, it would save hundreds of millions of dollars per year that is now spent developing new computer codes and acquiring ever more powerful computing platforms. Furthermore, it would allow NNSA to close numerous nuclear weapons research facilities, whose primary purpose is to feed results into code development.

We also recommend that NNSA cease its current practice of subsidizing development of new computer technology by continually upgrading its computer facilities to the fastest computers in the world through joint development programs with supercomputer manufacturers. DOE might continue to subsidize development of supercomputing in this manner via other programs with greater scientific and social merit (for example, meeting the immense computing needs of predicting global climate changes). However, development of supercomputers would not be a mission of the nuclear weapons program under Curatorship.

Under Curatorship, as improvements in computer technology become available in the commercial marketplace, NNSA could adapt its existing codes to run on those faster computers. NNSA could also continue to validate its computer codes by comparing new calculations to existing test data and could continue to apply its codes to better understand the behavior of the legacy stockpile under a variety of conditions.

High Energy Density and Pressure (HEDP) R&D – NNSA has numerous facilities it uses to create high pressures, densities, and temperatures for studying the behavior of materials under conditions similar to those in an exploding nuclear weapon. These facilities, including large lasers, pulsed power machines, and gas guns, are referred to collectively as HEDP facilities. HEDP facilities are used primarily to provide information on material properties in extreme conditions. NNSA primarily uses that information to improve the computer codes used to model exploding nuclear weapons. NNSA also uses HEDP facilities for integrated tests of those codes. Since NNSA would no longer seek to improve its modeling capabilities under the Curatorship approach, all HEDP facilities would be candidates for closure, unless they had some other legitimate scientific use.

Some of the HEDP facilities can produce X-rays or other effects, which NNSA may use in "environmental testing" to qualify replacement components or as part of the surveillance program. NNSA has numerous other facilities that produce similar effects, many of which would remain in operation under Curatorship (see Major Environmental Test Facilities below). Selected HEDP facilities might also remain in operation, if they are cost effective or crucial to environmental testing. In addition, some HEDP facilities might have applications in fields other than nuclear weapons, including fusion energy, astrophysics, and as sources of X-rays for research in numerous areas. Those facilities might be transferred to other DOE offices or other agencies and remain in operation. The remaining HEDP facilities would be closed.

Hydrodynamic Testing – Hydrodynamic Testing is sometimes used (in conjunction with computer modeling) to examine issues that are discovered during surveillance. It is more often used to perform weapons physics research, to improve modeling of nuclear weapons performance, to study new nuclear weapons geometries, to design and certify new nuclear weapons, and to evaluate the performance of new materials and components. Under Curatorship, it would be used for the first purpose only. That would require only a small fraction of the current testing rate.

Under Curatorship, all hydrodynamic testing facilities would be closed, except for the *Dual-Axis Radiographic Hydrodynamic Test* (DARHT) facility at LANL. DARHT is the most modern of NNSA's hydrotest facilities. When DARHT becomes fully operational, it will be capable of performing tests with multiple shots from two different viewing angles on targets including full-scale mockups of any warhead in the current stockpile. About 100 hydrotests per year are performed at DARHT, which would be more than sufficient for all of the hydrotesting required under Curatorship. Under our plan, any planning for a follow-on Advanced Hydrotest Facility, part of NNSA's long-term vision for the Nevada Test Site, would end.

Sub-critical tests are a special class of hydrodynamic test, in which small amounts of Pu or HEU are compressed in ways that produce some fission, but cannot lead to a self-sustaining fast neutron chain reaction in the material. They are currently performed at the U1A underground test facility at the NTS. Sub-critical tests would cease under Curatorship and the U1A facility would be closed.

Major Environmental Test Facilities – NNSA's *Final Supplemental Programmatic Environmental Impact Statement (SPEIS) on Complex Transformation* identifies more than thirty "Major Environmental Test Facilities (ETFs)." NNSA uses those facilities for multiple purposes including R&D on new component and weapon designs and for certification of new components and weapons. Under Curatorship, there would be no development of new components or weapons and those uses would drop out. Some Environmental Test facilities have also been used to test and validate changes in computer models. Those uses would also drop out.

NNSA also uses many of the ETFs to test components from weapons randomly drawn from the stockpile as part of its surveillance program. That activity would expand under Curatorship. In addition, testing for certification and quality assurance of necessary replacement parts would also continue under Curatorship. Under Curatorship, NNSA would retain or replace only those ETFs that are essential to the surveillance program. Many of the facilities that are retained or replaced under NNSA's preferred alternative—consolidate major environmental testing at SNL-NM—appear to meet that criterion. There is, however, insufficient information in the SPEIS to determine whether each of those facilities would do so. Some ETFs are likely to have very limited roles under Curatorship and would be transferred to another DOE office, another agency, or closed.

High Explosives (HE) R&D – Most of the HE R&D that NNSA currently supports is focused on formulation of new explosives. This work would cease under Curatorship. Studies of aging of HE formulations in existing weapons and components could continue at Pantex. Surveillance activities and quality assurance (QA) studies of HE in existing components would be expanded.

Tritium R&D – NNSA performs R&D on tritium primarily to improve its understanding of mixing issues in imploding primaries or to design new gas handling systems. We recommend halting both of those activities under Curatorship. R&D at SNL-NM for production support and quality improvement of neutron generator production could continue.

Microsystems, Nanotechnology, and Advanced Electronic R&D – NNSA supports a substantial amount of R&D on microsystems, nanotechnology, and advanced electronics. This work is applicable only for designing and fabricating new nuclear weapon components. Under Curatorship, there would be little or no introduction of new components into nuclear weapons and little need for NNSA to perform such research. Research in microsystems, nanotechnology, and advanced electronics contributes to other missions, including fostering the competitiveness of US industry. However, unless NNSA's state of the art facilities for R&D on those technologies are supported by other programs or agencies, they would be closed under Curatorship.

CHAPTER 6

Strategy for Production Activities

In this chapter, we provide our strategy for consolidating production facilities to support a smaller stockpile with fewer changes to nuclear weapons. That strategy is based on four guiding principles:

- NNSA should reduce its infrastructure to that needed to support a total stockpile of 500 nuclear weapons, under a Curatorship approach, which stringently minimizes changes to existing warheads.
- NNSA does not need any capability to produce components that are not currently in weapons in the stockpile.
- NNSA should expand its capabilities for surveillance of warheads remaining in the stockpile and retain facilities to replace genuinely "limited life components," and, if necessary, replace any other component when there is evidence of a problem that left unattended could significantly degrade warhead performance or safety.
- NNSA should dismantle excess warheads and consolidate and reduce stockpiles of special nuclear materials, as quickly as possible, to reduce costs and security risks.

We believe that a 500-warhead stockpile, with stringent constraints on modifying those warheads, could be more than adequately supported by only three production sites.

Adhering to these principles would result in a much smaller production complex than exists today. Currently, most nuclear weapons production and maintenance activities are carried out at six sites—LANL, Y-12, Pantex, KCP, SNL-NM, and SRS. The other locations—LLNL, NTS, SNL-CA—primarily conduct supporting nuclear weapons research, development, and testing, but they also perform some surveillance work. (See Chapter 4 for descriptions of the facilities and activities at each site.)

We believe that a 500-warhead stockpile, with stringent constraints on modifying those warheads, could be more than adequately supported by only three production sites. Moreover, because nuclear weapons activities would be sharply curtailed, each of those three sites should experience a net reduction in workload, with the possible exception of a short-term increase in dismantlements at Pantex. (See map on inside front cover.)

Under our plan: LANL would be responsible for nuclear-related operations, (primaries, secondaries, and tritium); SNL-NM would produce or acquire nonnuclear components and, as it has been doing, integrate weapon functions; and Pantex would have responsibility for chemical high explosives and for warhead disassembly/assembly operations, with an increased focus on dismantlements. All three sites would conduct surveillance on various components. In addition, supporting research and analysis, devoted primarily to peer review of important warhead issues, would continue at LLNL. The timing of consolidation from six production sites (out of eight sites in all) to three and the sizing of any new facilities that might be needed to accomplish the consolidation is difficult to specify. Both depend on the timing of stockpile reductions to the 500-warhead level and beyond. If the vision of a world free of nuclear weapons is realized soon, it might be cheaper merely to wind down activities at the existing sites, without ever relocating any operations. On the other hand, if stockpile reductions proceed on a gradual glide path over twenty years or more, as is more likely, there would be substantial environmental, security, and cost benefits in consolidating to three sites.

For planning purposes, we assume that the U.S. reduces its stockpile to 500 total nuclear warheads, beginning now and concluding between 2015 and 2020, and that consolidation to three sites is completed shortly after the stockpile is reduced to 500 warheads, or around 2025. This end-date for the consolidation process is set by the anticipated completion of uranium component dismantlement activities at Y-12. Accordingly, we recommend that NNSA begin the planning needed to shrink and consolidate all production, surveillance, and disassembly/reassembly activities to LANL, SNL-NM, and Pantex and prepare for a smaller complex by canceling or deferring construction of several large new facilities, including:

- The Uranium Processing Facility (UPF) at Y-12,
- A new nonnuclear components manufacturing complex in Kansas City,
- The "Nuclear Facility" (NF) for the Chemistry and Metallurgy Research Building Replacement (CMRR) Project at LANL,
- The Weapons Engineering Science and Technology (WEST) facility, scheduled for construction at LLNL beginning in 2010,
- The proposed annex to the High Explosives Application Facility (HEAF) at LLNL,
- The Mixed Oxide (MOX) fuel fabrication plant at SRS,
- The Pit Disassembly and Conversion Facility (PDCF) planned for SRS, and
- The Waste Solidification Building (WSB) planned for SRS.

Until the pace of arms reductions is clearer, we recommend that NNSA make no decisions to build new facilities or relocate facilities that it might need to consolidate production activities, with two exceptions. We recommend that NNSA remove all Category I and II amounts of special nuclear material (SNM) from LLNL by the end of 2010 and consolidate nuclear materials to fewer areas within the sites that retain significant quantities. In addition, we recommend that NNSA study the alternatives for transferring essential nonnuclear component fabrication activities from KCP to SNL-NM, LANL, or the private sector, with a view toward closing KCP by 2015. Shutdown of NNSA operations at KCP would be followed by comprehensive site cleanup of serious groundwater contamination. These recommendations are discussed further below.

The options that NNSA analyzed in its *SPEIS on Complex Transformation* all supported many more than 500 warheads. In response to public comments calling for a lower production option, the Final SPEIS included a new low production option it called the "No Net Production/Capability-Based Alternative." Under that alternative, NNSA would maintain capabilities to continue surveillance of the weapons stockpile, produce limited life components, and continue dismantlement. NNSA would produce a limited number of components beyond those associated with supporting surveillance, but would not add new types or increased numbers of weapons to the total stockpile. This alternative allows for production of ten sets of components or assembly of ten weapons per year to maintain capability and to support a limited Life Extension Program (LEP) workload.[76] However, even under that alternative, NNSA assumed it would need to support 1,000 operationally deployed strategic warheads. That is only a 50% reduction from the level of the Moscow Treaty. After adding non-deployed warheads, tactical warheads, spares, and replacements, it could still represent a total stockpile five or more times the size of our recommended level.

NNSA's *Final SPEIS on Complex Transformation* includes a brief discussion of the possible effects on its programmatic alternatives if the stockpile were reduced to several hundred weapons. It concludes, "At some point following completion of the bulk of dismantlements, closure and further consolidation of production sites could become reasonable."[77] Under this scenario, after dismantlements are completed, Pantex and Y-12 would be closed and NTS would be used for disassembly/reassembly operations. However, that is not the option NNSA plans to implement. NNSA's December 19, 2008 ROD on Complex Transformation[78] calls for construction of large, new production facilities, which would allow it to maintain a complex big enough to support today's nuclear weapons stockpile indefinitely. NNSA has decided to continue operations at all of its production sites, with no plans for consolidation.

Additional details on our production strategy follow.

Strategy for Producing Plutonium Pits

A peer review study performed by the JASON group of work done at LANL and LLNL on the aging of Pu, released in unclassified form in November 2006, concluded that the minimum expected lifetime of plutonium pits in U.S. nuclear weapons is 85 years.[79] The oldest warhead in the enduring stockpile under the Bush Administration's plan to comply with the Moscow Treaty entered service in 1978.[80]

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76 Final SPEIS op. cit. p. 3–64.

77 Ibid. p. 3–73.

78 Record of Decision on Complex Transformation. op. cit.

79 "Pit Lifetime," R.J. Hemley, et al., JASON Program Office (JSR-06-335), The MITRE Corporation, November 2006, http://nukewatch.org/facts/nwd/JASON_ReportPuAging.pdf.

80 "U.S. Nuclear Weapons," www.globalsecurity.org/wmd/systems/nuclear.htm.

Thus, there should be no need to replace any pits because of aging for another 50 years or more. Under our planned Curatorship approach to maintaining the stockpile, there would be no new weapon designs, or major changes to existing designs, which would require the production of new pits. Thus, we do not anticipate a need for NNSA to produce a substantial number of plutonium pits for many years, if ever.

Nevertheless, under our plan NNSA would maintain a small capability to fabricate plutonium pits for existing designs in case an unexpected generic problem arises in a warhead design in the stockpile. The surest way to maintain such a capability is to produce one or two pits a year. This might be done solely as a training exercise to maintain capabilities, with the completed pits melted and recast after they are examined. Alternatively, NNSA could incorporate the pits into warheads to replace some of those it removes from the stockpile and destructively analyzes under its surveillance program. Placing those warheads in the active stockpile would exercise all of the capabilities that are needed to build and certify replacements for existing warheads.

We do not see a need to build any new plutonium production facilities at LANL to augment its existing capabilities. In particular, we believe that NNSA should cancel plans to build the "Nuclear Facility" (NF) for the Chemistry and Metallurgy Research Building Replacement (CMRR) Project at LANL.

NNSA recently certified replacement pits for the W88 warhead, which it produced at LANL, and it is working to demonstrate that capability for other types of warheads in the existing stockpile. The existing pit production facility at LANL is approved to produce up to 20 pits per year. That capacity is more than sufficient to meet any production needs that we foresee. Beyond producing one or two pits per year, we recommend that NNSA maintain that facility in cold standby, with the capability to restart production of as many as 20 pits per year in a timely manner should unforeseen problems arise. No new pit production facilities or enhancements to pit production capabilities at LANL are needed.

The force structure at the 500-warhead level could have as many as seven different warhead designs and should include pits that were produced over at least a ten-year period. Thus, even if an unforeseen problem is discovered in some warheads of a particular design, it would affect only a small portion of the stockpile. NNSA could replace those warheads in a few years, with a production level of 20 per year. As further insurance, thousands of pits from retired warheads will remain available for possible use as emergency replacements for the next ten to fifteen years before a majority of them are disassembled and converted to a form appropriate for final disposition.

Again, we do not see a need to build any new plutonium production facilities at LANL to augment its existing capabilities. In particular, we believe that NNSA should cancel plans to build the "Nuclear Facility" (NF) for the Chemistry and Metallurgy Research Building Replacement (CMRR) Project at LANL, which is meant to replace the old CMR Building. The *Final SPEIS on Complex Transformation* states, "under the no net production alternative, CMRR *could* [emphasis added] still be needed to support pit production."[81] If the need for that facility is in doubt under that scenario, then it certainly is not needed under our plan for a stockpile of about one-fifth the size and with fewer changes to nuclear weapons.

