Secretary of Energy Advisory Board

Report of the Task Force on Nuclear Nonproliferation

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U.S. Department of Energy

DRAFT

Executive Summary

This section is to be inserted subsequent to SEAB review of report.

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Introduction

Despite many successful U.S. efforts in nuclear nonproliferation, daunting challenges remain. Some nations are pursuing nuclear weapons and others are expanding their nuclear arsenals; some stockpiles of nuclear weapons and nuclear-weapons-usable materials remain dangerously insecure; U.S.-Russia cooperation on nuclear security has diminished; and an increasing number of terrorist organizations appear eager to obtain and use nuclear weapons against the U.S. and its allies and friends. Longstanding challenges to U.S. nonproliferation efforts are being joined by new obstacles and emerging dangers at a time of declining resources. This state of affairs demands fresh thinking about ways to improve the effectiveness and efficiency of nuclear nonproliferation activities within the Department of Energy and across the U.S. Government.

The Secretary of Energy on December 20, 2013 established the Secretary of Energy Advisory Board (SEAB) Task Force on Nuclear Nonproliferation (TFNN). The Task Force's charge was to "advise the DOE on future areas of emphasis for its nuclear nonproliferation activities by addressing the following questions:

1. What are the current and likely future challenges to nuclear nonproliferation?
2. What should DOE be doing to help the United States Government prepare to meet those challenges?
3. What are DOE's current areas of emphasis in nuclear nonproliferation?
4. In what ways should DOE's nuclear nonproliferation efforts be modified and/or expanded?
5. What obstacles stand in the way of making the recommended changes in DOE's nuclear nonproliferation activities, and how might they be overcome?"

The complete charge to the TFNN appears in Appendix A; task force membership appears in Appendix B; and an Interim Report, issued in July 2014, appears in Appendix C.

The Interim Report addressed five timely and important matters that, in the view of the Task Force, merited prompt attention: (i) setting objectives and priorities for DOE nuclear nonproliferation programs; (ii) improving DOE nuclear policy integration, analysis, and advocacy; (iii) strengthening DOE relationships with field offices, national laboratories, and production facilities; (iv) continuing and revitalizing U.S.-Russian nuclear security and nonproliferation cooperation; and (v) developing and implementing an investment strategy for nuclear nonproliferation research and development.

DOE has made significant progress toward implementation of key recommendations in the Interim Report, including: preparation and recent issuance by NNSA of its first strategic plan to address the threats of nuclear proliferation and terrorism;[1] development of risk-informed priorities for nuclear nonproliferation; establishment of the DOE Nuclear Policy Council to serve as a mechanism for Department-wide consideration of cross-cutting nuclear issues; reorganizing the office of Defense

[1] NNSA, "Prevent, Counter, and Respond – A Strategic Plan to Reduce Global Nuclear Threats (FY2016-2020)," March 2015.

Nuclear Nonproliferation along the lines of "enduring missions;" and establishment of a Council of DOE Headquarters, Labs, Plants and Sites to coordinate nuclear nonproliferation strategy and planning, including (but not limited to) R&D.

This Final Report explicitly addresses each element of our charge: assessing the emerging threat landscape and what should be done to meet it, examining DOE's current areas of emphasis and potential misalignment, recommending actionable improvements, and suggesting how to overcome obstacles to successful implementation. Smart policy ideas will not be enough. Improving U.S. nonproliferation efforts, particularly in an era of budget austerity, will also require better organizational structures and processes that can set and sustain priorities, leverage expertise, deploy resources more strategically, and enhance a whole-of-government approach. Our goal is to recommend ways to improve DOE's all-around performance in nuclear nonproliferation that can stand the test of time midst a changing threat landscape.

Summarized below are the TFNN's responses to the five questions posed in the charge.

I. What Are the Current and Likely Future Challenges to Nuclear Nonproliferation?

Current and likely future challenges to nuclear nonproliferation can be divided into four interrelated categories: preventing additional countries from acquiring nuclear weapons; preventing non-state actors from acquiring nuclear and radiological weapons; reducing the risks posed by existing nuclear arsenals; and maintaining and strengthening the international nonproliferation and nuclear security regime.

Preventing Proliferation to Additional Countries. In recent years, U.S. nonproliferation efforts have focused on India, Pakistan, North Korea, Iran, Libya, and Iraq. The results have been mixed. On the one hand, India and Pakistan now have substantial nuclear arsenals, North Korea has conducted three nuclear tests, and Iran has developed many of the capabilities essential to producing nuclear weapons. On the other hand, neither Libya nor Iraq now has a meaningful nuclear weapons program. In the near term, North Korea and Iran continue to present the most pressing proliferation challenges that can realistically be addressed.

North Korea has a nuclear arsenal of uncertain size and sophistication. In the absence of successful efforts to curb its program, North Korea seems highly likely to expand its arsenal and to deploy nuclear weapons on ballistic missiles, and, eventually to be capable of striking the continental U.S. In addition to the direct military threat to the U.S. and its allies in East Asia, expansion of the North Korean nuclear program: would increase pressure in South Korea and Japan to develop independent nuclear deterrents; could stimulate deployments of ballistic missile defenses by the U.S. and others, thereby diminishing prospects for future arms control agreements; and could increase Pyongyang's willingness to sell or transfer nuclear technology, materials, or weapons to states or non-state organizations eager to acquire them.

Iran has gradually achieved substantial centrifuge capabilities to enrich uranium and has under construction a heavy water reactor that could produce significant amounts of plutonium. Current negotiations between Iran and the P5+1 (U.S., U.K., Russia, France, and China—plus Germany) might lead to an agreement imposing, for a decade or more, verifiable constraints on Iran's ability to produce nuclear-weapons-usable materials quickly at declared facilities. If the negotiations fail, however, Iran could resume and possibly accelerate programs that would enhance its nuclear weapons option.

Iran's acquisition of nuclear weapons, or of the capability to produce them on short notice, would pose threats to peace and stability in the Middle East and to the international nonproliferation regime. For example, a nuclear-capable Iran might pursue more aggressive regional policies, increasing tensions and the risks of conflicts in the region, and it might feel less constrained in its support for terrorism in the Middle East and beyond. A nuclear-capable Iran would increase pressure on the governments of Egypt, Turkey, and Saudi Arabia to seek their own incipient or realized nuclear weapons. And a nuclear-armed Iran would raise concerns about the effectiveness of nuclear security and command and control over its forces. In light of these potentially serious consequences of a nuclear-armed Iran, it is conceivable that if the negotiations between Iran and the P5+1 were to fail, the U.S. and/or Israel might launch a preventative attack against Iranian nuclear facilities.