There is a clear need for work to cease at the old and unsafe CMR Building, which should be decommissioned and demolished. However, that need does not mean that

81 Final SPEIS. p. 3–69.

the CMRR–NF is required. First, "Phase A" of the CMRR Project (185,000 sq-ft of light labs and offices) is nearing completion. That building is nearly the size of the old CMR's current operating space, and will house much of its old missions. Even more telling is the fact that a major portion of the CMR's nuclear mission, plutonium materials characterization, has already been moved to PF-4—the existing pit production facility at LANL. That was confirmed in an October 1, 2008 letter from NNSA Administrator Tom D'Agostino in reply to questions from the Defense Nuclear Facilities Safety Board (DNFSB) regarding when the old CMR Building could cease operations. Since pit production is not being expanded, demand for space in PF-4 has been relieved and the old CMR's plutonium analytical chemistry mission can now also go to PF-4. Each new pit produced requires up to 100 quality control samples involving analytical chemistry, so limiting pit production lowers the workload for analytical chemistry dramatically.

NNSA also claims the CMRR-NF is needed to consolidate special nuclear materials (SNM), including material from LLNL. LANL may have a legitimate need for a new SNM vault, but that need (if valid) can and should be de-linked from the much more costly and unnecessary CMRR-NF. A stand-alone vault could be built at several locations within TA-55.

Strategy for Disassembly/Reassembly Operations

The United States has not built any completely new nuclear weapons since 1992. However, in recent years, NNSA has been performing Life Extension Programs and other modifications to nuclear warheads, which require it to dissemble and reassemble about 200–300 nuclear weapons per year. Another 60–80 warheads have been disassembled for surveillance and testing. The majority of those are reassembled and returned to the stockpile. In addition, in 2008, NNSA increased the rate of dismantling warheads for retirement to about 350 per year.[82] That comes to a total of about 870–1,110 individual disassemblies or reassemblies per year.[83] All of those disassembly and reassembly operations are now done at the Pantex Plant, near Amarillo, Texas. Pantex began assembling nuclear weapons for the Atomic Energy Commission in 1951. Since 1975, it has been the sole facility for assembly and disassembly of nuclear weapons in the complex.

Most components from warheads that are disassembled at Pantex for surveillance and testing or for modification under LEPs or other refurbishment programs are transported to other sites for that work. Primary components are generally transported to LANL for additional analysis or modification and the secondaries (canned subassemblies) are shipped to Y-12 for testing or rebuilding. Most nonnuclear components go to SNL for surveillance and testing. Most of the testing is non-destructive and the components are transported back to Pantex for reassembly. The canned subassemblies from disassembled warheads that are being retired are transported to Y-12 for

82 "Weapons Stockpile Secrecy and Confusion," Hans Kristensen., op. cit.

83 For the purpose of making rough estimates of Pantex's capabilities, we assume that the workloads for disassembling and assembling nuclear weapons are about the same.

evaluation, storage, or further dismantlement and processing. Most pits from retired warheads remain at Pantex, but some go first to LANL for analysis before being returned to Pantex for storage.

Under our plan, NNSA would continue to disassemble, surveil, and reassemble about eleven warheads of each type in the stockpile, or about 70–80 warheads per year, much as it does today. That number would decrease somewhat as the level of 500 warheads is approached or if the Government chose to keep fewer than seven warhead types. We estimate that fewer than 50 warheads would be disassembled each year, on average, to replace components that the surveillance program has identified as posing a potential risk to the safety or reliability of the warhead. In addition, we recommend that NNSA ramp up the pace of dismantling retired warheads to 800–1,000 per year as ongoing life extensions are phased out. Thus, the total workload of dismantlements and disassemblies/reassemblies would be about 1,040–1,260. That is slightly higher than it is today, but should be easily achievable in existing facilities, since Pantex performed an average of 1,200 warhead dismantlements alone each year during the 1990s.[84]

We recommend that NNSA ramp up the pace of dismantling retired warheads to 800–1,000 per year as ongoing life extensions are phased out.

As of January 2009, 4,200 warheads removed from the active stockpile were awaiting dismantlement.[85] Under our plan, 4,700 additional warheads would be retired, bringing the total number requiring dismantlement to 8,900 if the stockpile is reduced to 500 total warheads. Thus, while the active stockpile might be reduced to 500 warheads sooner, at a pace of 900/year NNSA would not finish dismantling retired warheads before 2020. This would allow ample time for negotiating an agreement with Russia providing for verification of the permanent and irreversible dismantling of excess nuclear weapons.

Strategy for Excess Plutonium

Currently, about 14,000 pits from dismantled warheads are stored at Pantex. Portions of them are designated as part of a "strategic reserve" for potential reuse in new nuclear weapons. The rest are awaiting further disassembly and final disposition of their plutonium. Under our plan, nearly 9,000 additional pits will be removed from currently intact nuclear weapons that will be dismantled through 2020 or shortly thereafter. That comes to 23,000 pits after all but the 500 total warheads in our projected stockpile have been dismantled. Assuming that those pits contain an average of 4 kg of Pu, there would be 92 metric tons of plutonium in them. Under our strategy, we would keep an additional 500 kg of plutonium for a working inventory and the rest would be declared excess. DOE has declared only 34 metric tons of plutonium as excess and that includes some material that is not currently in the form of pits or warheads.

NNSA plans to convert the majority of its excess weapons plutonium into mixed oxide (MOX) fuel for use in light water reactors. Under that plan, after irradiation in a reactor, the spent MOX fuel would eventually be sent to a permanent repository, if

84 Hans Kristensen, FAS Strategic Security Blog. op. cit.

85 NRDC Estimate.

and when such a facility is established. DOE is also considering non-reactor alternatives for final disposition of a portion of its excess Pu, but it is looking at those options primarily for plutonium that is in forms other than pits.

Converting excess weapons plutonium into MOX fuel is not the best disposition alternative when safety, security, non-proliferation, waste management, and cost are all considered.

We believe that converting excess weapons plutonium into MOX fuel is not the best disposition alternative when safety, security, non-proliferation, waste management, and cost are all considered. Nevertheless, NNSA is rushing forward to build a $4.7 billion MOX fuel plant at SRS, for which it broke ground last August. Others share our concern regarding the MOX facility. A recent report from the House Committee on Appropriations stated, "The Committee is very concerned about the past and present management of the MOX fuel fabrication facility." The Committee noted that the GAO and the NRC had determined the project did not have an "adequate quality assurance program," resulting in the recent acceptance of over 3,000 tons of reinforcing bar that "did not meet industry standards for nuclear facilities." The report also noted the Committee's concern that NNSA was pressing ahead with construction, without resolving NRC concerns "about the potential for an explosive reaction between chemicals used to purify plutonium oxide in the MOX facility, also known as a 'red oil runaway reaction."[86] Furthermore, NNSA plans to finish the plant before it is able to convert plutonium from pits (which are metallic) into the oxide form needed to feed the MOX plant.

Under our plan, plutonium disposition activities in the United States would be put on hold pending a bottom up review of all reasonable alternatives.

Under our plan, plutonium disposition activities in the United States would be put on hold pending a bottom up review of all reasonable alternatives, including the immobilization and disposal of plutonium as a waste. We would halt construction of the MOX plant and defer construction of a $350 million Waste Solidification Building (WSB), which NNSA is planning for processing future MOX waste streams. Until the future disposition path for excess warhead plutonium is clearly established, we would also halt design activities for NNSA's proposed $2 billion Pit Disassembly and Conversion Facility (PDCF), which is currently planned for the Savannah River Site. The final choice of disposition option(s) should optimize safety, security, non-proliferation, waste management, and cost. In addition, the U.S. program should be transparent and should facilitate future international verification of plutonium disposition under a treaty advancing the elimination of all nuclear weapons.

Under our plan, NNSA would continue to store dismantled pits at Pantex, pending a future decision on the disposition of plutonium. The maximum number of pits that NNSA may currently store at Pantex, under its site-wide environmental impact statement (EIS), is 20,000.[87] That number is insufficient to accommodate all existing pits and those expected to come from future dismantlements before a viable disposition

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86 FY 2009 Energy and Water Development Appropriations Bill, House Appropriations Committee, H. Rept. 110-921, December 10, 2008. Despite these misgivings, and the plant's ballooning costs, the Committee still provided $487 million for the project for FY09. The failure of the Committee to follow through on its own concerns by halting the project can perhaps be explained by the fact that two members of the House leadership, Budget Committee Chairman John Spratt and Majority Whip James Clyburn, hail from South Carolina, host to the Savannah River Site where the MOX facility is being built.

87 Supplemental Analysis for the Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components (DOE/EIS-0225/SA-03), NNSA, February 2003.

scheme is put into place. Additional pits might be temporarily stored at the Device Assembly Facility (DAF) facility at NTS. However, that would require NNSA to transport them two extra times. We propose that NNSA perform a new site-wide EIS for Pantex and examine whether the safe storage limit can be increased to 25,000 pits. Meanwhile, we recommend closing the pit storage bunkers in Zone 4 and transferring the pits there to secure, underground storage.

We believe that disposition of plutonium is not an appropriate mission of NNSA's Office of Defense Programs, which oversees nuclear weapons activities. Under direction from Congress, Defense Programs is currently responsible for disassembling pits and converting the plutonium from metal to oxide form for use in the MOX plant. Construction of the MOX plant is now funded through DOE's Office of Nuclear Energy, but managed by NNSA' Office of Defense Nuclear Non-proliferation. Under our plan, Defense Programs would be responsible only for disassembling plutonium pits, after which it would transfer control of the surplus plutonium to another DOE office to manage and fund the final disposition.

Strategy for Weapons Secondaries and HEU

There is even less concern that HEU or other materials in warhead secondaries might degrade over time and have to be replaced because of aging than there is for plutonium pits and other primary components. Nevertheless, to date, NNSA has chosen to rebuild the weapons secondary (also called canned subassembly or CSA) for each warhead undergoing an LEP.[88] NNSA has not explained why it needs to rebuild every CSA. We cannot see a reason for such work, unless NNSA is modifying the secondaries in the process. Under our plan, NNSA would maintain only a small capability to fabricate up to twenty canned subassemblies per year for existing designs in case an unexpected generic problem arises in a warhead design in the stockpile. NNSA would also maintain a capability to produce all materials and components in the secondary assemblies of warheads in the stockpile, with possible exceptions for components and materials that are difficult or hazardous to make (such as Fogbank), but for which NNSA has ample inventories to meet any contingency.

NNSA currently performs all of its uranium surveillance, production, processing, and storage activities at the Y-12 Site near Oak Ridge, Tennessee. Most of those activities are conducted in old facilities that do not meet current standards of safety and security. NNSA's December 19, 2008 ROD on Complex Transformation calls for the construction of a large, multi-billion dollar Uranium Processing Facility (UPF) at Y-12, which would allow it to consolidate all HEU-related surveillance, production, and processing into one modern facility.

While we applaud NNSA's desire to improve safety and security at Y-12, the proposed UPF is much larger than necessary and cannot begin operating soon enough to make a significant contribution. The proposed UPF is sized to produce 125 CSAs

88 Independent Business Case Analysis of Consolidation Options for the Defense Programs SNM and Weapons Production Missions, TechSource, Inc., Dec. 2007, p. 6–2, www.complextransformationspeis.com/RM_276%20-%20TechSource%202007a.pdf.

Nuclear materials are often handled in glove boxes such as this to protect the workers.

per year in a single shift and up to 200 per year in multiple shifts. NNSA's plan for the UPF would allow it to support production of up to four new replacement warheads.[89] No new warheads would be produced under our plan. The proposed UPF is much larger than needed to support even today's stockpile, not to mention the much smaller stockpile expected by the time it could begin operating. The earliest that NNSA could complete the UPF is 2018. NNSA's schedule calls for another four years for testing, startup and transition from existing facilities, so that full operation is not expected until 2022.[90] Under our plan, the stockpile would contain 500 or fewer nuclear weapons by then and there would be no need for the oversized UPF to support stockpile operations.

89 Uranium Operations Mission Transformation Integrated Project Team Report, NNSA, July 18, 2008. p. 24, www.complextransformationspeis.com/RM_510%20-%20TechSource%202008a-p2.pdf.

90 Independent Business Case Analysis for the Consolidation of NNSA Highly Enriched Uranium Operations, TechSource, Inc., September 2008, p. C-9, www.complextransformationspeis.com/RM_498%20-%20TechSource%202008a.pdf.

After the total stockpile is reduced to 500 or fewer nuclear weapons, we would relocate residual HEU-related stockpile surveillance and production activities from Y-12 to LANL. LANL already has a capability to produce up to 50 secondaries per year at its Sigma Complex,[91] which is more than sufficient for a 500-warhead stockpile.

We understand that as many as 8,000 CSA's are currently stored at Y-12 awaiting dismantlement.[92] Under our plan, nearly 9,000 additional CSA's will be removed from currently intact nuclear weapons that will be dismantled, which brings the total to about 17,000 CSA's that will have to be dismantled. We are not aware of any unclassified estimates of how many CSAs NNSA currently dismantles per year at Y-12, but according to the *Final SPEIS on Complex Transformation*, dismantlements account for less than one-quarter of Y-12's current and future workload.[93] Since much of Y-12's current workload is devoted to LEPs, which would be significantly reduced and narrowed in scope under our plan, we believe NNSA can and should increase the pace of dismantlements significantly. If NNSA could reach the level of 1,000 CSA dismantlements per year, which it achieved in the early 1990s,[94] the dismantlement mission could be completed around 2025, without any contribution from the proposed UPF, which could not come on line before 2022 in any event. The lack of chemical high explosives surrounding the fissile material in the CSA's and the lower specific activity of HEU versus Pu makes secondary dismantlement intrinsically less hazardous than the dismantlement of the weapon primaries at Pantex. We recommend that NNSA dismantle CSA's in existing facilities at the swiftest pace possible, consistent with safe operations and the size of the current work force, to minimize the number of years it needs to continue operating these older facilities.

About 400 metric tons of HEU is stored at Y-12 in many forms, including separated metal, oxides, liquids, and CSAs. HEU is stored in five different facilities at Y-12, none of which meets current safety and security standards. NNSA recently completed construction of a new High Enriched Uranium Materials Facility (HEUMF), which will allow it to consolidate all HEU storage into one modern facility. While NNSA plans to move most of the HEU to the HEUMF by the end of 2011, it will be many years before all of the HEU in other facilities can be stabilized sufficiently and moved to the new facility. NNSA projects that the consolidation of all Y-12 HEU inventory to HEUMF will not be completed until 2020.[95]

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91 The "No Action Alternative" in NNSA's Final Site-Wide Environmental Impact Statement for Continued Operations at LANL, dated May 2008, states on p. 3–18 that the Sigma Complex can, "Fabricate components for up to 50 secondary assemblies (of depleted uranium, depleted uranium alloy, enriched uranium, deuterium, and lithium) per year."

92 "Reducing the Risks of Highly Enriched Uranium at the U.S. Department of Energy's Y-12 National Security Complex," Robert Alvarez, Institute for Policy Studies. October 9, 2006, www.clarku.edu/mtafund/prodlib/ips/Y-12.pdf.

93 Final SPEIS. p. 3–66.

94 "Status of Highly Enriched Uranium Capability at Building 9212 Oak Ridge Y-12 Plant, "Defense Nuclear Facilities Safety Board, December 8, 1995., www.dnfsb.gov/pub_docs/oak_ridge/tr_19951208_or.html.

95 Independent Business Case Analysis for the Consolidation of NNSA Highly Enriched Uranium Operations, TechSource, Inc., September 2008, p. 3–3, www.complextransformationspeis.com/RM_498%20-%20TechSource%202008a.pdf.

We believe that NNSA should move more rapidly to consolidate HEU storage into the HEUMF and to close down the old storage facilities. Furthermore, we recommend that NNSA promptly blend down all excess HEU to an enrichment level of less than 20 percent U-235, at which point it could treat the product as low enriched uranium (LEU). LEU cannot be used as readily for making nuclear weapons as HEU and the security requirements for storing LEU are much lower. LEU would not have to be stored in the HEUMF. It could be stored outside the high security area at Y-12, sold for use in power reactors, or moved to medium security facilities elsewhere. Since downblending HEU to LEU would reduce the amount of material that would ultimately have to be stored in the HEUMF, a portion of that facility could be used to add blending capacity or other processing operations that could speed the ability of Y-12 to process and eliminate its excess inventory of HEU. In addition, the Nuclear Fuel Services Plant in Erwin, TN, which is now owned by Babcock and Wilcox (B&W), and B&W's Nuclear Products Division in Lynchburg, VA, both have excess capacity for downblending HEU to LEU that could be applied to the process.