The states currently or potentially interested in acquiring nuclear weapons appear to be concentrated in East Asia and the Middle East. Countries in other regions seem currently to lack either strong motivation to acquire nuclear weapons or the technological capabilities required to do so. This has not always been so in the past, however, and might not persist into the future.

Proliferation to Non-State Actors. The al Qaeda attacks in New York and Washington, D.C. on September 11, 2001, exemplify and dramatize the willingness of terrorist organizations to carry out large scale, mass casualty operations. If such groups were to gain control of nuclear weapons, they would be more likely than state actors to use them. And if they were to use them, the magnitudes of the resulting death and destruction could dwarf those of 9/11. Because non-state actors seeking nuclear weapons are far less able than states to produce the required nuclear materials, they have tried to buy or steal those materials from states or from enterprises operating under the legal authority of states. To our knowledge, they have not yet been successful. But so long as there are vulnerable stocks of nuclear materials and violent extremists bent on mass destruction, the threat of nuclear terrorism will persist.

Significant risks of nuclear theft exist in a number of countries. For example, Russia has the world's largest nuclear stockpiles in the world's largest number of buildings and bunkers, with security that still has some substantial weaknesses and in an environment that includes widespread corruption and insider theft. Pakistan has the world's most frightening combination of growing nuclear stockpiles and terrorist groups capable of infiltrating security organizations and attacking heavily defended targets. Other countries have sensitive nuclear sites, such as reactors fueled with highly enriched uranium, with especially weak security in place.

Risks of Existing Arsenals. The relationships among nuclear deterrence, nuclear arms control, and nuclear proliferation are prominent elements of the international debate surrounding the nonproliferation regime. Indeed, a significant portion of DOE's nonproliferation activity is devoted to developing and implementing verification and monitoring approaches for current and possible future arms control agreements.

It is in South Asia that existing nuclear arsenals are most likely to be used. India and Pakistan share a border, have fought several wars, are coping with attacks by terrorist groups, and are expanding their already sizable nuclear arsenals. Pakistan's deployment of battlefield nuclear forces lowers the nuclear threshold from strategic to tactical, and increases the risk that terrorist groups might seize weapons stationed with front-line forces. India's development over time of mobile land-based missiles and submarine-launched missiles could stimulate further expansion of Chinese nuclear forces and complicate any effort to engage China in arms control negotiations.

The International Nonproliferation and Nuclear Security Regime. The international nonproliferation and nuclear security regime comprises four elements: a system of treaties (such as the NPT and the Convention on the Physical Protection of Nuclear Materials); United Nations resolutions (such as UN Security Council Resolution 1540, which requires all member states to put in place a wide range of proliferation controls); multilateral institutions (such as the International Atomic Energy Agency and the Conference on Disarmament); and voluntary associations (such as the Nuclear Suppliers Group, the Proliferation Security Initiative, and the Global Initiative to Combat Nuclear Terrorism).

At the heart of the nonproliferation aspect of this regime lies the NPT, the legitimacy of which depends upon its perceived effectiveness. To the extent that the NPT is seen as failing to prevent nuclear proliferation, failing to lead to progress in nuclear disarmament, or failing to promote peaceful uses of nuclear energy, its overall credibility is undercut. In this regard: the absence of Israel as an NPT party weakens the validity of the Treaty in the eyes of other nations in the Middle East; an Iranian success in developing nuclear weapons under the guise of a civilian program might encourage others to do the same; progress toward nuclear disarmament is widely viewed as having stalled, as exemplified by failures to achieve a Nuclear Weapons Convention or a Fissile Material Cut Off Treaty, to bring into force the Comprehensive Test Ban Treaty, or to negotiate further U.S.-Russia nuclear arms reductions; and international controls on nuclear exports, especially dual-use technologies and materials, are seen by some states as hampering their access to the peaceful uses of nuclear energy.

The supply control aspect of the international regime also faces major challenges. The scientific, technological, and industrial capacities relevant to the production of nuclear weapons no longer are concentrated in countries with advanced economies. This is evidenced, for example, by India's nuclear test in 1974, by the breadth of the Iraqi nuclear program that surfaced in the wake of the 1991 war in Iraq, by the nuclear black market network of Pakistan's A.Q. Khan, and by North Korea's nuclear test in 2006. As a result of the spread of nuclear-weapons-related capabilities, it is no longer sufficient for the advanced countries alone to adopt national export control systems and instruments of international cooperation (such as the Nuclear Supplies Group) to coordinate export policies. Success in controlling

and protecting nuclear technologies, equipment, and materials now requires the engagement of a much larger and more diverse group of nations. In addition, it is likely that some currently emerging and future technologies will have important implications for anticipating and dealing with potential nuclear proliferators.

Special challenges are posed by countries that have a wide range of the technologies and materials relevant to the production of nuclear weapons, but limited willingness to cooperate in the international nonproliferation and nuclear security regime. As examples: North Korea appears willing to sell missile technology and perhaps nuclear technology to any country that wants to make such a purchase; Pakistan's export controls remain very much in need of improvement; and there continues to be a substantial flow of technology through China to Iran and North Korea.

Finally, the spread of civilian nuclear energy to additional countries must be accompanied by a spread of effective safeguards and security to minimize proliferation risks, and by credible fuel assurances and spent fuel storage arrangements to dissuade additional countries from pursuing their own national fuel cycle programs.

II. What Should DOE Be Doing to Help the U.S. Government Prepare to Meet the Current and Likely Future Challenges to Nuclear Nonproliferation?

To help the U.S. Government prepare to meet the current and likely future challenges to nuclear nonproliferation, DOE should concentrate its efforts in the following areas:

- Support U.S. Government efforts to formulate and implement nuclear nonproliferation policies;
- Prevent nuclear and radiological terrorism;
- Halt illicit transfers of nuclear technology;
- Build the foundations for dealing with future challenges and opportunities;
- Provide intelligence to guide policy; and
- Reduce the proliferation risks of nuclear energy.

Each of these priority areas is discussed in detail as part of the TFNN's response to the fourth question posed in its charge; viz., "In what ways should DOE's nuclear nonproliferation efforts be modified and/or expanded?"

III. What Are DOE's Current Areas of Emphasis in Nuclear Nonproliferation?

DOE's nonproliferation programs have made and are making essential contributions to U.S. national security, and should be regarded, funded, and managed as critical investments in the security of the U.S., much in the way that DOE's nuclear weapons programs are treated. Current DOE nonproliferation

activities fall predominantly into four key areas: materials security and counterterrorism; nonproliferation and arms control; research and development; and intelligence.

National Security and Counterterrorism. Securing dangerous nuclear and radiological materials from theft and use by terrorists is a high priority. This area of activity includes:

- Cooperating on nuclear and radiological security with Russia, other states of the former Soviet Union, China, India, Pakistan, and other countries around the world;
- Helping other countries to remove weapons-usable material from their territory and to consolidate any remaining material at a small number of well secured sites;
- Assisting with converting research and medical reactors around the world to the use of fuels other than HEU;
- Removing or securing dangerous radiological materials at sites in the U.S. and abroad;
- Strengthening the nuclear security culture at sensitive facilities globally;
- Helping to block nuclear smuggling by providing radiation detectors and training in their use at key border crossings and ports; and
- Maintaining and enhancing capabilities for responding to nuclear and radiological emergencies and in nuclear forensics.

Nonproliferation and Arms Control. Given the technical expertise at its laboratories and the scale and breath of its nuclear security and nonproliferation program, DOE is unique in the technical, operational, and policy insights it can bring to interagency discussions of nuclear threat reduction and proliferation prevention. DOE provides essential support for U.S. Government efforts to stem the spread of nuclear weapons, control the risks of existing stockpiles, implement current agreements, and lay the foundation for future agreements. Included among these efforts are:

- Providing the foundation for negotiating and implementing international agreements by developing verification technologies and procedures, having DOE experts serving on U.S. negotiating delegations, and providing crucial technical advice on matters ranging from modifying Iran's Arak reactor to reduce its capacity for producing plutonium for weapons to disabling North Korea's nuclear facilities;
- Leading the effort to reduce the stocks of HEU and plutonium produced by the U.S. and Russia over decades of Cold War;
- Blocking illicit procurements of nuclear and dual-use technologies by playing a central role in implementing U.S. export controls, helping other countries to put in place and implement suitable export controls, and working with other U.S. Government agencies to track illicit procurement networks and stop illicit transfers;
- Strengthening the IAEA and other international organizations by developing advanced safeguards technologies, helping states to implement safeguards effectively, and training a new generation of safeguards experts.

- Limiting the proliferation risks of nuclear energy by leading U.S. Government efforts to develop reactors and fuel cycles that reduce or eliminate the use of materials and technologies applicable to the production of nuclear weapons, and by constraining the spread of enrichment and reprocessing technologies, particularly by offering attractive alternatives; and
- Addressing regional risks by working with other agencies in developing approaches to halting or mitigating current and potential regional conflicts, such as those in South Asia.

Nonproliferation Research and Development. Through its laboratories, DOE plays a central role in the development of technologies for detecting, monitoring, verifying, and responding to nuclear proliferation threats. A few examples of the broad range of R&D activities currently underway are as follows:

- Developing new capabilities to detect uranium enrichment, uranium processing, plutonium processing, and weaponization activities;
- Developing new capabilities to detect special nuclear material, including in transport, and to improve the effectiveness of international safeguards; and
- Conducting measurements on nuclear weapons and components to support development of new approaches to verifying possible future agreements calling for reductions in nuclear weapons and materials.

Intelligence. For decades, DOE has played a critical part in supporting intelligence assessments of foreign nuclear activities – including both those of states and of non-state actors – and it continues to do so. Given the unique expertise resident in the DOE laboratories and facilities on topics ranging from nuclear weapon design to the technologies of plutonium and HEU production, DOE's role remains crucially important. Since 2006, DOE has launched and taken the lead on an important community-wide initiative, the Nuclear Materials Information Program (NMIP), intended to provide information about and assess security for weapons-usable nuclear material worldwide.

In recent years, new approaches have been established to manage and fund the DOE labs' intelligence work, which includes work both for DOE and for other elements of the intelligence community. There has been an increased emphasis on specialization, with weapons labs working on weapons design issues, material production sites working on materials production issues, and so on. This appears to have had the unintended side effect of virtually eliminating integrated analysis, which combines an understanding of the technical, organizational, and political aspects of foreign nuclear programs, at the DOE labs. Such integrated analysis is essential to deep understanding of these foreign programs and their implications for U.S. security, and had long been an impressive strength of DOE's laboratories.

IV. In What Ways Should DOE's Nuclear Nonproliferation Efforts Be Modified and/or Expanded?

Our response to the question of how DOE's nuclear nonproliferation efforts should be modified and/or expanded comprises a candidate "vision" of a world that sustained nonproliferation efforts by the U.S. and others might reasonably be expected to achieve; a proposed list of priorities for DOE efforts in support of that vision; and, consistent with the vision and the priorities, a set of recommendations for modification and/or expansion of DOE efforts.

Vision. Sustained nonproliferation efforts by the United States and others might reasonably be expected to achieve in the intermediate term (e.g., 10-20 years) a world in which:

- The number of states with nuclear weapons has decreased (or at least not increased);
- All nuclear weapons and weapons-usable materials are effectively and sustainably secured against the full range of plausible threats (including cyber breaches), and other steps have been taken to bring the probability of nuclear or radiological terrorism to the lowest achievable level;
- The numbers of deployed and non-deployed nuclear weapons have been reduced substantially, and they are postured in ways that reduce the risks of their being used;
- Measures that reduce both the demand for nuclear weapons and the supply of technologies to proliferating states' nuclear weapons programs have been put in place worldwide;
- The risks of nuclear activities have been substantially reduced through expanded transparency, verification, and multinational control;
- There is stronger global governance of nuclear activities; and
- Countries can enjoy the benefits of nuclear energy with decreased proliferation risks.

Priorities. In light of the foregoing vision, we believe that DOE's nonproliferation efforts should be concentrated in the following areas:

- Support U.S. Government efforts to formulate and implement nuclear nonproliferation policies;
- Prevent nuclear and radiological terrorism;
- Halt illicit transfers of nuclear technology;
- Build the foundations for dealing with future challenges and opportunities;
- Provide intelligence to guide policy; and
- Reduce the proliferation risks of nuclear energy.

Recommendations. DOE's already strong nonproliferation efforts can be strengthened further through changes within DOE (including headquarters, laboratories, plants, and sites) and in DOE's relationship with other U.S. Government agencies involved in nuclear nonproliferation. Our interim report focused primarily (but not solely) on changes that might be made within DOE. A number of the recommendations in that report have been or are being implemented.