We recommend that NNSA promptly blend down all excess HEU to an enrichment level of less than 20 percent U-235.

Under our plan, all HEU—except that in weapons in the stockpile; in a two metric ton working inventory of HEU for fabrication of replacement components, if necessary; and in a 50-year reserve held to fuel US naval vessels—would be blended down to LEU. Depending on how much HEU is retained for the U.S. Navy; it might take about a decade beyond 2020 to finish the dismantlement and blending operations. Thus, some facilities at Y-12 may have to stay in operation that long. However, we believe this would not stand in the way of moving Y-12's remaining nuclear warhead support functions to LANL once the stockpile is reduced to 500 warheads or less. Once the stockpile support mission is moved out of Y-12 and NNSA completes the dismantlement of excess CSAs, which we anticipate could occur in 2025, Y-12 could become an excess HEU storage, processing, and downblending facility and it would no longer be considered part of the weapons complex. Moving the stockpile support mission from Y-12 and moving additional processing activities into the HEUMF as HEU is removed will greatly reduce the extent of operations in the old facilities at the site. At some point, the only remaining HEU at Y-12 would be the stockpile held for the Navy. That too might eventually be moved to another facility, or eliminated, if the Navy were to switch from using HEU fuel.

In sum, under our plan we would maintain weapons HEU and related operations in support of CSAs at Y-12 until around 2025 and add HEU conversion and dilution capabilities to the HEUMF, but not build a new UPF. After the stockpile is reduced to 500 weapons, the small, residual HEU-related operations needed to support a diminishing nuclear weapons stockpile could be transferred to LANL. However, any firm decisions to move weapon HEU operations and/or build new facilities should not be made until the trajectory and pace of future stockpile reductions is much clearer than it is today. Y-12 would remain a HEU storage, processing, and downblending facility, at least until all HEU declared excess to weapons and naval propulsion needs is blended into LEU. We anticipate that might be around 2030, after which DOE's Naval Reactors program could take charge of the highly enriched material remaining in the HEUMF, which would be the sole remaining nuclear weapons-related facility operating at the site.[96]

NNSA claims that with the UPF as its preferred option for Complex Transformation at Y-12, it could reduce the footprint of operations within the site's high security area by 90 percent. However, that reduction cannot occur until the UPF is operating and all SNM is cleaned out of the current facilities, which would be well after 2020 under NNSA's plan. Our plan would realize the same ultimate reduction on about the same time scale, but would not require the premature commitment of billions of dollars to a weapons uranium facility that would be grossly oversized for its mission before it could be completed. In the mean time, we would more rapidly eliminate the backlog of CSA dismantlements and reduce the amount of HEU at risk.

Strategy for Tritium

Tritium is used in all nuclear weapons in the U.S. arsenal.[97] Since tritium has a radioactive half-life of 12.3 years, the reservoirs of this material in warheads must be replenished periodically. Tritium occurs only rarely in nature. Historically, DOE/NNSA has produced tritium in its own nuclear reactors. NNSA still has a large stockpile of tritium from prior production activities, most of which it has removed from retired warheads and purified for reuse. Nevertheless, NNSA began producing more tritium in 2003 by irradiating Tritium Producing Burnable Absorber Robs (TPBARs) at the Tennessee Valley Authority's (TVA's) Watts Bar nuclear powerplant. After irradiation, the TPBARs are brought to the Tritium Extraction Facility at NNSA's Savannah River Site, where the tritium is extracted and stored.

The size of the tritium stockpile is classified, as is how much tritium is used in each type of nuclear weapon. However, NNSA definitely has enough tritium to last many years. As recently as 2007, NNSA had sufficient tritium to support deployment of 5,350 nuclear warheads for up to five years into the future, without production of any fresh tritium. Assuming that all nuclear weapons require about the same amount of tritium, after using up NNSA's current five-year reserve and the first 12.3-year half-life of the remaining current inventory, enough tritium would remain to support 2,675 weapons until the year 2025. Another half-life of decay, without production, would mean 1,340 weapons could be supported until 2037. Thus, even assuming, on average, that the warheads in the 500-warhead stockpile require up to twice as much tritium as the average warhead in the 2007 stockpile, there would still be enough tritium to support our planned 500-warhead stockpile to around 2040 before there is any need for producing tritium. A more accurate calculation is a bit more complex, and must take into account the decay of tritium in the supply pipeline as well as decay of the currently required 5-year reserve of tritium. However, using an earlier starting point for the calculation than 2007, when there was sufficient tritium for

96 Extensive operations would likely continue for environmental restoration and possible reuse of Y-12 for local economic development.

97 Tritium is used mostly to "boost" the explosive power of nuclear weapon primaries. It allows for much smaller and more powerful nuclear weapons.

many more than 5,350 warheads, would indicate even larger margins before NNSA needs to produce any new tritium to support 500 warheads.

Nevertheless, NNSA plans to continue producing tritium. This represents the height of government waste. Production of a decaying asset, well in advance of its actual need, makes no sense. NNSA claims it is a hedge against future supply disruptions. However, the President has legal authority under the Atomic Energy Act to order the production of tritium in any one of 100 U.S. civil reactors in the event of some future national defense emergency. After the initial demonstration in 2004 of TVA's capability to provide for tritium production at the Watts Bar reactor, no further demonstration was necessary. NNSA's current plan calls for increasing the number of TPBARs deployed in the Watts Bar reactor from 368 to 1,200, by April 2011, and to continue at that level until March 2020. In addition, NNSA would initiate tritium production at TVA's Sequoyah reactor with 480 TPBARs in April 2015 and increase to 1000 TPBARs through March 2021.[98]

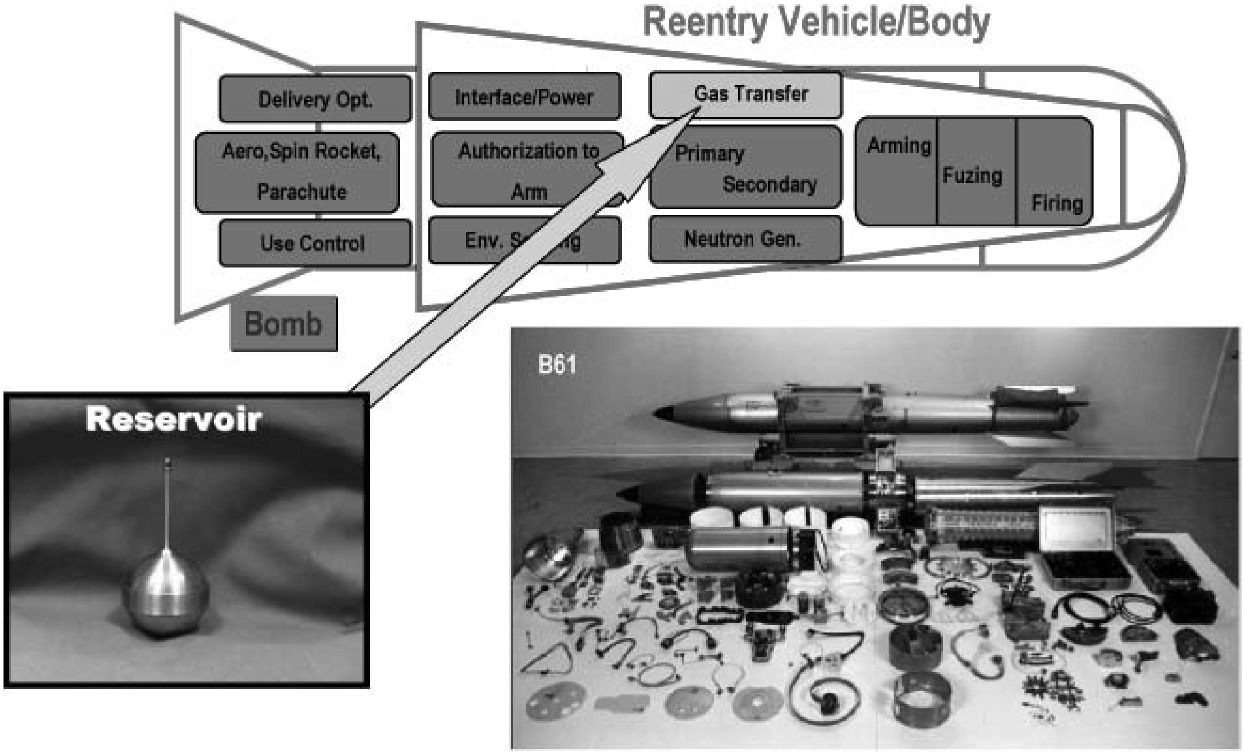
Under our strategy, NNSA would cease all tritium production. NNSA must, of course, continue to refresh the tritium in existing nuclear weapons periodically. We estimate that NNSA refreshes the tritium in the average nuclear weapon every six to eight years (actual frequencies vary among different weapon types and are classified). NNSA currently unloads, purifies, and reloads tritium into new reservoirs in a facility called the New Manufacturing Facility, which began operations within the H-area at SRS in 1994.

Under our strategy, tritium purification and recycling activities would continue at SRS for the time being. At some point, as the nuclear stockpile is reduced toward 500 warheads, NNSA would relocate the remaining, residual tritium operations to the Weapons Engineering Tritium Facility (WETF) at LANL. The WETF is currently used for research and development. It has capabilities to support all of the operations needed for unloading, purifying, and reloading tritium into reservoirs. According to the latest Site-Wide EIS for LANL, the WETF can "Handle and process tritium gas in quantities of about 3.5 ounces (100 grams) approximately 65 times per year." [99] We estimate that 100 grams is sufficient to fill 10 to 20 tritium bottles. Thus, the capacity of WETF appears to be considerably more than sufficient for filling the 100 or so bottles per year that might need refilling with 500 warheads on a refill schedule as often as once every 5 years. Thus, it might be possible for NNSA to shift tritium operations from SRS to LANL well before the stockpile is reduced to 500 warheads. We anticipate the shift could occur when the active stockpile is reduced below 1,000 warheads.

According to its December 19, 2008 Record of Decision on Complex Transformation, NNSA is headed in the opposite direction and intends to centralize all tritium research and development activities at SRS. Under that plan, NNSA would remove all tritium from the WETF at LANL, and presumably close the facility, by 2014. Our plan relocates reduced tritium operations for a smaller stockpile to the WETF and shuts down all tritium operations at SRS. After that, SRS would no longer have a role

98 Final Complex Transformation SPEIS, op. cit., p. 5–509.

99 Final Site-Wide Environmental Impact Statement for Continuing Operations at LANL, NNSA, May 2008, p. 3–30.



There are approximately 3,000 components in a B61 thermonuclear bomb. Shown here are a tritium reservoir and dozens of nonnuclear components.

in support of nuclear weapons and could be transferred out of the nuclear weapons complex, resulting in huge taxpayer cost savings, a better opportunity for comprehensive site cleanup, and an excellent non-proliferation example to the rest of the world. We anticipate the transfer of tritium operations would occur before 2020.

Strategy for Nonnuclear Components and Materials

NNSA manufactures or procures 85% of the nonnuclear parts for U.S. nuclear weapons at its Kansas City Plant (KCP), located at the Bannister Federal Complex in Kansas City, MO. The remaining 15% of nonnuclear components are fabricated at SNL-NM, LANL, Y-12, or Pantex. NNSA chose to exclude consideration of the manufacture of nonnuclear components in its *SPEIS on Complex Transformation,* with the spurious argument that decisions made elsewhere in the nuclear weapons complex would not affect KCP and vice versa. Now, without considering the system-wide environmental impacts, NNSA plans to move the Kansas City Plant into an entirely new privately owned suburban "campus" constructed in what is predominantly a soybean field, using local revenue bond authority originally intended to combat urban blight.

Several of our organizations have joined in a lawsuit in federal court in Washington, D.C. to set aside the new plant project and direct the agencies to prepare a new environmental analysis of site-cleanup and relocation alternatives for the existing Kansas City Plant.[100] The Department of Energy considered consolidating KCP operations elsewhere in its 1996 Stockpile Stewardship and Management Programmatic Environmental Impact Statement, but decided against doing so because of the expense and possible environmental liabilities of building new facilities. Obviously, NNSA has changed its mind, without performing the required environmental reviews.

NNSA and GSA are trying to avoid an explicit violation of the Federal Anti-Deficiency Act, under which agency officials could face criminal penalties for making federal debt obligations without corresponding congressional appropriations.

In order to take advantage of the subsidized local revenue bonds, the plan for the new KCP has a byzantine structure involving a capital lease-to-purchase agreement between the Kansas City municipal government and the private developers, who in turn would sublease the new Plant to NNSA through the federal General Services Administration (GSA). If built, the new KCP would likely cost over a billion dollars, which would be entirely borne by the Federal Government. However, because of the intricate funding scheme, the full cost will never appear in NNSA's Congressional Budget Request, and hence it will not receive the congressional scrutiny that it deserves. That is possible, because NNSA and GSA are treating the arrangement as an annual operating lease (which implies an obligation for only the annual cost), rather than recognizing their true obligation for the full $1 billion or more. In this manner, NNSA and GSA are trying to avoid an explicit violation of the Federal Anti-Deficiency Act, under which agency officials could face criminal penalties for making federal debt obligations without corresponding congressional appropriations. We recommend that Congress and the Government Accountability Office (GAO) investigate this questionable activity to determine if criminal charges should be brought. We are encouraged by a recent report that the GAO is looking into the plans for the new Kansas City Plant.[101]

Under our plan, we would not build this or any new facility in Kansas City. Rather, we recommend that NNSA "downsize-in-place" its nonnuclear component fabrication activities at the existing KCP in line with the much-reduced requirements to support a 500-warhead stockpile. Furthermore, NNSA should immediately begin planning to move the small, residual nonnuclear production activities to other sites that already have these capabilities, with the ultimate goal of transferring all nonnuclear production activities to SNL, LANL or the private sector. Component production at the Kansas City Plant should cease by 2015, so needed environmental restoration can begin.[102]

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100 "Suit Challenges Legality of Proposed Kansas City Nuclear Weapons Plant," Natural Resources Defense Council, Physicians for Social Responsibility, Nuclear Watch New Mexico, and Tri-Valley CAREs, October 9, 2008, www.nukewatch.org/KCNukePlant/KCPlawsuit-PR10-9-08.pdf.

101 "GAO Looking into NNSA's Planned Move to New Kansas City Plant," Todd Jacobson, Nuclear Weapons & Materials Monitor, February 2, 2009.

102 KCP is heavily contaminated with PCBs and industrial solvents that could delay for many years the possible economic reuse of the site, which the Kansas City municipal government would like to see done soon.

Most, if not all, of the work of the KCP could easily take place at existing facilities elsewhere in the complex in support of a 500-warhead stockpile and many of those facilities could support higher workloads on the way down to 500 warheads. For example, fabrication of tritium reservoirs can take place at LANL's Sigma Complex, which has long had the capability to produce 200 reservoirs annually.[103] LANL already manufactures nuclear weapons detonators, under direction from KCP, and the Lab could manage that activity itself. With regard to the numerous electromechanical components that KCP now produces, SNL-NM already has design and engineering authority for those components and also has tens of thousands of sq-ft of manufacturing space that could absorb a reduced-in-scope nonnuclear components production mission. Some examples of candidate facilities at SNL-NM are its Advanced Manufacturing Process Laboratory, the Microelectronics Development Laboratory, the Processing and Environmental Technology Laboratory, and most importantly the new Microsystems and Engineering Sciences Applications (MESA) Complex. According to SNL, they have a good record of producing components for NNSA. "Since 1992 we have delivered more than 40,000 components. Products include actuators, thermal batteries, igniters, gas generators, capacitors, magnetics, frequency devices, and electronic components. We have maintained a 100 percent first-time acceptance by the National Nuclear Security Administration's Albuquerque office."[104]

Construction of the new KCP should be cancelled. NNSA should immediately begin downsizing and transferring missions out of the existing Kansas City Plant.

At 400,000 sq-ft and $518 million, MESA was the biggest and most expensive construction project in SNL's history. It was designed for R&D and production of electronic circuits and microelectromechanical systems. Central to the MESA Complex is a new Integrated Weapons Engineering Transformation Facility that "will support an integrated modern Weapons Engineering capability to meet current and future missions of nuclear stockpile maintenance and weapon development."[105] Under our Curatorship approach to maintaining the stockpile, little or no development of nuclear weapon components would take place. Instead, the MESA Complex as a whole could be directed toward residual stockpile maintenance. SNL-NM and other sites could and should absorb greatly down-scoped nonnuclear components production missions. Construction of the new KCP should be cancelled. NNSA should immediately begin downsizing and transferring missions out of the existing Kansas City Plant and, by 2015, end production and transfer the plant out of the nuclear weapons complex to the DOE Office of Environmental Management for cleanup.

The following table provides a site-by-site summary of our plans for shrinking and consolidating the nuclear weapons complex from today's eight sites to three sites by 2025.

103 See *Final Site-Wide Environmental Impact Statement for Continuing Operations at LANL*, NNSA, May 2008, p. 3–18.

104 Annual Report, 2002/2003, Sandia National Laboratories, p. 20, http://materials.sandia.gov/news/publications/annual/pdf/ar2002-2003.pdf.

105 See SNL FY09 Ten-Year Site Plan, p. 12, at http://nnsa.energy.gov/infrastructure/Ten-year_site_plan.htm.

Summary of Site-Specific Recommendations

Site	Short Term Steps	Longer-Term Plans
Los Alamos National Lab (LANL)	• Significantly reduce nuclear weapons R&D, in conformance with a Curatorship approach, and encourage mission diversification. • Cancel the CMRR-NF Project and upgrades for LANSCE. • Expand surveillance and testing of existing components. • Cancel plans for expanded pit production. Maintain a capability to produce 1 or 2 pits/yr with additional capacity in cold standby to produce up to 20/yr in 12–18 months if needed. • Retain a residual capability to design and certify nuclear components, if needed.	• Relocate support for tritium reservoirs from SRS to the WETF at LANL when the stockpile is reduced below 1,000 warheads. • Transfer residual HEU activities from Y-12 to LANL after the stockpile is reduced to 500 warheads.
Lawrence Livermore National Lab (LLNL)	• Remove all Category I and II SNM from LLNL by the end of 2010. • Close out SNM processing and handling, except for limited surveillance activities. • Close most of Superblock, including Buildings 332 and 334. • Close all nuclear weapons R&D facilities or transfer them to other missions. • Close Site 300 or transfer it for use to other missions. • Cancel plans for new weapons-related facilities, including an annex to HEAF and a new WEST facility. • Retain independent teams of experts to analyze warhead safety and reliability issues relevant to the current stockpile. • Peer review recertification of warheads and components and potential changes to them.	• Increase lab activities in basic science, energy and environmental research, while maintaining strong programs in non-proliferation, safeguards, transparency and verification of warhead dismantlement, intelligence, and nuclear emergency response. • By 2012, LLNL will no longer be considered part of the nuclear weapons complex administered by NNSA.
Sandia Lab New Mexico (SNL-NM)	• Limit experimental facilities primarily to surveillance and environmental testing of existing components. • Maintain cradle to grave responsibility for design, testing, and recertification of nearly all existing nonnuclear components. • Fabricate or procure new and replacement components, as needed, as responsibilities transfer from the KCP. • Retain a residual capability to design and certify nonnuclear components and perform weapons integration, if needed.	• Remain the predominant site for all engineering, surveillance, production, and dismantlement of nonnuclear components. • Host future facilities needed for environmental testing of components as part of the surveillance program. • Continue residual production and maintenance of neutron generators, including tritium loading of neutron target tubes.
Sandia Lab California (SNL-CA)	• Close out all NNSA activities. Some facilities may continue operating for other missions under other entities and some activities, including surveillance, may transfer to other NNSA sites.	• By 2012, SNL-CA will no longer be considered part of the nuclear weapons complex administered by NNSA.

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Site	Short Term Steps	Longer-Term Plans
Nevada Test Site (NTS)	• Cease sub-critical testing and close the U1A facility. • BEEF, large gas guns, and some other facilities could continue as user facilities with new owners. • Transfer site landlord responsibility from NNSA to another DOE office or other appropriate entity.	• By 2012, NTS will no longer be considered part of the nuclear weapons complex administered by NNSA.
Pantex Plant	• Begin process to increase storage capacity from 20,000 to 25,000 pits. • Close pit storage bunkers in Zone 4 and transfer pits to more secure, underground storage on the site. • Continue operation as the sole facility for routine disassembly/assembly of nuclear weapons. • Consolidate all high explosive production and fabrication to Pantex.	• Increase dismantlement rate to 800–1,000 warheads per year.
Y-12 Facility	• Cancel the Uranium Processing Facility (UPF). • Maintain a capability to fabricate no more than 20 canned sub-assemblies (CSAs) per year. • Move all HEU, except for processing inventories, into HEUMF by the end of 2011. • Blend down HEU to 20% U-235 at existing facilities, new facilities in HEUMF, or B&W-owned facilities. • Expand surveillance of CSAs. • Continue to supply enriched uranium to meet the fuel needs of the U.S. Navy.	• Increase dismantlement rate for CSAs to at least 1,000 per year. • Transfer all production and surveillance activities (except for dismantlements) to LANL after the stockpile reaches 500 warheads. • Complete all dismantlements by 2025, at which point Y-12 will no longer be considered part of the nuclear weapons complex administered by NNSA. • Continue operating as a uranium and HEU processing and storage center. • Downblend all excess HEU to LEU by 2030.
Kansas City Plant (KCP)	• Do not build new plant. • Downsize in place and begin shifting missions to SNL-NM and LANL.	• All NNSA activities cease by the end of 2015. No longer considered part of the nuclear weapons complex.
Savannah River Site (SRS)	• Cancel the PDCF. • Place the MOX fuel plant and the Waste Solidification Building on hold. • Close the Tritium Extraction Facility after removing tritium from remaining TPBARs.	• Transfer all support for tritium reservoirs from SRS to LANL, as the stockpile is reduced toward 500 warheads (between 2015 and 2020), at which time SRS will no longer be considered part of the nuclear weapons complex administered by NNSA.

CHAPTER 7
Security Issues

Without question, DOE nuclear warhead production plants, test facilities, research labs, storage locations … are attractive targets for terrorists.
– House Government Reform Subcommittee on National Security[106]

In a 2008 performance test, mock terrorists overwhelmed the LLNL guard force, stole mock plutonium and HEU, and showed that they could have easily assembled an improvised nuclear device on-site.

When the public hears about poorly secured nuclear facilities, often they picture Russia and the former Soviet states. The U.S. government has emphasized its efforts to secure dangerous nuclear facilities and loose nuclear material in the former Soviet Union. Despite this focus away from our homes and communities, U.S. nuclear facilities pose their own significant security risks. In January 2009, DOE inspectors found that the amount of nuclear material that LANL could not account for "exceeded alarm limits."[107] While Los Alamos said there is no suspicion of theft or diversion, if it cannot account for the material properly, it cannot say for certain that the material has not been stolen. Also, in a 2008 performance test, mock terrorists overwhelmed the LLNL guard force, stole mock plutonium and HEU, and showed that they could have easily assembled an improvised nuclear device on-site. LLNL is located in a residential community in the densely populated San Francisco Bay Area. At the Y-12 Site, which houses our nation's repository of HEU, armed guards came close to shooting unarmed mock attackers during a simulated attack when communications broke down. These guards are not federal employees and do not have the benefits and protections of law afforded to federal employees. They are limited in what actions they can take to protect the facilities. Yet, the public is not aware of these on-the-ground realities, since much of the information about the security of the weapons complex is classified.

For the most part, information about failed security tests and diluted security requirements has been obtained only when concerned insiders have made it available. Without the public and congressional scrutiny that has accompanied such revelations, there would be virtually no accountability regarding DOE and NNSA's security of the weapons complex.

While security of the nuclear weapons complex has improved since 9/11, there are numerous ways to secure the complex further. This includes reducing the number of

106 "Updating Nuclear Security Standards: How Long Can the Department of Energy Afford to Wait?," House Committee on Government Reform, Subcommittee on National Security, H.Rept. 109–435, April 2006.

107 "DOE: Broken System for Protecting Nuclear Material Could Compromise Los Alamos Operations," POGO Press Release, February 26, 2009, www.pogo.org/pogo-files/alerts/nuclear-security-safety/nss-lanl-20090226.html.

sites that house significant amounts of weapons-grade material, known as Categories I and II of Special Nuclear Material (SNM), reducing the amount of SNM, and federalizing the protective guard force.

The Threat

The potential impact of a terrorist attack using nuclear weapons on U.S. soil is too significant to permit the kind of inefficient and ineffective security at nuclear weapons facilities that has persisted for many years. Experts warn that the threat of nuclear terrorism is growing.[108] As the nation learned on September 11, 2001, terrorists can be suicidal.

There are three main scenarios to consider when assessing security against a terrorist attack at nuclear weapons sites:

1. The creation of an improvised nuclear device on site by suicidal terrorists, which only takes minutes to accomplish.[109]
2. The use of conventional explosives on site to create a radiological dispersal device, also known as a dirty bomb.
3. The theft of nuclear materials in order to create a crude nuclear weapon off-site that could be used to devastate a highly-populated U.S. city.

Senator Richard Lugar (R-IN) and former Senator Sam Nunn (D-GA) identified the high priority of securing, consolidating, and eliminating HEU and Pu stating, "The gravest danger, however, and the one requiring urgent attention is the possibility that terrorists could obtain highly-enriched uranium (HEU) or Pu for use in an improvised nuclear device."[110]

How DOE Protects Against the Threat

Recently, DOE issued a new policy on the protection of nuclear weapons facilities that house weapons-grade and weapons-quantity amounts of HEU and Pu. Formerly known as the Design Basis Threat (DBT), this new policy is called the Graded Security Protection (GSP) plan.

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108 "What Are Nuclear Weapons For?" op. cit. Drell and Goodby.

109 An improvised nuclear device is qualitatively different from a "dirty bomb" in that it would use a nuclear chain reaction to cause a large explosion. Terrorists could rapidly improvise such a nuclear device at a number of DOE sites from nuclear weapons or special nuclear materials in bomb-grade quality and quantity. The explosion from the nuclear bomb dropped on Hiroshima was created using a "gun type" method (firing a piece of HEU at another piece to create a critical mass). Using the same technique, terrorists could create a crude device by taking two pieces of HEU and slamming them together with conventional explosives or even by dropping one plate of HEU onto another. This happened on a small scale accidently at LLNL some years ago. One disk of HEU was brought into contact with another, which caused a minor explosion and fire.

110 "The Four Faces of Nuclear Terrorism," Charles Ferguson and William C. Potter, Monterey Institute, Center for Nonproliferation Studies Nuclear Threat Initiatives, 2004, www.nti.org/c_press/analysis_4faces.pdf.

This change, following the 2003 DBT, the 2004 DBT, and the 2005 DBT, is the fourth new security requirement in six years. The DBT describes the level of threat against which protective forces at a nuclear weapons site are required to defend. It is based upon the Postulated Threat, which was developed by the Defense Intelligence Agency (DIA), with input from the FBI, CIA, DOE, and DoD. The DBT contains criteria such as the number of outside attackers and inside conspirators, as well as the kinds of weapons and size of truck bombs that would be available to terrorists. However, the DBT, the GSP, or any other measurement of security requirements is not able to account for the three advantages that adversaries have: surprise, speed, and violence of action.

Within the DBT framework, and presumably the GSP, DOE periodically conducts performance tests of its nuclear facilities' security by staging mock terrorist attacks. These force-on-force exercises, with laser-weapons simulation equipment, make it possible for the Department to simulate what might happen during a real terrorist attack and to assess whether security forces can adequately defend against the attacks.

All numbers related to the security requirements are classified, so we can only talk about them in relative terms. The 2003 DBT, which was to be implemented by 2006, required site protective forces to be prepared to repel fewer than half the number of terrorists engaged in the 9/11 attacks. The 2004 DBT, which was to be implemented by 2008, was created because the 2003 DBT was far too weak. The 2004 DBT had the most robust of the security requirements and required site protective forces to be prepared to repel close to the 9/11-level of 19 attackers. It also specified that the attackers should be expected to carry far more lethal weapons and to use much larger truck bombs than had been assumed in the 2003 DBT. Unfortunately, in November 2005, DOE concluded the 2004 DBT would cost too much to implement, and replaced it with a weaker 2005 DBT. The 2005 DBT, which was to be implemented at most sites by the end of 2008, required the protective forces to be prepared to repel approximately 75 percent of the attackers from 9/11. On January 19, 2006, the NNSA Administrator concluded that even the 2005 DBT could not be achieved, because of White House imposed budget caps.

While details of the GSP are classified, we have heard there will be variations of security requirements from site to site. We understand that Pantex and the Office of Secure Transportation, which assemble and transport nuclear weapons respectively, will still comply with the highest level, comparable to the 2004 DBT. We have also heard there will be a committee of experts who will analyze the security requirements needed at each site. We believe that DOE might reduce the security requirements even below the 2003 DBT at some sites. One matter that concerns us is why different sites use different requirements if they are guarding the same critical and dangerous nuclear materials—HEU and Pu.

Unfortunately, it appears that NNSA is using the GSP as a way to avoid compliance with directions from Congress. For example, NNSA decided that LLNL did not have to meet the 2005 DBT, because it is a "non-enduring site," meaning that the Lab has been slated eventually to remove all Category I and II SNM from the site. Such waivers come in defiance of the Senate Armed Services Committee, which stated in

2007, "Sites that store and use weapons grade fissile materials must meet the defined, rigorous Design Basis Threat (DBT) standards for security."[111]

Numerous security lapses at various sites in the nuclear weapons complex have been well documented. We believe that DOE has not done enough to address the deficiencies they demonstrate and to reduce security risks throughout the weapons complex. We have three principle recommendations for improving security. We recommend that DOE reduce the number of targets, reduce the amount of sensitive material, and federalize its protective forces. Below is a site-by-site analysis of security risks and recent security lapses, followed by a discussion of our three principle recommendations.

Lawrence Livermore National Laboratory

Lawrence Livermore National Lab (LLNL) is the most obvious security problem.

Lawrence Livermore National Lab (LLNL) is the most obvious security problem. No matter how much money is spent to protect against the threat level, LLNL's location makes it impossible to protect its Pu and HEU. Recognizing this fact, after years of delay, NNSA plans to remove all of LLNL's Category I/II SNM by 2012. We believe that this overly relaxed timetable poses an unacceptable security risk and recommend that the material be removed by the end of 2010. This could be accomplished if the DOE Secretary made such a directive and assigned specific responsibilities to particular people. This is how SNM was swiftly removed from Technical Area 18 at LANL, after years of delays before the Secretary stepped in. One of the primary excuses we have heard for not being able to safely prepare and package the SNM from LLNL is the lack of qualified personnel. This obstacle can be overcome by transferring qualified personnel from other sites.