Recent reviews, including the "Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise" (i.e., the Augustine-Mies report), call for fundamental reforms of the way the National Nuclear Security Administration (NNSA) is run – including management of DOE's main nuclear nonproliferation efforts.[2] In a recent memorandum to the Secretary of Energy, the SEAB stated that it "strongly supports the Augustine-Mies Report."[3] A recent workforce survey placed NNSA near the bottom (228th of 315) among similarly sized units of federal agencies as a place of work. Employee ratings for both DOE and NNSA in this survey have been declining sharply in recent years.[4] These are clearly issues that require immediate attention, as it is highly unlikely that an unhappy, unmotivated workforce will conduct successful programs. We believe that the reforms proposed by the Augustine-Mies panel and others; the steps DOE has already been taking; the actions recommended in our interim report; and a nonproliferation program centered on a clearly articulated vision and set of priorities, could contribute significantly to addressing these problems.

We note also that the overall budget for DOE's nonproliferation programs has declined from over $2.2 billion in FY2013 to $1.6 billion for FY2015, a reduction of 25 percent. Some of this reduction reflects projects having been completed or efforts having been put on hold while DOE reviews its approach to them – most prominently the uranium-plutonium mixed oxide (MOX) project for disposition of excess weapons plutonium. Yet, it appears to us that the need to counter current and likely future challenges to nonproliferation justifies increased, rather than reduced, investment in this area.

In accordance with the charge to the Task Force, the recommendations in this report focus primarily on nonproliferation efforts that should be modified, reduced, or expanded, and not on current activities (no matter how important) that should be sustained at approximately current levels. Hence, the fact that a particular program is not called out for discussion in this report does not mean that we do not believe it is important.

1. Support U.S. Government efforts to formulate and implement nuclear nonproliferation policies.

DOE provides technical, analytical, operational, and policy expertise in support of U.S. nuclear nonproliferation policymaking and implementation in general and with regard to nations of particular nonproliferation concern (such as Iran and North Korea). In our interim report, we offered recommendations aimed at increasing the effectiveness of that support, including specific measures for setting objectives and priorities for nonproliferation efforts; for improving nuclear policy analysis, integration, and advocacy; and for strengthening relationships between DOE headquarters, the field

[2] Congressional Panel, *A New Foundation for the Nuclear Enterprise: Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise* (2014).
[3] Memorandum to the Secretary of Energy from John Deutch, Chair of SEAB, "SEAB comments on the Report of the Congress and Advisory Panel on the Governance of the Nuclear Security Enterprise," February 17, 2015.
[4] Partnership for Public Service and Deloitte, *The Best Places to Work in the Federal Government: 2014 Rankings* (Washington, D.C.: Partnership for Public Service, 2014), http://bestplacestowork.org/BPTW/.

offices, the national labs, and the production facilities. We are pleased to note that substantial progress is being made in these areas, and we recommend that the following further steps be taken:

Recommendation 1-A: *Ensure the effectiveness of an organizational structure that provides for integration within DOE of all aspects of nuclear policy (including nuclear weapons, nuclear nonproliferation, nuclear energy, nuclear waste, emergency response, and nuclear counter-terrorism).*

DOE recently established a new Nuclear Policy Council for this purpose, with a small staff reporting directly to the Secretary. We encourage the Secretary to assess the effectiveness of the Council after six months, and in particular to review whether the small initial staff attached to the Council is sufficient to innovate and lead the crosscutting policy analyses and initiatives.

Recommendation 1-B: *Improve mechanisms for integrating scientific and technical expertise (especially that which resides in the national labs) into nuclear policymaking.*

Here, too, DOE is already taking important action, including creation of a new group including leaders of the nonproliferation effort at headquarters and at the laboratories and facilities. In addition to facilitating greater engagement of the scientific and technical experts at DOE headquarters, field offices, national labs, and production facilities, this new group should serve to strengthen relationships among these elements of the Department.

There remains a need for additional steps to bring the voices of technical experts more fully into the policymaking process, including:

- Seeking DOE involvement at all levels in the interagency policy process on nonproliferation and nuclear security matters;
- Ensuring that DOE's representatives in interagency processes are supported by the strong technical expertise available in the DOE laboratories and are able to bring those insights to bear on the subjects at hand;
- Reducing the bureaucratic barriers to laboratory and facility personnel coming to headquarters for stints of 2-3 years (and strengthening the incentives for them to do so);
- Convincing program managers to bring laboratory and facility personnel into their policy deliberations, thereby making fuller use of their perspectives and expertise; and
- Instituting regular mechanisms for providing technical advice to DOE's nonproliferation policy leadership.

Recommendation 1-C: *Intensify efforts to anticipate and prepare for evolving and possible future threats to nuclear nonproliferation.*

Two particularly important examples of evolving threats involve cyber-attacks and terrorist organizations.

Cyber methods might be used for purposes such as gaining access to information about nuclear weapons or sensitive nuclear technologies, undermining security and facilitating theft of nuclear materials, sabotaging nuclear facilities, defeating some aspects of IAEA safeguards, or even creating uncertainties about nuclear command and control.

The number of independent and quasi-independent terrorist organizations has grown. The United States and its allies now face many groups in many countries. Assessments of the danger of terrorism using nuclear, biological, chemical, or radiological weapons must seek to track and analyze all available indicators of both capabilities and intentions of a wide range of groups.

2. Prevent nuclear and radiological terrorism.

The most important measures to prevent nuclear and radiological terrorism are ensuring that all nuclear weapons and weapons-usable materials (including those under control of the U.S.) are effectively and sustainably secured against the full range of plausible threats and that states take action to provide appropriate security for their radiological materials and major nuclear facilities.

DOE's contributions to nuclear security worldwide have been and continue to be admirable. The nature of nuclear security effort has been shifting from a period of U.S. financing of large-scale equipment installations to a period in which other countries will be expected to do more themselves, and the goal of DOE programs will focus increasingly on convincing other countries to act and offering best practices in how to do so. Savings from this transition may help to offset increased investment in other areas of nuclear security. To the extent that funds can be made available for new or expanded initiatives in nuclear security, we offer the following recommendations.

Recommendation 2-A: *Expand efforts to build a global nuclear materials security system of effective nuclear security norms, standards, and best practices worldwide.*

DOE, working with the State Department, the IAEA and other donor states, should expand its efforts to ensure that *all* countries where nuclear weapons or weapons-usable materials exist protect them effectively (though the top priorities should remain on South Asia and Russia). DOE could redeploy some of the personnel and resources it had planned to devote to nuclear security in Russia to working with the rest of the U.S. Government on efforts to build this global architecture and to get effective nuclear security practices in place around the world.