In early 2008, NNSA identified LLNL as a "non-enduring" site, which exempted it from meeting the 2005 DBT. However, even when tested against the less stringent 2003 DBT, LLNL still failed miserably in an April 2008 security test. *TIME Magazine* reported in May 2008 that mock terrorists, who tested Livermore's security, succeeded in two separate scenarios at stealing simulated CAT I/II SNM and in detonating an improvised nuclear device on the spot.[112] That failure cost the contractors almost $16 million in award fees.[113]

In a recent meeting with a high level NNSA official, we were puzzled to hear that, due to recent layoffs, the timeline for removing category I/II SNM from LLNL could not be accelerated, because the lab faces a shortage of staff that can safely package the materials. We are told by NNSA that de-inventorying is a priority. So why did they allow Livermore to lay off the key people who know how to do this work?

Strict oversight of NNSA and LLNL is key in ensuring that SNM is removed from the Lab in a timely manner. In 2007, when the GAO looked into how DOE has progressed in keeping its promises to consolidate SNM, it did not like what it found.

111 National Defense Authorization Act for Fiscal Year 2008, Senate Armed Services Committee Report 110-77, June 5, 2007, p. 619, http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_reports&docid=f:sr077.110.pdf.

112 www.time.com/time/nation/article/0,8599,1739535,00.html.

113 www.pogoarchives.org/m/nss/nnsa-llnl-fee-20081211.pdf.

According to GAO, "…DOE has spent nearly 2 years developing plans for the consolidation and disposition of special nuclear material, its plans are incomplete; and complex wide consolidation and disposition activities have not begun."[114]

The GAO report also pointed out a great weakness in DOE's implementation plans—a lack of accountability:

> [T]he Pu-239 plan states that the committee's Executive Steering Committee must approve the plan, but does not include any information on which program offices, sites, or other DOE organizations are responsible for carrying out the other actions that the plan identifies as necessary next steps, such as finalizing a schedule for Pu-239 shipments from Hanford, Los Alamos, and Lawrence Livermore.[115]

GAO's conclusions appear to indicate that LLNL will be housing its SNM for much longer than the four years DOE is currently estimating, and at half the protection level deemed necessary by the intelligence community.

Los Alamos National Laboratory

On October 20, 2006, Los Alamos police found classified information from the lab during a drug bust at the home of a former LANL subcontractor employee.

The Los Alamos National Laboratory (LANL) has a bad track record of managing and tracking its sensitive information and material and for allowing breaches of physical security and cybersecurity. On October 20, 2006, Los Alamos police found classified information from the lab during a drug bust at the home of a former LANL subcontractor employee. Police found three memory sticks containing 408 separate classified documents and an additional 456 hard-copy pages of classified documents, including some classified as Secret-National Security Information (pertaining to intelligence) and Secret-Restricted Data (pertaining to nuclear weapons).

The Methedrine drug bust at Los Alamos is just the latest in a bizarre series of incidents involving unauthorized removal of classified information and missing classified data from LANL. For instance, there was the infamous case in 2000 in which computer hard drives holding classified and highly sensitive Nuclear Emergency Search Team (NEST) information went missing. The hard drives mysteriously reappeared weeks later behind a copying machine in a secure room that was previously searched three times. No fingerprints were found on the hard drives and this incident has never been explained. Furthermore, between 2002 and 2004 there was a rapid-fire series of seven instances of missing or mishandled classified computer equipment and classified removable electronic media.

In February 2009, NNSA sent a Special Review Team to assess LANL's Material Control and Accountability (MC&A) program, which keeps track of its huge stocks of Pu and HEU. The Team found inaccuracies in accounting, a lack of adherence to requirements, and that "key personnel in critical positions lacked a basic understanding of fundamental MC&A concepts." In fact, in light of the Team's findings, both government and contractor officials have recently been removed from their positions. According to a February 23, 2009 DOE letter to Los Alamos National Security,

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114 "Securing U.S. Nuclear Material: DOE Has Made Little Progress Consolidating and Disposing of Special Nuclear Material," U.S. Government Accountability Office, (GAO-08-72), October 2007, p. 10, www.gao.gov/new.items/d0872.pdf.

115 Ibid. p. 16.

LLC, the operating contractor for the lab, if identified weaknesses remain unresolved it "would impact the ability of the facility to continue operations."

We know for certain that LANL has had serious problems with its MC&A. In the summer and fall of 2008, multiple teams of MC&A experts from DOE headquarters, NNSA, and other nuclear weapons sites visited Los Alamos attempting to reconcile LANL's databases and its physical inventory of the nuclear material. When all of these assessment teams descend on your lab, you know there is a serious problem.

In mid-2008, after prodding from several groups, NNSA admitted that it could not locate a small amount of plutonium. However, officials would not say how much material could not be located. The LANL database indicated that items and quantities of plutonium were in a particular vault, but they could not be found there. A senior DOE official described the situation at LANL as "serious." This has been a long-standing problem and was the subject of a September 2007 DOE Inspector General (IG) report.[116] POGO has obtained a June 20, 2008 memorandum from LANL asking DOE's Los Alamos Site Office (LASO) to cancel a regularly scheduled inventory.[117] After POGO shared the memo with DOE Headquarters, LASO rejected LANL's request.

A 2008 DOE IG report found that many of the underlying problems that led to these breaches, such as "a lack of separation of duties and the presence of unclassified and classified systems operating in the same environment," had "not been addressed in system security plans."[118]

Similarly, the GAO found, in June 2008, "[W]hile LANL's storage of classified parts in unapproved storage containers and its process for ensuring that actions to correct identified security deficiencies have been cited in external security evaluations for years, complete security solutions in these areas have not yet been implemented."[119]

Another DOE IG report concluded, in 2008, "[T]he Department of Energy's Office of Intelligence and Counterintelligence and its subordinate Field Intelligence Elements at Los Alamos National Laboratory and Sandia National Laboratories did not have adequate administrative internal controls over their databases used to track sensitive compartmented information (SCI) access authorizations."[120]

116 "Material Control and Accountability at Los Alamos National Laboratory," U.S. DOE Office of Inspector General (DOE/IG-0774.), Sept. 2007, www.ig.energy.gov/documents/IG-0774.pdf.

117 Memorandum from Diane Otero-Bell, Security and Safeguards Division, LANL to Lee LeDoux, Security Management Team, LASO; Subject: TA-55 Physical Inventory Variance; June 20, 2008; http://pogoarchives.org/m/nss/inventory-variance-request-20080620.pdf.

118 "Audit Report, Certification and Accreditation of the Department's National Security Information Systems, " US DOE Office of Inspector General (DOE/IG-0800), August 2008, www.ig.energy.gov/documents/IG-0800.pdf.

119 "Los Alamos National Laboratory: Long-Term Strategies Needed to Improve Security and Management Oversight," U.S. Government Accountability Office (GAO-08-694), June 2008, p. 8, www.gao.gov/new.items/d08694.pdf.

120 "Internal Controls Over Sensitive Compartmented Information Access for Selected Field Intelligence Elements," US DOE Office of Inspector General (DOE/IG-0796). July 2008, www.ig.energy.gov/documents/IG-0796(1).pdf.

That IG report highlighted an example of an individual who "physically accessed a Los Alamos SCI facility without escort after her SCI access authorization was terminated," and noted that the "Los Alamos Field Intelligence Element officials did not report the security incident to appropriate Office of Intelligence and Counterintelligence officials." In fact, the "Los Alamos Field Intelligence Element had not terminated the SCI access authorizations of 13 individuals whose personnel security clearances had been terminated up to 10 months previously."

Pantex Plant

A 2007 labor strike by the protective force at the Pantex Plant highlighted significant security vulnerabilities at all of the sites in the complex. Shockingly, during the strike, a force of only 200 replacements guarded Pantex. That is far fewer than half the number of officers considered necessary to defend this extremely sensitive site full of warheads and components—primaries and secondaries—containing plutonium and HEU. This replacement force was made up of private security supervisors from various sites around the nuclear weapons complex, as well as federal nuclear transportation couriers. Unlike the private segment of the force, the couriers are federal employees and so could not be supervised by the Pantex contractor, B&W Pantex. As a result, we have been told, federal employees from the Pantex Site Office were re-tasked to supervise the couriers. These supervisors were not trained for this type of work and, worse, were unarmed and ill equipped to deal with a real security situation. In addition, the people newly detailed to Pantex had only one week of training on the unique weapons in use at Pantex, as well as on Pantex's unique tactics and response plans.

The occurrence of a strike and the resulting over-tasked guard force was not a new phenomenon for DOE. Yet, DOE has never implemented any of the possible remedies that have been proposed. In 1997, the security officers at DOE's Rocky Flats Plant went on strike in the hopes of gaining retirement benefits. Although that strike was resolved fairly quickly, some DOE officials attempted to avoid future strikes and to prepare in case they could not be avoided. For example, DOE Deputy Secretary Charlie Curtis developed an improved retirement system for the security officers. However, Defense Programs (the predecessor agency to NNSA) never implemented the system. Similarly, DOE's Office of Safeguards and Security had discussions with a unit of the Marine Corps, trained to protect nuclear weapons, in an attempt to arrange for a back-up force in case the unionized guard forces ever went on strike again. However, as with the retirement system, there was no follow-through and the contingency plan was never implemented.

While the Preferred Alternative in NNSA's *Final SPEIS on Complex Reconfiguration* called for it to "Consolidate Category I/II SNM at Pantex within Zone 12, and close Zone 4," the December 19, 2008 Record of Decision on Complex Transformation made no reference to that consolidation. Furthermore, NNSA has not provided a schedule for transferring the thousands of plutonium pits stored on the flight path of the nearby Amarillo airport runway to a more secure location.[121] We believe this should be started immediately and completed as soon as possible.

Y-12 Site

There are several very vulnerable targets at the Y-12 National Security Complex in Oak Ridge, TN. This includes about 400 metric tons (MT) of HEU stored in a wooden storage building and four other World War II-era buildings. During NNSA's 2007 force-on-force exercise, the mock adversaries were successful in a theft scenario; meaning they were successful in removing mock SNM from the site.

There are nearly 300 fewer guards protecting the HEU at Y-12 than is required to meet the government's standards, leaving the site at high risk.

In order to bolster security, Y-12 will begin transferring HEU from five obsolete storage buildings to the recently completed Highly Enriched Uranium Materials Facility (HEUMF) in March 2010. NNSA's December 19, 2008 ROD on Complex Transformation also calls for construction of a new Uranium Processing Facility (UPF) at Y-12 to consolidate HEU manufacturing and processing activities. NNSA has claimed that the major mission of this facility is to manufacture new or rebuilt secondaries for warheads, yet the demand for these is not clear. Both the HEUMF and the UPF, currently in the design phase, are aboveground structures. The DOE Inspector General has been critical of the aboveground design on both cost and security grounds. Since DOE Secretary Bodman's granting of a security waiver from the 2005 DBT, Y-12 does not have to hire the additional guards required to protect the multiple aging buildings. Therefore, there are nearly 300 fewer guards protecting the HEU at Y-12 than is required to meet the government's standards, leaving the site at high risk.[122]

The effects on the population surrounding Y-12 of a terrorist detonating an improvised nuclear device would be devastating. At POGO's request, the Natural Resources Defense Council (NRDC) performed a simulation of the effects of a 10-kiloton nuclear explosion at the approximate location of the HEU storage site at Y-12.[123] NRDC's calculation concluded that the detonation of an improvised nuclear device at Y-12 could cause over 60,000 casualties, including nearly 5,000 fatalities, if the detonation occurred during the day.[124] Casualties were calculated based on the residential population only. That does not include the 13,000 workers at Y-12 and ORNL, who would be killed immediately. The total number of fatalities would likely be about 18,000 people.

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121 One of the authors of this report has personally observed military airborne tankers directly above the Pantex Plant refueling military fighters that use the Amarillo airport for "touch and go" practice landings.

122 "U.S. Nuclear Weapons Complex: Y-12 and Oak Ridge National Laboratory at High Risk," Project On Government Oversight, 2006, www.pogo.org/pogo-files/reports/nuclear-security-safety/Y-12/nss-y12-20061016.html.

123 Matthew McKinzie, Scientific Consultant, Natural Resources Defense Council (NRDC) performed the simulation using the U.S. Department of Defense computer code HPAC (Hazard Prediction and Assessment Capability) version 3.2.2.

124 The calculation assumed that the explosion was caused by a fission reaction and was at ground level at Y-12 on a clear November day with winds blowing eastward at four meters per second. In this scenario, the most intensely radioactive zone in the fallout plume is calculated to extend no more than 10 miles from the explosion site.

Savannah River Site

The Savannah River Site (SRS) has better security than most DOE sites, in part due to its large size and remote location. The facility does have a large amount of Pu, which is stored at the building that once housed the K-Reactor. However, that plutonium has been declared excess to NNSA's nuclear weapons programs and its ownership transferred to DOE's Offices of Environmental Management or Nuclear Energy. While not minimizing the importance of absolute security for SRS' Plutonium, since it is outside of NNSA control, it is beyond the scope of this report.

Nevada Test Site

The only facility at the Nevada Test Site (NTS) with significant amounts of SNM is the Device Assembly Facility (DAF). The DAF, which is mostly underground, is the most secure site in the nuclear weapons complex. Since only a small portion of the DAF is currently being used, NNSA might use the DAF for interim storage of additional excess SNM (including excess pits) or to supplement the existing capacity at Pantex to dismantle warheads. However, such use would increase the number of times that retired warheads and SNM must be transported. Under our plan, we prefer to minimize the transport of nuclear weapons and materials. Hence, we recommend that NNSA dismantle warheads as rapidly as possible, using existing facilities, and that it consolidate and eventually eliminate SNM, without transport for interim storage at the DAF, unless absolutely necessary.

Non-NNSA Facilities with NNSA Material

A number of locations possess NNSA-material, but are not NNSA-sites. ***The Nuclear Fuel Services*** (NFS) plant, located in Erwin, Tennessee, ***and the Nuclear Products Division*** in Lynchburg, Virginia, are private facilities, which process tons of HEU annually for the production of naval and research reactor fuel and for downblending it to LEU for power reactors. Both of those facilities are owned by the Babcock and Wilcox (B&W) Company, which also operates the Y-12 Site for NNSA. Those privately-owned facilities are regulated by the Nuclear Regulatory Commission (NRC). The security standards required by the NRC at these two locations are much lower than those required by DOE at Y-12, which handles the same dangerous materials.

The Oak Ridge National Laboratory (ORNL), which like Y-12 is in Oak Ridge, TN, but is several miles away and is operated for DOE by a different contractor, stores approximately a ton of unirradiated uranium-233. This material, which is a legacy of ORNL's 1960s molten-salt breeder reactor program, has a smaller critical mass than HEU and is just as effective in a gun-type improvised nuclear device. However, ORNL is not a NNSA-site and does not have the security systems required for housing weapon-grade materials. In September 2005, one of the authors of this report walked unescorted, for 15 minutes, around the outside of the building that houses the U-233, before there was a response from the guard force. Since then, DOE has sent three teams to ORNL to determine how it might meet the 2003 DBT requirement. In 2006, ORNL spent $12 million to upgrade security at this single building.

As a result of instructions from Congress in 2005, DOE proposes to dilute the U-233 with depleted uranium to less than one percent U-233 enrichment—far below the level where it would be weapon-usable. In its budget request for fiscal year 2008, the DOE Office of Environmental Management states that downblending will not begin until 2012 and estimates that it will cost $355 million. We would like to see DOE begin that downblending sooner and complete it as soon as possible to eliminate this security threat.

How to Improve Security within the Complex

NNSA's plan for Complex Transformation continues a long history of missed opportunities to improve significantly the security of the complex. Following are the major actions that we believe DOE can and should take to improve the security of the complex.

Reduce the Number of Targets

Consolidation is not a new idea. Faced with the huge anticipated costs of the new post 9/11 security requirements, in May 2004, DOE endorsed consolidation of nuclear materials at fewer sites, and in fewer and more secure buildings within existing sites, as a way to both reduce DOE security costs and increase security.

In 1999, a classified report strongly urged construction of consolidated, underground storage facilities for HEU at the Y-12 Site and for plutonium at SRS.[125] A 2001–2002 study of the security of DOE and Defense Department nuclear sites, chaired by former National Security Advisor Brent Scowcroft, also recommended consolidation.[126] The study was deemed so sensitive that it was never released. In fact, key officials in DOE were never able to see a copy.

The Secretary of Energy's Advisory Board (SEAB) Task Force on the Nuclear Weapons Complex recommended, in 2005, that all of the weapon complex's Category I and II quantities of special nuclear materials be removed to a single Consolidated Nuclear Production Center (CNPC) at a remote location, with "as small a total physical footprint as possible."[127] The task force recommended underground facilities to simplify the security problem. However, NNSA has not adopted that approach. NNSA's December 19, 2008 ROD on Complex Transformation would remove Category I and II quantities of SNM from only one facility (LLNL)

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125 Study chaired by Roger Hagengruber, former Deputy Director of Sandia National Laboratory. According to several people who read the report, it recommended using the Kirtland Underground Munitions Storage Complex (KUMSEC) at the Kirtland Air Force Base in Albuquerque, New Mexico and the Device Assembly Facility on the Nevada Test Site as design templates for the proposed underground storage facilities.

126 Rep. Edward Markey requested an unclassified version in a Jan. 23, 2002 letter, but, to the best of his staff's recollection, he never received one.

127 "Recommendations for the Nuclear Weapons Complex of the Future," Report of the Nuclear Weapons Complex Infrastructure Task Force, US DOE Secretary of Energy Advisory Board, July 13, 2005, p. 19, www.seab.energy.gov/publications/NWCITFRept-7-11-05.pdf.

and would take four more years to do so, would not speed the elimination of excess HEU, would continue production activities at all four main production sites indefinitely, and would continue to maintain a weapons complex of eight major sites.

A June 2007 report by the House Appropriations Committee's Subcommittee on Energy and Water criticizes NNSA for avoiding meaningful consolidation of its complex:

> Instead of working with the Committee to arrive at a realistic plan that has the possibility of garnering bipartisan political support, the NNSA continues to pursue a policy of rebuilding and modernizing the entire complex in situ without any thought given to a sensible strategy for long-term efficiency and consolidation.[128]

Our proposals, outlined in Chapters 5 and 6 of this report, would consolidate SNM more rapidly and extensively than NNSA's plan. In addition, we would significantly speed up elimination of all excess HEU, would seek to eliminate all excess plutonium, and would consolidate most nuclear weapons activities to only three sites (LANL, Pantex, and SNL) by 2025. Furthermore, we recommend that the B&W HEU-processing activities in Erwin, TN and Lynchburg, VA be relocated to Y-12, as long as the move does not interfere with the downblending of excess HEU. This would consolidate all U.S. HEU-processing activities at a single site. Such a move might be facilitated by the fact that B&W also manages the Y-12 Site for DOE.

HEU is more valuable to terrorists than any other nuclear material, because it is relatively easy to assemble into a crude nuclear weapon.

Reduce the Amount of Sensitive Material

NNSA's plan for Complex Transformation does not set any downblending goals or declare any new HEU excess. Some answers stare NNSA in the face, but the agency looks the other way. Downblending reduces security risks.[129] HEU is more valuable to terrorists than any other nuclear material, because it is relatively easy to assemble into a crude nuclear weapon. There is a major international effort to eliminate HEU by consolidating it and blending it down so that it is not weapon-usable. However, at great costs and risks, NNSA is currently storing about 400 MT of HEU in World War II era buildings at Y-12.

With great fanfare, in 2005, NNSA declared 200 MT of HEU was no longer needed for the weapons program; in addition to the 174 MT it had declared excess in 1994. However, it turned out that 160 MT of it would be stored for future use as fuel for U.S. naval vessels and 20 MT would be reserved for space and research reactors. Thus, only 20 MT would be downblended. Instead of declaring the rest of the HEU inventory at Y-12 excess and downblending it, DOE plans to store it at the HEUMF. If most of the excess HEU were downblended, there would be adequate space in HEUMF to accommodate some processing operations. If this were combined with

128 FY 2008 Energy and Water Development Appropriations Bill, House Appropriations Committee Report, June 11, 2007, pp. 96–97.

129 Downblending of HEU involves mixing it with blendstock that is either depleted uranium, natural uranium, or low enriched uranium (LEU) to produce material enriched to less than 20 percent U-235 (which is the upper limit on LEU). LEU does not pose a serious security risk or require expensive security systems to guard it. Terrorists have little interest in LEU because huge quantities are needed to sustain an explosive nuclear chain reaction.

the reductions in the stockpile of nuclear weapons that we propose, NNSA's proposed Uranium Processing Facility (UPF) could be cancelled, saving about $3.5 billion in construction costs.

B&W's Nuclear Fuel Services plant in Tennessee and its Nuclear Products Division, in Lynchburg, VA have plenty of excess capacity for downblending HEU. However, NNSA has not used the opportunity of Complex Transformation to make better use of that capacity or to set any future goals for downblending.

The Department of Defense claims that large amounts of HEU are needed for naval reactors. However, we believe that much more HEU is being reserved for the Navy than is realistically needed. According to a 2008 report by the International Panel on Fissile Materials, the U.S. uses two tons of weapon-grade HEU annually.[130] Thus, the 160 tons of HEU set aside for the Navy in 2005 should be enough for 80 years in addition to the several decades' worth of HEU that the Navy had previously. There is no rational reason to maintain such a large HEU reserve for naval ships. We believe that over time the Navy can and should switch its fleet to using LEU enriched to 20 percent U-235. This would significantly reduce the amount of HEU the Navy needs to stockpile and would reduce risk of terrorists gaining access to the Navy's fuel stockpile.

__A federal force would be easier to select, vet, train, equip, and control leading to better response. Federalized forces, like DoD security forces, would be under the control of DOE directly and not managed through a contract.__

Federalizing DOE's Protective Force

The fact that protective force officers at the nuclear weapons sites are being asked to die for their country, but are not given full protections from the government, creates a security vulnerability. Unlike firefighters and other first responders, DOE protective force officers do not receive benefits that ensure they and their families will be taken care of in the event of a serious injury or death. This lack of first responder benefits dampens the protective force officers' willingness to accept high levels of risk, and raises a question about whether they will stay and fight if real bullets fly. Mandated testing of security, performed at all DOE facilities, shows that up to 50 percent of the guard force could be killed while reacting to or trying to prevent the theft or sabotage of nuclear material.[131] This leaves protective force officers asking themselves each time they go to work, "Who is going to look after my family if I am disabled or killed saving the day?"

There are a number of different security contractors protecting DOE's various weapons sites, each with its own standards for personnel, equipment, and benefits. Additionally, the use of civilian contractors and the lack of standardization, leads to DOE's inability to exercise effective command and control over the security forces.

A federal force would be easier to select, vet, train, equip, and control leading to better response. Federalized forces, like DoD security forces, would be under the control of DOE directly and not managed through a contract. DOE needs a structure similar to that of DoD, in which policy would come from DOE headquarters and be

130 Global Fissile Material Report 2008, International Panel on Fissile Materials, 2008, p. 13, www.ipfmlibrary.org/gfmr08.pdf.

131 This mandatory testing only reflects "life" or "death" results; it does not indicate how many of the "surviving" protective force officers may suffer significant or career-ending injuries. See the Protective Force and Program Manual M473, p. 2-2.

implemented by subordinate echelons of command. This would rid DOE of the unworkable practice of independent contractors controlling security at the various sites.

Transitioning the protective force officers to federal employee status would standardize front-line medical availability; equipment and training for the protective force; the retirement system and health, disability, life, and other benefits; and prohibit labor strikes, which could seriously undermine the security of the nuclear weapons facility.[132] Federalization would also provide the protective force with law-enforcement authority and the power to make arrests, eliminating a whole raft of jurisdictional and legal barriers. For example, the pre-decisional NNSA-commissioned study on federalization pointed out that:

> Another noteworthy issue that needs to be addressed by the Administration in this regard is that any operations by the Protective Force using deadly force in repelling attack or in recovery operations could cause collateral non-combatant casualties. In light of the incidents in Iraq involving the use of deadly force by Contractors resulting in significant civilian collateral damage and the perception that it may be inappropriate for contractor employees not under the direct supervision of federal personnel to be empowered to use deadly force, it may be appropriate to consider whether any offensive operations by the Protective Force should be conducted by anyone other than federal employees.[133]

In order to gain these benefits, protective forces have resorted to striking for them. Protective force officers at Pantex went on strike during the summer of 2007 for retirement benefits, as did the force at Rocky Flats, in 1997, when they were unable to get their concerns addressed in any other way. As a result, the security at these plants was seriously compromised. This reality was not lost on those tasked with the NNSA federalization study who wrote, "It is the Team's belief that elimination of the potential for protective force work stoppages or even the mitigation of future stoppages is imperative."[134]

Federalizing the protective force would address a number of issues. By doing so, the Department of Energy can resolve authority, equipment, training, benefits, and strike issues. While federalization of the guard force is not yet a reality, its importance has not been lost on DOE. A 2004 NNSA memorandum, "Review Options for the Protective Force: Phase II," concludes,

> In the final analysis, the fundamental argument for federalization is that being asked to die or to kill for one's country should mean having the unmistakable full measure of government involvement and support. Protective force members deserve nothing less.[135]

There is a precedent within DOE for federalizing protective forces. Security guards, who protect truck convoys for DOE's Office of Secure Transportation, are federal

132 "Review Options for the Protective Force: Phase II," Memorandum for Kyle McSlarrow from Linton Brooks and Glenn Podonsky, October 22, 2004.

133 *"Comparative Analysis of Contractor and Federal Protective Forces At Fixed Sites,"* prepared by Systematic Management Services, Inc. for NNSA, March 6, 2008, p. 6.

134 Ibid. p. 1.

135 Ibid.

agents and receive all of the authority, equipment, training, and benefits associated with that status. We recommend that all of the protective forces at DOE sites be federalized.

DOE has shown that it can improve underperforming security forces. One of the best examples of what can happen when resources and attention are focused on the problem is the transformation of DOE's Transportation Security Division, now known as the Office of Secure Transportation. The Transportation Security Division was infamous for its poor results in moving nuclear weapons and weapons-grade uranium and plutonium from site to site across the nation. Guards' weapons were of inadequate range to reach the adversary and guards were caught cheating on their force-on-force tests. However, today they are known throughout the complex as the best-trained, most well-organized security force.

The risk of nuclear terrorism in countries where nuclear materials are poorly secured, such as the former Soviet Union, has been a public concern for some time. The U.S. has been at the forefront of efforts to address these vulnerabilities, spending billions of dollars attempting to secure SNM. However, Congress and the U.S. public have paid much less attention to terrorism risks inherent in nuclear materials in our own country. Harvard University's Matthew Bunn, an expert on the security of nuclear materials in the international arena, has argued that the U.S. should lead by example. He has called for "a fast-paced global effort to remove the potential bomb material from the world's most vulnerable sites and make sure that every remaining cache has security sufficient to defeat terrorist threats. To credibly lead that effort, the United States has to get its own house in order."[136] Our plan would greatly reduce the opportunities for potential terrorist access to U.S. nuclear materials, which is a clear and all important national security imperative.

136 "The Nuclear Campus," Matthew Bunn, *Boston Globe* op-ed, October 20, 2005.

APPENDIX A
Budget for a Smaller Weapons Complex

The table below compares the fiscal year 2009 appropriation for the Nuclear Weapons Activities account[137] with funding estimates for our approach for 2010, 2015, and 2020.[138] Our projections are based on the nuclear force structure and the strategies for maintaining nuclear weapons presented in this report. Our plan would reduce spending on nuclear weapons by $2.33 billion in 2010 compared to 2009.[139] We would cut spending by another $1.35 billion/yr by 2015 and an additional $556 million/year by 2020. Under our plan, NNSA spending on nuclear weapons in 2020 would be $2.139 billion—about one-third of what it is today. That is still a substantial amount. For comparison, the 2008 budget for Britain's Atomic Weapons Establishment (a rough equivalent to NNSA) is £800 million ($1.5 billion) to support 200 nuclear weapons.[140] France, with a stockpile of less than 300 nuclear weapons, recently spent about $4 billion/yr to support its nuclear forces, although that also includes the cost of deploying them.[141]

The strategy that underlies our funding projections is discussed extensively in the main body of this report. Our funding projections are sufficient to support a stockpile of about 4,000 nuclear weapons in 2010, declining to 1,000 by 2015 and 500

137 "Nuclear Weapons Activities" is the title of the appropriations account, within the budget of the Department of Energy, into which Congress annually appropriates the funding to NNSA for maintenance of nuclear weapons and support of the nuclear weapons complex.

138 All spending figures are in 2009 dollars and so do not reflect inflation.

139 The Obama Administration recently submitted the outline for its 2010 budget request, which reportedly includes $6.32 billion for Nuclear Weapons Activities. That is $660 million less than the Bush Administration's projection for 2010, but is still $2.27 billion more than our spending plan. So far, few details are available regarding the Obama Administration's request for nuclear weapons.

140 Atomic Weapons Establishment Aldermaston, Westminster Hall Debates, March 26, 2008, www.theyworkforyou.com/whall/?id=2008-03-26a.101.1.

141 "On average, France's nuclear defense budget for 2003–2008 (in the five-year defense plan voted by Parliament in 2002) was planned to be €2.8 billion ($3.8 billion) per year. The 2007 nuclear defense budget includes €3.36 billion ($4.6 billion) for program authorizations, including €1.31 billion ($1.8 billion) for the Commissariat a` l'E´nergie Atomique (CEA), and €3.27 billion ($4.6 billion) for payment credits, including €1.26 billion ($1.7 billion) for the CEA." "The last to disarm: The future of France's nuclear weapons," Bruno Tertrais, *Nonproliferation Review*, Vol. 14, No. 2, July 2007, p. 255, http://cns.miis.edu/pubs/npr/vol14/142/142tertrais.pdf.

by 2020. Our projections are based on a Curatorship strategy for keeping nuclear weapons safe, secure, and reliable. We assume significant consolidation of the nuclear weapons complex and that by the end of 2015 most of NNSA's weapons activities will be confined to four sites—LANL, SNL-NM, Pantex, and Y-12—with only limited activities at LLNL and SRS. We assume NNSA might occasionally conduct above-ground experiments at NTS, but only in connection with resolving problems in the stockpile. NNSA would no longer conduct any activities at SNL-CA or KCP. We also assume that nuclear weapons activities at Y-12 end by 2025, but that is beyond the range of our funding projections.

Additional assumptions and explanations of our estimates follow the table. In both the table and in the descriptions that follow it, bolded headings indicate line-items, which represent the levels at which Congress controls NNSA spending. Non-bolded entries are informational entries only. Expressions in quotes ("...") in the explanations are from NNSA's 2009 Budget justification documents.

We strongly oppose transferring any NNSA programs from DOE to DoD (with the possible exception of the Naval Reactors Program).