This will require the creation of a stronger global nuclear security architecture – an ambitious objective being pursued internationally in part through the Nuclear Security Summit process. DOE, with its unique technical expertise on nuclear security, should play a leadership role within the U.S. interagency process in shaping and advocating for a global system of norms, standards and best practices, and assist with the implementation of the global system.

DOE and the rest of the U.S. Government should work to build a global nuclear materials security system in which:

- All nuclear materials are covered by the system, including military and other non-civilian materials.
- States adhere to a common set of international norms and best practices, including:
    - All nuclear weapons and weapons-usable materials – or nuclear facilities whose sabotage could cause a major catastrophe – are protected against a set of threats that includes the full spectrum of plausible adversary capabilities.
    - All nuclear weapons and weapons-usable materials have accounting and control systems capable of detecting any significant theft.
    - All operators managing such items or facilities are subject to regular, in-depth inspection, peer review, and realistic testing to ensure that their security and accounting systems really are effective.
    - All operators managing such items or facilities have programs in place to assess and improve their staff's security culture – their focus on achieving and sustaining effective protection.
- States take steps to demonstrate to others – both domestically and internationally – that they do indeed have effective nuclear security measures in place for these dangerous stockpiles, while protecting sensitive information. International peer review is a particularly effective approach to increasing such assurance of the effectiveness of nuclear security.
- Effective training and certification programs are in place to ensure that all individuals with important nuclear security roles are demonstrably competent to do their jobs.
- Risks are minimized over time by countries reducing their stocks of nuclear weapons and weapons-usable materials and the number of locations at which they are kept to the minimum necessary for their ongoing military and civilian needs, and by eliminating any sites whose continuing benefits are outweighed by their costs and risks.

One area of nuclear security in which DOE innovation and leadership would be particularly valuable would be in establishing agreed international norms and practices for the security of military nuclear materials (material designated for military uses, or in military custody, including nuclear weapons themselves).

Recommendation 2-B: *Seek to rebuild nuclear security cooperation with Russia, and to strengthen bilateral nuclear security cooperation with other key states.*

At the end of 2014, Russia ended most U.S.-Russian joint work on nuclear security in Russia. Despite the dramatic improvements in nuclear security in Russia that DOE programs have helped accomplish over the past 20 years, however, there are still important weaknesses that should be addressed, in the interests of U.S., Russian, and world security.

DOE should continue cooperation in those areas Russia has allowed to continue, including working with the Russian regulatory agency, Rostekhnadzor, and with the modest number of facilities or institutions where Russia has not cut off cooperation. DOE's nuclear security relationship with China has long focused primarily on in-depth workshops and best practice exchanges on particular aspects of nuclear security – from insider protection to nuclear material accounting – without many visits to major Chinese nuclear facilities. It may well be possible to have a similar ongoing discussion with Russia. Maintaining the dialogue among technical experts, to the extent possible, is important even if the United States will no longer be involved in major technical improvements at Russian nuclear facilities. At the same time, working with the rest of the U.S. Government, DOE should seek to develop and propose approaches to nuclear security cooperation that appear to put both countries in equal roles and may be more attractive to Russia. Such approaches are not likely to be accepted in the current political environment. But if the parties make progress in resolving the crisis in Ukraine, such steps should be an early focus of efforts to rebuild the nuclear relationship.

In cooperation with the rest of the U.S. Government, DOE should also review steps that can be taken to mitigate the resulting risks to U.S. security if no significant cooperation with Russia continues and, as a result, the security of Russian nuclear materials improves more slowly than would otherwise be the case. These might include, for example, expanded work with foreign countries to help them establish police or intelligence teams targeted on addressing nuclear smuggling and providing mobile radiation detection equipment where deemed needed.

DOE should also seek to strengthen nuclear security cooperation with other states with significant stocks of nuclear weapons or weapons-usable materials. In Pakistan, DOE and other parts of the U.S. Government should cooperate to the extent feasible on improving nuclear security and should seek to convince the Pakistani government to manage its nuclear arsenal and complex in ways that minimize risks of nuclear theft – including by sharing U.S. experiences with the dangers of the battlefield nuclear weapons Pakistan is now pursuing. In India, DOE should seek to expand the very limited nuclear security cooperation that India as accepted to date, including cooperation with Indian regulators and with the Central Industrial Security Force. In China, as the nuclear security Center of Excellence (a facility for education and training in nuclear security, funded jointly by the U.S. and China) moves toward completion, there may be opportunities to expand work on strengthening regulations (including working with China to establish an appropriate national-level design basis threat regulation) and on security culture – including, potentially, cooperation that includes some visits to Chinese nuclear facilities. DOE should explore the possibility of expanding the successful trilateral best practice exchanges with Russia and the United Kingdom to include all of the P5 countries – and ultimately, countries such as India and Pakistan as well. DOE should also seek to expand it work with non-nuclear-weapon states with significant nuclear material stocks, such as Japan.

Recommendation 2-C: *Expand the effort to limit the number of places in the world where nuclear weapons and weapons-usable material exist, including both HEU and plutonium, both civilian and military materials.*

DOE has done excellent work in seeking to reduce the civilian use of HEU, helping to convert research and isotope production reactors and remove HEU from sites around the world. These efforts should continue, but they should be complemented by broader approaches:

- DOE should work with countries with weapons-usable nuclear materials, including nuclear weapon stockpiles, to convince them to make every effort to consolidate their nuclear weapons and weapons-usable nuclear materials to the minimum number of locations necessary;
- DOE and the rest of the U.S. Government should work to limit the spread of reprocessing to additional countries and locations, to ensure that all operations with separated plutonium are protected against the full spectrum of plausible adversary threats, to end the growth of plutonium stocks, and to begin reducing these stocks over time; and
- In addition to continuing work on converting HEU-fueled reactors to LEU, DOE should establish an effort to offer incentives and assistance to shut down research reactors that are no longer needed.

Recommendation 2-D: *Intensify the focus on identifying and reducing cyber vulnerabilities in nuclear systems worldwide.*

The United States, including DOE, has been in the forefront in recognizing the potential dangers cyber vulnerabilities could pose in a variety of areas. Nevertheless, there is more to be done in the United States, and in many other countries the road still to be traveled is even longer. DOE should strengthen coordination between its physical security and cyber security offices, and should work with appropriate international organizations to develop best practices for addressing cyber vulnerabilities in nuclear systems globally.

3. Halt illicit transfers of nuclear technology.

All of the states that have sought nuclear weapons in recent decades have established illicit procurement networks to get the technologies they need. DOE plays a key role in stopping this dangerous trade, supporting domestic U.S. controls, providing information for investigations and interdictions, and helping countries around the world strengthen their own controls.