In February 2009, the White House Office of Management and Budget (OMB) requested that DoD and DOE "assess the costs and benefits of transferring budget and management of NNSA or its components to DoD and elsewhere." In addition to being responsible for maintaining nuclear weapons and the nuclear weapons complex, which the NNSA manages through its Office of Defense Programs, NNSA is also responsible for certain non-proliferation programs, for designing nuclear reactors for U.S. naval vessels, and for other activities, which are managed and funded separately. We strongly oppose transferring any NNSA programs from DOE to DoD (with the possible exception of the Naval Reactors Program) for the following reasons:

- There would be even less transparency and opportunity for public input into the management of the nuclear weapons complex and the conduct of nuclear weapons activities than there is now within the DOE;
- DoD has demonstrated even less concern for the security of nuclear weapons than DOE, through actions such as the mistaken transport of live nuclear weapons attached to unsecured aircraft;
- Transferring the current nuclear weapons laboratories to DoD control, especially LLNL, would make it difficult to redirect scientists at those laboratories from nuclear weapons to civil research, such as alternative energy and climate modeling. Existing DoD laboratories are generally limited to work that narrowly supports the DoD mission. Most DOE laboratories, including the weapons labs, are multiprogram labs, at which there are significant synergies among different activities; and
- Transferring the NTS to DoD control would send the wrong signal to international observers, who may worry that the U.S. will resume testing of nuclear weapons;

We doubt that transferring NNSA to DoD would help reduce spending on nuclear weapons, which is apparently the reason for OMB's interest in the matter. While spending on Nuclear Weapons Activities ($6.4 billion in 2009) is huge by most standards, it is small compared to the DoD's authorized spending of $651 billion for FY 2009, or even compared to the estimated $22.5 billion DoD spent in FY 08 upgrading, operating, and maintaining nuclear weapon delivery systems.[142] Rather than being funded as part of the Defense Appropriation, the Weapons Activities Account has long been part of the Energy and Water Appropriations, where it must compete for funds with energy, science, and infrastructure (flood control, etc) programs that are high priorities for the Obama Administration and the Democratic controlled Congress. In the past few years, the Energy and Water Appropriations Subcommittees (especially the House Subcommittee) have reduced funding for or cancelled several high profile nuclear weapons programs, including the Reliable Replacement Warhead (RRW) and the Robust Nuclear Earth Penetrator (RNEP). Since we favor fewer nuclear weapons, a smaller nuclear weapons complex, and reduced spending on Nuclear Weapons Activities, we recommend that the budgeting and management of NNSA's activities remain within DOE and that appropriations for Nuclear Weapons Activities remain under the purview of the Energy and Water Subcommittees.

142 "Nuclear Security Spending: Assessing Costs, Examining Priorities," Stephen I. Schwartz with Deepti Choubey, Carnegie Endowment for International Peace, 2009, p. 18.

Budget for Nuclear Weapons Activities

(in millions of 2009 dollars)

	Enacted	Our Plan		
WEAPONS ACTIVITY	**2009**	**2010**	**2015**	**2020**
Directed Stockpile Work (DSW)				
Life Extension Programs	**205**	**0**	**0**	**0**
Stockpile Systems	**329**	**210**	**130**	**110**
Weapons Dismantlement and Disposition				
Weapons dismantlement and disposition	106	120	180	180
Pit Disassembly and Conversion Facility	84	0	0	0
Subtotal, Weapons Dismantlement and Disposition	**190**	**120**	**180**	**180**
Stockpile Services				
Production support	293	280	200	180
Research and development support	35	0	0	0
R&D certification and safety	188	100	80	70
Management, technology, and production	195	120	80	60
Plutonium manufacturing capability	155	60	40	30
Subtotal, Stockpile Services	**866**	**560**	**400**	**340**
Total, Directed Stockpile Work	**1,590**	**890**	**710**	**630**
Campaigns				
Science Campaign				
Advanced certification	19	0	0	0
Primary assessment technologies	80	40	30	20
Dynamic plutonium experiments	23	0	0	0
Dynamic materials properties	83	0	0	0
Advanced radiography	29	0	0	0
Secondary assessment technologies	77	40	30	20
Test readiness	5	0	0	0
Subtotal, Science Campaign	**317**	**80**	**60**	**40**
Engineering Campaign				
Enhanced surety	46	0	0	0
Weapon systems engineering assessment	17	12	8	6
Nuclear survivability	21	10	8	4
Enhanced surveillance	66	70	75	80
Subtotal, Engineering Campaign	**150**	**92**	**91**	**90**

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WEAPONS ACTIVITY	Enacted 2009	Our Plan 2010	2015	2020
Inertial Confinement Fusion Ignition and High Yield Campaign	**437**	**250**	**0**	**0**
Adv. Simulation and Computing Campaign	**556**	**300**	**150**	**120**
Readiness Campaign				
Stockpile readiness	28	23	10	5
High explosives and weapon operations	7	5	5	5
Nonnuclear readiness	30	25	10	5
Tritium readiness	72	0	0	0
Advanced design and production technologies	25	20	15	10
Subtotal, Readiness Campaign	**161**	**73**	**40**	**25**
Total, Campaigns	**1,620**	**795**	**341**	**275**
Readiness in Technical Base and Facilities (RTBF)				
Operations of Facilities				
Kansas City Plant	90	60	0	0
Lawrence Livermore National Laboratory	83	60	15	10
Los Alamos National Laboratory (LANL)	289	240	180	150
Nevada Test Site	92	50	10	5
Pantex Plant	101	100	90	80
Sandia National Laboratories	124	130	120	100
Savannah River Site	93	40	15	0
Y-12 National Security Complex	235	200	160	80
Institutional Site Support	56	50	40	30
Subtotal, Operations of Facilities	**1,164**	**930**	**630**	**455**
Program Readiness	**72**	**57**	**39**	**28**
Material Recycle and Recovery	**70**	**50**	**20**	**10**
Containers	**23**	**25**	**20**	**15**
Storage	**32**	**33**	**35**	**36**
Subtotal, RTBF Operating Programs	**1,360**	**1,095**	**744**	**544**
RTBF Construction				
Chemistry and Metallurgy Facility Replacement, LANL	97	0	0	0
Uranium Processing Facility, Y-12	93	0	0	0
LANSCE Upgrade	19	0	0	0
Other RTBF Construction, Various Sites	105	90	60	40
Subtotal RTBF Construction	**315**	**90**	**60**	**40**
Total, Readiness in Technical Base and Facilities	**1,674**	**1,185**	**804**	**584**

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	Enacted	Our Plan		
WEAPONS ACTIVITY	**2009**	**2,010**	**2015**	**2020**
Safeguards and Security				
Defense nuclear security	735	700	500	400
Cyber security	121	110	90	70
Total, Safeguards and security	**856**	**810**	**590**	**470**
Other Weapons-Related Programs				
Secure Transportation	214	240	150	100
Nuclear Weapons Incident Response	215	0	0	0
Facilities and Infrastructure Recapitalization	147	130	100	80
Environmental Projects and Operations	39	0	0	0
Total, Other Weapons-Related Programs	**616**	**370**	**250**	**180**
Congressional Earmarks	23	0	0	0
TOTAL WEAPONS ACTIVITY	**6,380**	**4,050**	**2,695**	**2,139**

Directed Stockpile Work

Life Extension Programs – We assume that Life Extension Programs, which have typically been warhead enhancement programs, are eliminated as separate line items. Warheads may still be refurbished under discrete scheduled operations, but the refurbishments would be funded within the stockpile systems program.

Stockpile Systems – Funding here is for "ongoing assessment and certification activities, routine maintenance; periodic repair; cyclical replacement of limited life components; surveillance; required alterations, modifications, and safety studies; resolution of Significant Finding Investigations (SFIs); and other support activities." Spending on many of those activities is proportional to the number of warheads. However, some surveillance and assessment activities depend on the number of warhead types. For example, NNSA routinely dismantles and examines eleven warheads of each type every year under its surveillance program. This practice would continue and it might even be augmented under the Curatorship approach. On the other hand, there would be fewer alterations and modifications under Curatorship. Our funding projections assume that the enacted 2009 spending level of $329 million consists of $100 million for alterations and modifications, $100 million for surveillance activities that depend on the number of warhead systems, and $129 million for maintenance activities that depend on the number of warheads and that only the latter two continue.

Weapons Dismantlement and Disposition – We assume that NNSA increases the pace of dismantlements from about 400/year in 2009 to 900/yr in 2015. We provide no funding for NNSA's proposed Pit Disassembly and Conversion Facility pending a review of plutonium disposition options. We further assume that pit disposition activities are ultimately conducted by another DOE office. The 2009 enacted level for Weapons Dismantlement and Disposition includes $22 million for the AIRES process at LANL to provide feedstock for the MOX plant. We include no funds for AIRES in our plan.

Stockpile Services

Production support – Here NNSA funds personnel and activities to maintain its basic capabilities for weapon disassembly/assembly, component production, dismantlements, and safety and reliability testing. We assume funding decreases slower than the size of the stockpile, because of the expanded rate of dismantlement. Our funding estimate for 2010 includes about $50 million in this account to begin consolidating production capabilities from KCP to SNL-NM.

Research and development support – Here NNSA funds infrastructure for it R&D capabilities at the design labs in support of Directed Stockpile Work. This activity would be significantly curtailed under Curatorship. We assume that any remaining funding would be provided by other programs.

R&D certification and safety – "R&D Certification and Safety activities provide underlying capabilities for R&D efforts at design laboratories and the NTS in support of the stockpile. These activities include the basic research required for developing neutron generators and gas transfer systems, surveillance activities, and the base capability for conducting hydrodynamic experiments." Of those activities, support for surveillance, including a base capability for conducting hydrodynamic evaluations of stockpile primaries at the DARHT facility, is the only portion that would continue under Curatorship.

Management, technology, and production – "Management, Technology, and Production activities are those activities that sustain and improve stockpile management, develop and deliver weapon use control technologies, and production of weapon components for use in multiple weapons systems." General support for the surveillance program is included within this budget line and accounts for most of the funding going forward.

Plutonium manufacturing capability – This program element supports the manufacture of as many as 20 pits/year, maintenance of pit manufacturing capability at existing LANL facilities, and expansion of pit manufacturing capabilities. Our funding projection assumes the production of no more than two pits/year, maintenance of additional existing pit manufacturing capability at LANL in a standby condition, and no construction of new production capacity.

Plutonium manufacturing capability – This line in NNSA's 2009 Budget funds expansion of pit manufacturing capabilities that would not take place under our plan.

Campaigns

Science Campaign – "The goal of the Science Campaign is to develop improved capabilities to assess the safety, reliability, and performance of the nuclear package portion of weapons without further underground testing." Under our recommended Curatorship approach, NNSA would not do R&D to improve its modeling and assessment capabilities. Thus, most Science Campaign activities would be suspended. Our projections assume that some work to validate existing codes to existing experimental data would continue under the primary and secondary assessment technology campaigns.

Advanced Certification – Our projections assume no funding for this activity, which is directed at certification of new warhead designs.

Engineering Campaign

Enhanced Surety – Here NNSA funds "developing, validating, and demonstrating advanced initiation and enhanced use-denial options for insertion [to introduce] a new level of use denial." This activity would not be funded under the Curatorship approach, as improvements in nuclear weapons surety would not be sought.

Weapons Systems Engineering Assessment Technology – This subprogram "provides the scientific understanding, experimental capability, diagnostic development and data required to develop and validate engineering computational models and develop assessment methodology for weapon design, manufacturing, qualification, and certification." Under Curatorship, NNSA would no longer develop new computational models. Some work related to technologies for improving assessment of existing components would continue.

Nuclear Survivability – This subprogram "provides the tools and technologies needed to design and qualify components and subsystems to meet requirements for radiation environments (e.g., intrinsic radiation or radiation from production and surveillance radiography), space environments, and hostile environments; develops radiation-hardening approaches and hardened components; and modernizes tools for weapon outputs." Under our plan, few, if any, new components would be designed; hence, nuclear survivability testing would be scaled back considerably.

Enhanced Surveillance – This subprogram "provides component and material lifetime assessments to support weapon replacement or refurbishment decisions and develops advanced diagnostics and predictive capabilities for early detection and assessment of stockpile aging concerns, and for cost effective surveillance transformation." This activity, which aims to improve monitoring, detection, and analysis of changes in existing components as they age would be expanded under the Curatorship approach.

Inertial Confinement Fusion (ICF) Ignition and High Yield Campaign – The main potential contribution from the ICF program to maintaining nuclear weapons is to provide data to enhance and validate new computer codes for modeling exploding nuclear weapons. Such improvements would not be pursued under Curatorship. Under our plan, NNSA would no longer support any of the activities of this campaign. All ICF and High Yield facilities would either be closed down or transferred to other DOE programs for use in basic or applied research with civil applications. In particular, the weapons budget would no longer support the NIF and OMEGA laser fusion facilities or the Z pulsed power facility. Our funding projection assumes funding for this campaign ramps down over a two or three-year period, to allow for orderly closeout of activities or transfer to other programs for continued funding.

Advanced Simulation and Computing (ASC) Campaign – Under this campaign, NNSA funds the acquisition and maintenance of cutting edge supercomputers and software for analyses of nuclear weapons and the development and validation of computer codes for modeling nuclear weapons. Under Curatorship, NNSA would still require high-performance computing capabilities, but would not support development of the world's fastest computers. Such support would shift to activities, such as large-scale climate modeling, which more urgently need the best computing platforms available. Our funding projections assume considerable savings from a less aggressive acquisition strategy for computers and software for nuclear weapons simulations. We also assume existing computer codes are maintained and modified to run on new computers, but are not expanded or improved.

Readiness Campaign – "The goal of the Readiness Campaign is to identify, develop, and deliver new or enhanced processes, technologies, and capabilities to meet the current and future nuclear needs of the stockpile." Under Curatorship, NNSA would continue process-development activities aimed at improving the efficiency of production processes for existing components that must be replaced. However, we assume that funding levels for most subprograms in the Readiness Campaign would decrease from current levels, since there would be little or no technology or process development for new components and because the level of production would fall considerably with reductions in the size of the stockpile.

Tritium Readiness – Here NNSA supports the reintroduction of capabilities to produce tritium. As discussed in Chapter 6, NNSA already has enough tritium to support 500 warheads through at least 2040. Hence, we provide no funding for new tritium production.

Readiness in Technical Base and Facilities (RTBF)

This program supports basic operation of the nuclear weapons complex, "including facility operating costs (e.g., utilities, equipment, facility personnel, training, and salaries); facility and equipment maintenance costs (e.g., staff, tools, and replacement parts); and environmental, safety, and health (ES&H) costs." It also supports design and construction of facilities and infrastructure that are not directly attributable to specific Directed Stockpile Work or to a Campaign. Despite NNSA's claim that it is consolidating the complex, this was the fastest growing program in the 2009 budget request. Under our proposal, the complex would truly be consolidated. RTBF would decline to only 55% of the 2009 appropriation by 2015 and to 40% by 2020.

Operations of Facilities – This program "operates and maintains NNSA-owned programmatic capabilities in a state of readiness, ensuring that each capability (including both workforce and facilities) is operationally ready to execute programmatic tasks identified by the campaigns and DSW. This activity funds maintenance of the complex and makes capital investments to sustain the complex into the future." Under our proposal, funding would decrease in accordance with cessation of all weapons-related activities at KCP and at SNL-CA and with significant reductions at the SRS, NTS, and LLNL. Savings would be small in the first few years, as some facilities to be closed are ramped down slowly and continuing capabilities are transferred between sites. Our funding assumption for each site is shown on the table.

Program Readiness – This program "supports selected activities that rely on more than one facility, Campaign, or DSW activity." We assume it decreases at the same rate as the Operation of Facilities program.

Material Recycle and Recovery – This program "is responsible for the recycling and recovery of plutonium, enriched uranium, and tritium from fabrication and assembly operations, limited life components, and dismantlement operations in support of weapons and components." It does not support disposition of excess materials from the dismantlement program. Under our proposal, funding for this item would decrease in accord with reduced material needs to support a much smaller stockpile with drastically fewer new components

Containers – This program supports "shipping container research and development, design, certification, re-certification, test and evaluation, production and procurement, fielding and maintenance, decontamination and disposal, and off-site transportation authorization for nuclear materials and components." Under our proposal, funding for this activity would increase slightly in 2010, since NNSA would need more containers as it increases shipments to retire and dismantle warheads and to consolidate nuclear materials at fewer sites. Funding would fall after NNSA acquires sufficient containers for the higher shipment rate.

Storage – This program provides for storage and management of surplus pits, highly enriched uranium (HEU), and other weapons and nuclear materials. Under our proposal, funding would increase, pending final disposition of materials, as more warheads are retired.

RTBF Construction – NNSA's current plan for construction within the RTBF program consists of two very large projects and a number of smaller infrastructure projects. The large projects are the Chemistry and Metallurgy Research Facility Replacement-Nuclear Facility (CMRR-NF) at LANL and the Uranium Processing Facility (UPF) at Y-12. NNSA has not produced firm price estimates for either large facility, but according to the 2009 Budget, the CMRR-NF facility could cost over $2 billion and the Uranium Processing Facility up to $3.5 billion. Under our plan, neither of those facilities would be built. Most of the other RTBF construction projects funded in 2009 are smaller infrastructure-related projects at LANL, Y-12, SNL-NM, and Pantex and would continue under our plan, except that we would not fund the upgrade to the LANSCE accelerator. Funding for RTBF construction would decrease over time as the size of the complex shrinks. Our estimates include funding to increase pit storage at Pantex.

Safeguards and Security

Defense Nuclear Security – This program provides "protection for National Nuclear Security Administration (NNSA) personnel, facilities, nuclear weapons, and information from a full spectrum of threats, most notably from terrorism." Most of the funds for this program support protective forces and physical security systems throughout the weapons complex. Funding is also provided here for conducting security clearances on personnel and visitors, for protecting classified information, and for controlling and accounting for nuclear materials. Maintaining security is a high priority under our proposal. We project that funding for security will decline as the size of the complex shrinks, as nuclear materials are consolidated to fewer locations, and as the number of warheads is reduced. However, we project that funding for security will decrease less than the decrease in the size of the complex or the number of weapons.

Cyber Security – This program funds that portion of NNSA's security costs that are managed by its Chief Information Officer. The 2009 Budget split this out from the rest of NNSA's security spending for the first time. Under our proposal, spending on cyber security would decrease as improved systems are put into place and the level of activity within the complex decreases. However, the decrease in funds for cyber security would be less than the reduction in size and activity level of the weapons complex.

Other Weapons-Related Programs

Secure Transportation – Under NNSA's plan, the workload and funding for this program is scheduled to increase over the next few years as the pace of dismantlements increase and as nuclear materials are consolidated at fewer sites. Under our plan, dismantlements would increase even more and nuclear materials would be consolidated at a faster pace. This would be moderated somewhat by a reduced maintenance schedule on a smaller stockpile, and reduced shipments of warheads in and out of life extension programs at Pantex, Y-12, and other sites. We anticipate a significant increase in funding for the transportation program over the next few years to provide additional shipping containers and vehicles. However, funding would begin to fall before 2015, as consolidation of fissile materials would be completed before then.

Nuclear Weapons Incident Response – This program includes a number of subelements that support preparedness to respond to a nuclear attack anywhere in the world. Most of the NNSA participation is directed by its Office of Emergency Operations. Under our proposal, this activity would continue at about the same level as in 2009. However, we assume that all funding for that Program would be appropriated directly to the Office of Emergency Operations and would not be considered part of the weapons program.

Facilities and Infrastructure Recapitalization Program – "The Facilities and Infrastructure Recapitalization Program (FIRP) mission is to restore, rebuild, and revitalize the physical infrastructure of the nuclear weapons complex." Construction of major new facilities is funded in the RTBF program. In contrast, the focus of this program is renewal of existing infrastructure and elimination of what NNSA refers to as a maintenance backlog throughout the complex. Under our proposal, funding for FIRP would be reduced as the size of the complex shrinks. However, funding for this program would decrease at a slower rate than the overall size of the complex, since we would maintain those existing facilities that have continuing missions, rather than build major new facilities under the RTBF Construction program.

Environmental Projects and Operations – Under this program, NNSA operates and maintains environmental cleanup systems, which have been funded and put in place by DOE's Office of Environmental Management (EM), as part of the cleanup of environmental legacies at NNSA sites. NNSA also performs environmental monitoring activities and analyses as part the long-term stewardship of its sites. DOE recently transferred funding for this program from EM to NNSA. This program is clearly an environmental management program, rather than a weapons program. Under our proposal, this program (along with sufficient funding to execute it) would be transferred back to the Office of Environmental Management, where it truly belongs.

APPENDIX B
Who We Are

Natural Resources Defense Council (NRDC)

Founded in 1970, NRDC and it 300-plus attorneys, scientists, economists and other professionals work to safeguard the Earth, its people, plants, and animals and the natural systems on which all life depends. NRDC played a large role, which it continues today, in creating and protecting the statutory authority, implementing regulations, and judicial record for most of the environmental protections that Americans now take for granted, such as the Clean Air Act, the Clean Water Act, and the National Environmental Policy Act. NRDC serves its 1.2 million members and online activists from offices in New York, Washington, DC, Chicago, San Francisco, Los Angeles, and Beijing.

For 35 years, NRDC's Nuclear Program has sought to reduce the risks from both the military and civil applications of nuclear energy. It is the only U.S. environmental NGO to have continuously maintained a program of scientists, seasoned policy analysts, and litigators dedicated to drastically reducing and ultimately eliminating the security and environmental risks from nuclear arsenals worldwide. The Program played a key role in the citizen scientist diplomacy that helped to end to the Cold War and nuclear weapons test explosions, and it was NRDC litigation that established the judicial precedent that brought DOE's nuclear weapons complex under the jurisdiction of the nation's environmental laws. The Program remains a leading nongovernmental authority on world nuclear forces and the history and operations of their supporting nuclear weapons complexes, and a prominent voice in the academic and policy debates over the future of nuclear power and proliferation in an era of climate change. Over the course of three decades, NRDC has worked in coalition with and represented numerous grassroots organizations as counsel in successful litigation involving the hazardous operations and/or cleanup of the US nuclear weapons complex.

Christopher E. Paine directs the Nuclear Program of the Natural Resources Defense Council in Washington, DC, which he joined as a Senior Analyst in June 1991 after five years with Senator Edward M. Kennedy, a member of the Senate Armed Services Committee, where he assisted successful efforts to end U.S. production of plutonium for weapons and underground nuclear test explosions. Long associated with congressional, public advocacy, and legal efforts to end further nuclear arms development and testing, reduce arsenals, and stop the spread of nuclear arms to other nations, in the 1980's Paine was a consultant to Princeton University's Project on Nuclear Policy Alternatives, a research fellow at the Federation of American Scientists, Washington, DC, a staff consultant for nuclear nonproliferation policy with the

House Subcommittee on Energy, Conservation & Power, and a co-founder of national campaigns to enact a Nuclear Weapons Freeze and stop deployment of the MX intercontinental ballistic missile. He is the author or co-author of numerous NRDC reports, as well as some 70 articles on proliferation and national security policy in such publications as Scientific American, Nature, Arms Control Today, Science, and the Bulletin of the Atomic Scientists. He is a 1974 graduate of Harvard University. Contact: cpaine@nrdc.org

Nuclear Watch New Mexico

Through comprehensive research, public education, and effective citizen action, Nuclear Watch New Mexico seeks to promote safety and environmental protection at regional nuclear facilities; mission diversification away from nuclear weapons programs at the national security labs; greater accountability and cleanup in the nationwide nuclear weapons complex; and consistent U.S. leadership toward a world free of nuclear weapons. Veteran New Mexican anti-nuclear weapons activists founded the organization in 1999, with a focus on the Los Alamos National Laboratory. However, the organization also takes nuclear weapons programs at the Sandia National Laboratories (whose primary site is in Albuquerque) and the Waste Isolation Pilot Plant (the world's only deep geologic repository for bomb-making wastes) under its purview. Additionally, Nuclear Watch grapples with the nuclear weapons complex as a whole, in particular emphasizing greater public awareness of the Kansas City Plant, which produces 85% of all nuclear weapons components. Nuclear Watch has provided the public with a wealth of information for all eight NNSA nuclear weapons sites, specifically through successful Freedom of Information Act litigation that resulted in online access to their "Ten-Year Site Plans." In 2004, Nuclear Watch asked Senator Jeff Bingaman (D.-NM) to legislatively require independent review of ongoing NNSA plutonium "pit" lifetime studies. The resulting November 2006 conclusion that these all important core components of nuclear weapons last a century or more seriously undermined NNSA's claimed needs for both new-design Reliable Replacement Warheads and a newly transformed nuclear weapons complex to produce them.

Jay Coghlan is the Executive Director of Nuclear Watch. Over the past 20 years he has been central to a wide range of efforts to contain and reduce the harmful effects of nuclear weapons programs at LANL, including defeating radioactive waste incineration and an advanced plutonium laboratory; obtaining a sixteen-month court injunction against the construction of an advanced nuclear weapons design facility at Los Alamos pending adequate NEPA review and agreement on further environmental protection measures; gaining a federal court ruling that LANL was in non-compliance with the Clean Air Act; and litigating against the DOE (in which NRDC was lead counsel) for its failure to complete a national cleanup study, resulting in a $6.25 million settlement to fund citizen studies of DOE environmental management issues. With Nuclear Watch New Mexico he has been central to obtaining site-specific information about each of the NNSA's nuclear weapons sites and the critical finding that plutonium pit "triggers" last a century or more.

Tri-Valley CAREs

Tri-Valley CAREs (Communities Against a Radioactive Environment) was founded in 1983 in Livermore, California, one of two locations in which U.S. nuclear weapons are designed. Tri-Valley CAREs' staff, board and more than 5,000 members monitor activities throughout the nuclear weapons complex, but maintain a special focus on the neighboring Lawrence Livermore National Laboratory. The organization's mix of area residents and Livermore scientists gives it a uniquely powerful voice to speak out on nuclear policy issues—locally, nationally, and internationally.

Tri-Valley CAREs is a key partner in regional, national, and global alliances that provide up-to-date information to communities and decision-makers in order to move the U.S. and other nuclear-armed states toward the elimination of nuclear and other weapons of mass destruction.

Further, several of the group's alliances focus on cleanup of the massive contamination that accompanies the design, development, testing, and production of nuclear weapons. Tri-Valley CAREs' peace and security accomplishments include: mobilizing media attention and grassroots opposition to NNSA's decision to ship additional weapons-grade plutonium into Livermore Lab, creating a political and community climate that achieved a reversal of that decision, and playing an early role in opposing the "Reliable Replacement Warhead" program by producing the first comprehensive analysis of the program in January 2006. The group has also initiated and participated in critical federal litigation to hold DOE accountable to U.S. environmental and community right to know laws.

Marylia Kelley is Executive Director of Tri-Valley CAREs. With a background in journalism and management, she also brings 26 years of research, writing, and facilitating public participation in decisions regarding the Department of Energy weapons complex, Livermore Lab, nuclear weapons, waste, and cleanup. She has served on the "Community Work Group" (since 1989) to advise EPA and state agencies on the Superfund cleanup of contaminants at Livermore Lab. She has provided input to the National Academy of Sciences, including on proliferation risks posed by programs at the U.S. weapons labs and on the spread of contaminants through environmental media at the Livermore Lab Main Site and Site 300. Marylia Kelley has testified on nuclear weapons issues before the California State Legislature and the U.S. Congress, most recently at a 2008 hearing on NNSA's plan to modernize the nuclear weapons complex. She has written for numerous publications and serves as editor and principal writer for Citizen's Watch. Her work with Tri-Valley CAREs has garnered numerous awards over the years, and, in 2002, she was inducted into the Alameda County Women's Hall of Fame.

Just Peace

Just Peace was formed n 2008 to oppose nuclear activities, with specific focus on the Pantex nuclear weapons plant in the Texas Panhandle, proposed new reactors at the Comanche Peak site near Dallas-Fort Worth, and proposed new reactors near Amarillo. We are engaged in research, advocacy, and community education programs about both the national security risks of nuclear weapons and associated facilities, and the health and environmental risks posed by the nuclear weapons complex. We are working with the Dallas Peace Center to do education and advocacy work in North Texas related to the Comanche Peak expansion. We are also working with area university students on alternatives to nuclear power as a solution to global climate change.

Physicians for Social Responsibility – Greater Kansas City Chapter

Started in the 1980s, Physicians for Social Responsibility – Greater Kansas City Chapter (PSR-KC) is an affiliate of the national PSR, which was founded in 1962 to work for the elimination of nuclear weapons and received the 1987 Nobel Peace Prize. PSR-KC hired local staff in 2008 to oppose the proposed new half-billion dollar KC Honeywell Plant, which currently makes 85% of all the non-nuclear parts of U.S. nuclear bombs and missile warheads. In a classic case of building up instead of cleaning up, the National Nuclear Security Administration (NNSA) is aggressively moving to build a new Plant, financed by private interests without specific authorization from the Congress, while it abandons the old contaminated site. PSR-KC garnered media attention and grassroots support in opposing local nuclear weapons production, when, in October 2008, the Kansas City, Missouri City Council approved $40 million dollars in tax abatements to assist in the construction of the new Plant. PSR-KC also signed on to a lawsuit against the DOE, NNSA, and GSA concerning the need for cleanup of the contamination at the present KC Plant, estimated to cost $278 million dollars. In all these efforts, PSR-KC collaborated with the Alliance for Nuclear Accountability, a national network of 35 grassroots and national organizations working on issues directly related to the U.S. nuclear weapons complex. We continue to do community education programs with PeaceWorks – KC about the health and environmental risks of the local Plant. PSR-KC is also working for legal redress for KC Plant employees suffering from illnesses due to exposure to beryllium and other toxic materials at the Plant.

Project On Government Oversight

The Project On Government Oversight (POGO) exposed the homeland security vulnerabilities created by the retention of plutonium and highly enriched uranium at the twelve sites across the US that maintain these materials in its report, "U.S. Nuclear Weapons Complex: Homeland Security Opportunities." POGO has been widely credited with being largely responsible for the de-inventorying of nuclear materials from Los Alamos' highly vulnerable Technical Area-18 site. POGO's policy advocacy is derived from its investigations into security and safety failures at the labs and production facilities. POGO's work has resulted in half a dozen hearings in the House Energy and Commerce Committee alone, as well as several in the Committee on Oversight and Government Reform. POGO has testified at least six times before the House of Representatives about security vulnerabilities caused by the ongoing storage of nuclear materials at these sites. POGO is a member of the International Panel on Fissile Materials, helping to establish the best practices for all nuclear states around the world.

Peter Stockton is a Senior Investigator at POGO. Stockton served as Special Assistant to Department of Energy Secretary Bill Richardson as his personal troubleshooter on physical and cyber security in the nuclear weapons complex. Prior to that, for 22 years, Mr. Stockton was the senior investigator on the House Energy and Power and the House Oversight and Investigations Subcommittees of the Energy and Commerce Committee.

Ingrid Drake is an investigator at POGO, who, since joining POGO in 2007, has worked on investigations examining the security of the Department of Energy's (DOE) weapons-grade quantities of plutonium and highly enriched uranium (HEU), which resulted in the report U.S. Nuclear Weapons Complex: Livermore Homes and Plutonium Make Bad Neighbors. Ingrid Drake came to POGO after years working as a print and radio journalist.

Robert L. Civiak

Bob Civiak is an independent consultant on nuclear weapons policy. He has been doing research and policy analysis in nuclear energy, nuclear weapons, arms control and related areas for over 30 years. He received a Ph.D. in physics from the University of Pittsburgh in 1974. From 1978 through 1988, he was a Specialist in Energy Technology in the Science Policy Division of the Congressional Research Service (CRS) at the Library of Congress. From 1988 through 1999, he was a Program and Budget Examiner with the Office of Management and Budget (OMB) in the Executive Office of the President. At OMB, his primary responsibilities included oversight of the national security activities of the Department of Energy, including the stewardship of the nuclear weapons stockpile and a number of programs designed to control the spread of nuclear weapons and weapons material. During the spring and summer of 1988, he was a Visiting Scientist at Lawrence Livermore National Laboratory. Dr. Civiak has authored over 100 reports and other publications including most recently, *The Reliable Replacement Warhead Program—A Slippery Slope to New Nuclear Weapons* and *The Need for Speed—An Alternate Plan to Eliminate Russian Nuclear Weapons Material*. He currently resides in Lebanon, New Hampshire.

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