Recommendation 3-A: *Expand efforts to ensure that countries put in place effective export controls and enforcement and that black-markets are tracked and, when possible, eliminated.*

DOE's efforts to strengthen export controls and enforcement around the world have made important progress but face major challenges. Yet, for many countries, effective export controls are a low priority. In a globalized world, some sensitive technologies could be manufactured anywhere a precision computer-aided manufacturing machine could be installed. That is why UN Security Council Resolution 1540 legally obligated all countries to put effective controls in place – an effort that is still very much in progress. DOE's effort to help countries strengthen export controls has been very successful, but could do more, more effectively, with a modest increase in funding and personnel. We heard from both DOE and State Department personnel about important meetings that DOE experts were unable to attend, engagements delayed, and insufficient investment in training the next generation of experts, all arising from the limited funds and federal employees available for this effort. A few millions of dollars in additional funds each year (which could be directed from other programs), along with appropriate federal personnel, could alleviate these issues and expand the number of countries for which assistance could be provided.

Similarly, an increase in the resources focused on tracking black-market procurement networks over time and supporting interdiction and enforcement efforts could help the U.S. Government stay ahead of these ever-evolving threats. This would combine efforts of nonproliferation and intelligence staff at headquarters and at the laboratories. DOE's expertise is critical to understanding which technologies are most important and feasible to restrict and how these networks are functioning.

4. Build the foundations for dealing with future nonproliferation challenges and opportunities.

To provide the capabilities needed to deal with future nonproliferation challenges and opportunities, DOE must anticipate emerging and future technologies having potential implications for nonproliferation and arms control; develop new detection and monitoring technologies and approaches in the R&D program; work with other countries to develop appropriate verification and implementation procedures and approaches (as in the warhead and fissile material transparency program, for example); and develop and maintain the people and facilities that will be needed to cope with future efforts.

Recommendation 4-A: *Work with other relevant USG agencies to design and launch a comprehensive national research and development program on technologies and procedures for verifying future nuclear arms reductions.*

The administration's Nuclear Posture Review called for a "comprehensive national research and development program" to support progress on arms reductions, including "expanded work on verification technologies and the development of transparency measures." Despite ongoing work in a number of areas, no such comprehensive national R&D program yet exists. Such a program could be built by expanding and integrating existing programs. The State Department has launched a new initiative on international cooperation on disarmament verification, in cooperation with the non-

government Nuclear Threat Initiative, which would be one important piece of such a comprehensive program. The Defense Threat Reduction Agency (DTRA) is pursuing important work in this area. But given DOE's management of the nuclear weapons complex and the expertise of the DOE labs, DOE is in a unique position to lead a comprehensive national program, as well as international R&D efforts focused on verification.

The goal of such an initiative should be to develop a comprehensive suite of verification and transparency tools to support potential future nuclear arms agreements. Priorities should include techniques to confirm warhead dismantlement without revealing classified information; approaches to inspecting warhead and fissile material storage locations; concepts for "nuclear archaeology" (confirming past production from current indicators) for additional types of nuclear facilities; and approaches to assessing the full suite of data available to judge whether declarations of stockpiles are accurate and complete. An appropriately sized effort would likely cost several tens of millions of dollars a year.

Recommendation 4-B: *Intensify the focus of nonproliferation R&D on high-risk, high-reward innovations.*

This is another area in which DOE has already taken important positive steps, including shifting its nonproliferation R&D programs toward a smaller number of larger-scale efforts, with more integration of laboratory perspectives in their design. We have heard concerns, however, that it may still be difficult for high-risk, "out of the box" ideas to get funded. DOE should consider setting aside a modest portion of the available nonproliferation R&D funds for competitively awarded grants for high-risk, high-reward ideas.[5]

Recommendation 4-C: *Invest in the next generation of nuclear nonproliferation professionals.*

Many of the nation's best nuclear experts will be retiring in the next decade. Recruiting, training, and retaining the next generation are urgent tasks. Congress and DOE should work together to make it easier to hire new federal employees at DOE; to make work at the national laboratories attractive; to provide the funding needed for younger people to work with senior experts, getting the experience they need to step into their shoes; to stimulate development of graduate education programs tailored to meet the needs of the laboratories; to expand recruitment programs such as NNSA's graduate fellowship program; and to improve employee morale.

5. Provide intelligence to guide policy.

The intelligence programs at DOE and its laboratories are critically important. Experts at DOE's laboratories offer unsurpassed insights on foreign nuclear weapons and nuclear technologies. Yet

[5] In a recent report, SEAB similarly called for an investment in high-risk, high-reward R&D to advance the cleanup of DOE's legacy weapons sites. SEAB, *Report on the Task Force on Technology Development for Environmental Management* (2014).

DOE's capabilities for conducting broad, integrated analyses to develop a comprehensive picture of a nation's nuclear programs have decayed over time.

Recommendation 5-A: *Rebuild DOE's capabilities for conducting broad, integrated analyses of nuclear programs.*

Broad, integrated analysis designed to develop a complete picture of a country's program, incorporating both political and technical aspects and drawing on a wide range of sources, is critically important. Only by understanding incentives, organizations, and technical capabilities can analysts make informed judgments about where a country's nuclear program may be heading next. Centers such as Lawrence Livermore's Z Division, for example, once provided unparalleled insights into foreign nuclear weapons programs based on such an in-depth integration of information on all aspects of proliferating states' programs. Today, the laboratories focus largely on their own core areas of expertise, rather than on such integrated analysis. In addition, substantial portions of funding have been shifted from the laboratories to headquarters personnel and Washington-area firms, further weakening the lab effort. DOE should undertake a targeted campaign to rebuild integrated all-source analysis of foreign nuclear weapons efforts at the laboratories over the next few years.

At the same time DOE should expand its efforts to look beyond the horizon – at the countries that may conceivably pursue nuclear weapons in the future, at new technologies that make it easier for states or groups to acquire nuclear weapons, at firms that may be developing the ability to supply sensitive technologies but may not yet have effective export compliance programs in place, and more.

Recommendation 5-B: *Strengthen – and share – intelligence on nuclear and radiological terrorism threats.*

DOE has played a leading role in recent years in intelligence on nuclear terrorism, nuclear security, and nuclear smuggling, including taking the lead in the important multi-agency Nuclear Materials Information Program (NMIP), which is an effort to assess security for nuclear weapons and materials around the world. DOE should work with other agencies to strengthen current efforts to track down and resolve past leads on terrorist nuclear and radiological activities and nuclear smuggling; to more fully understand the potential for today's highest-capability terrorist groups to pursue nuclear or radiological terrorism; and to proactively explore nuclear black markets, including through expanded use of stings and related operations.

There is a need to share key information with other countries. DOE should work with other agencies to develop an in-depth analysis of everything the U.S. Government knows about the risk, at several levels of classification – one only for use within the U.S. Government, one that could be shared with countries such as Britain and France with whom the United States has restricted data sharing agreements, one that could be shared confidentially with a broader set of countries, and one that could be publicly released.

6. Manage the proliferation risks of nuclear energy.

A number of countries are building or planning their first nuclear power plants. DOE and its laboratories are the repositories of most of the U.S. Government's expertise on nuclear energy, giving them a critical role to play in reducing the proliferation risks a nuclear expansion could pose. Although implementation of Recommendation 1-A (*Formalize an organizational structure that will ensure integration within DOE of all aspects of nuclear policy, including nuclear weapons, nuclear nonproliferation, nuclear energy, and nuclear waste*) would contribute substantially to DOE's ability to recognize and reduce the proliferation risks associated with nuclear energy, there are additional steps that should be taken.

Recommendation 6-A: *DOE should promote and participate in an interagency effort to support U.S. commercial involvement with civilian nuclear activities around the world.*

New reactor construction in the U.S. is unlikely to continue after the current five plants are completed, given the low price of natural gas, the absence of growth in electricity markets, and the high capital costs of nuclear plants. Some countries in Europe are committed to new construction, but others have rejected nuclear energy and are prematurely closing plants. At the same time, there are aggressive construction programs in China, Russia, South Korea, and India. Russia is already a formidable international vendor and not doubt China will become a major exporter over time. Many of the new entrant countries are in Asia or the Middle East. In these circumstances the center of gravity in the use of civilian technology will move from the U.S. and Europe to Russia and Asia. The capacity for the United States to influence the rules of the road on safeguards, security, and safety would be likely to diminish in a world in which the United States ceased to be a major player in commercial markets. An accident at a civilian nuclear facility anywhere in the world would have negative implications for nuclear power programs in the U.S. and elsewhere. There is therefore both an economic and a national security interest in seeking to preserve U.S. influence in the commercial nuclear world by encouraging and assisting the efforts of U.S.-based vendors of reactors, fuel, equipment, and services. DOE should take steps such as working with the private sector to expand nuclear technology training programs for potential newcomer countries; working with the Department of Commerce to strengthen their approach to formal and informal advocacy of U.S. nuclear firms; working with the Nuclear Regulatory Commission to strengthen the Commission's outreach to potential newcomer countries; and seeking to build support in Congress for continuing the Export-Import Bank, whose financing has been important in recent nuclear negotiations.[6] DOE should also seek to build international support for sensible "rules of the road" on safety, security, and nonproliferation, through bilateral cooperation, initiatives such as the International

[6] See the recommendations presented by the International Subcommittee of DOE's Nuclear Energy Advisory Committee, December 2014.

Framework for Nuclear Energy Cooperation, and support for non-government initiatives such as the recent agreement on a code of conduct for nuclear exports.[7]

Recommendation 6-B: *Accelerate and expand efforts to build an International Framework for Nuclear Energy Cooperation (IFNEC) that would strengthen incentives for nations to enjoy the benefits of nuclear energy without acquiring enrichment and reprocessing capabilities.*

In the context of IFNEC, DOE should continue to develop and support international options for nuclear fuel supplies and waste management that would serve as reliable, affordable, attractive alternatives to acquiring and operating national enrichment and/or reprocessing facilities. Examples of promising alternatives are fuel-leasing arrangements, an IAEA fuel bank, and U.S. take-back of limited quantities of spent fuel when doing so would contribute significantly to U.S. national security. DOE should expand its cooperation with countries to help them overcome the political and regulatory obstacles to expanding dry cask storage. When DOE considers pursuing joint R&D with non-nuclear-weapon states on technologies relating to enrichment or reprocessing, it should carry out a thorough nonproliferation assessment of the proposed project as part of the decision on whether or not to proceed.

7. Enhance U.S. approaches to plutonium management and disposition.

Recommendation 7-A: *Undertake an expanded effort to improve management of plutonium separation and stocks around the world.*

Countries pursuing a once-through fuel cycle and countries pursuing reprocessing of spent fuel are not likely to agree soon on which fuel cycle is more desirable. It is indisputable, however, that the spread of reprocessing, which provides more widespread access to separated plutonium, carries substantial proliferation and nuclear security risks. And it is important to manage the reprocessing activities and the stocks of separated plutonium that already exist safely and securely, and to reduce these stocks over time.

DOE should work with other countries with excess plutonium stocks to develop safe, secure, and cost-effective approaches to disposition of this material, which could either supplement or substitute for efforts to use this material in mixed oxide (MOX) fuel. This could include joint R&D efforts on plutonium disposition alternatives.

Recommendation 7-B: *DOE should explore alternatives to the U.S. MOX program for plutonium disposition.*

[7] See the "Nuclear Power Plant and Reactor Exports' Principles of Conduct," http://nuclearprinciples.org/. These principles have been endorsed by the major nuclear reactor vendors, and were facilitated by the Carnegie Endowment for International Peace.

The more than $30 billion projected cost of the U.S. MOX program provides sufficient incentive to explore alternative approaches to plutonium disposition that would be less costly and might overcome any domestic, diplomatic, or technological barriers to change.

Alternatives worthy of consideration include long-term storage, as well as immobilization or other processing for disposal in a future nuclear waste repository or in deep boreholes. As suggested above, DOE should pursue international cooperation on such alternatives as appropriate. All of these alternatives have their own uncertainties and issues.

V. What Obstacles Stand in the Way of Making the Recommended Changes in DOE's Nuclear Nonproliferation Activities, and How Might They Be Overcome?

A variety of barriers could stand in the way of implementation of the various recommendations offered in this report. The principal obstacles and means by which they might be overcome include the following:

Limited foreign willingness to cooperate. The successful pursuit of U.S. nonproliferation objectives depends inherently on the cooperation of foreign governments. For example, foreign government engagement and agreement is necessary to establish an enhanced global nuclear security system, to build nuclear security cooperation on a bilateral basis with Russia and other countries, to limit the number of places in which weapons-usable nuclear materials exist, to reduce cyber vulnerabilities worldwide, to expand the effectiveness of export controls, and to strengthen incentives for nations to enjoy the benefits of nuclear energy without acquiring enrichment and reprocessing capabilities.

Achieving foreign engagement would require hard work by DOE and other government agencies to articulate and advance the understanding of the common interest of the world community in the pursuit of these activities. This is not an obstacle that DOE can overcome on its own, but it is critical for the success of DOE's non-proliferation efforts.

Limited resources – both people and money. Nearly all of our recommendations have implications for budget and staffing. We recognize that in a time of budget stringency there are necessary constraints on the funds that can be applied in pursuit of the nonproliferation mission. Some of our recommendations could be effectively pursued by the reallocation of funds that are part of the current budget; others might require additional budgetary support.

It is our understanding that in recent years Congress also has reduced by about 25 percent the number of staff that may be employed as part of the DOE nonproliferation program. Although we have had occasion to undertake only a limited examination of the matter, our impression is that the FTE constraint has limited the effectiveness of the overall program.

The response to this obstacle is both to be more effective in making the case for the importance of DOE's nonproliferation activities to Congress and others (discussed below) and in assuring that the existing resources are deployed effectively.

Need for improved DOE management. Both the Augustine-Mies report and a recent report of the National Research Council focus on issues related to the management of NNSA and the NNSA laboratories.[8] As noted in these reports, in a memorandum from SEAB to the Secretary of Energy, and earlier in this report, these matters require immediate attention.

Need for intensified DOE engagement with other agencies. DOE through its laboratories brings great technical expertise to all aspects of the U.S. Government's approach to nonproliferation activities. Most of our recommendations require extensive DOE interaction and cooperation with other U.S. Government agencies at all levels. These include the formulation and implementation of nonproliferation policies, expanded efforts to build a global nuclear materials security system, building effective bilateral nuclear security cooperation, limiting the number of places at which weapons-usable materials exist, addressing cyber vulnerabilities worldwide, assuring effective export controls, launching a comprehensive national research and development program, strengthening the sharing of intelligence on nuclear and radiological terrorism, advancing the interagency efforts to promote U.S. commercial involvement with civilian nuclear activities, and accelerating and expanding efforts to build an International Framework for Nuclear Energy Cooperation. In light of the importance of these activities, DOE personnel should be engaged to the greatest extent possible in the interagency processes in which they are formulated and implemented.

Limited understanding of the DOE program. It is apparent to the Task Force that the scope, value, and effectiveness of DOE's nonproliferation activities are not fully understood and appreciated in the Congress, in OMB, and elsewhere in government. As a result of lack of understanding, the overall program may be subject to unnecessary and inappropriate constraints.

The response to this obstacle involves recognizing the problem and pursuing aggressive efforts to inform others of the range of activities and of the achievements. We understand that the Office of Defense Nuclear Nonproliferation has undertaken some efforts to enhance its "public relations" in this respect. We very much encourage the continuation and expansion of that effort.

Absence of a disposition path for used fuel and high-level waste. For reasons entirely separate from nonproliferation considerations, there is a need for the U.S. to develop a disposal pathway for the nation's used nuclear fuel and high-level radioactive waste. But, as an ancillary benefit, nonproliferation objectives would be better served if the U.S. was in a position to accept spent fuel and separated plutonium from abroad for disposal in the U.S. The removal of this material from other countries would obviously serve to make it unavailable for use for weapons purposes. Indeed, the capacity to offer this service could advance U.S. civilian commercial engagement; we understand that

[8] National Research Council, *Aligning the Governance Structure of the NNSA Laboratories to Meet 21st Century National Security Challenges* (2015).

the success of the Russian reactor vendor arises in part for its capacity to offer a "package deal" in which it will both provide fresh fuel and then take it back for disposition in Russia, thereby enabling the recipient country to avoid expensive fuel-cycle related activities. Moreover, the creation of a disposal path for spent fuel and high-level waste would provide an option for disposition of U.S. separated plutonium.

We recognize that the response to this obstacle necessarily involves Congressional engagement and is not solely within DOE's control. Nonproliferation considerations reinforce the importance of addressing this issue.

* * *

Implementation of our recommendations would require DOE to seek to overcome numerous obstacles, many of which are not subject to its sole control. Nonetheless, given the importance of the nonproliferation program, we believe that an aggressive effort to join with others to overcome the obstacles is warranted.

The Secretary of Energy
Washington, DC 20585

December 20, 2013

MEMORANDUM FOR THE CO-CHAIRS
SECRETARY OF ENERGY ADVISORY BOARD

FROM: ERNEST J. MONIZ

SUBJECT: Establishing a Task Force on Nuclear Nonproliferation

I request that you form a Secretary of Energy Advisory Board (SEAB) Task Force on Nuclear Nonproliferation. The Task Force will comprise SEAB members and individuals with expertise and experience in the technologies, institutions, and policy issues associated with curbing the proliferation of nuclear weapons and the materials, technologies, and expertise associated with them. The Task Force should inform itself on the range of future nuclear proliferation threats and consult with officials in other agencies.

Purpose of the Task Force: The SEAB Task Force on Nuclear Nonproliferation will advise the DOE on future areas of emphasis for its nuclear nonproliferation activities by addressing the following questions:

- What are the current and likely future challenges to nuclear nonproliferation?
- What should DOE be doing to help the United States Government prepare to meet those challenges?
- What are DOE's current areas of emphasis in nuclear nonproliferation?
- In what ways should DOE's nuclear nonproliferation efforts be modified and/or expanded?
- What obstacles stand in the way of making the recommended changes in DOE's nuclear nonproliferation activities, and how might they be overcome?

Designated Federal Official: Karen Gibson, Director, Office of Secretarial Boards and Councils

Schedule: The Task Force will provide a brief written report and make a presentation to SEAB in July 2014. The Task Force will submit a written report and make a presentation to SEAB and the public at SEAB's sixth meeting, expected in December 2014.

Secretary of Energy Advisory Board
Task Force on Nuclear Nonproliferation

Members

Albert Carnesale, University of California, Los Angeles; Task Force Chair*

Matthew Bunn, Harvard University

Jay Davis, The Hertz Foundation

John Deutch (ex officio), Massachusetts Institute of Technology*

Jessica Mathews, Carnegie Endowment for International Peace

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Joan Rohlfing, Nuclear Threat Initiative

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Secretary of Energy Advisory Board

Interim Report of the Task Force on Nuclear Nonproliferation

August 1, 2014

U.S. Department of Energy

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Executive Summary

The SEAB Task Force on Nuclear Nonproliferation (TFNN) was established by the Secretary of Energy on December 20, 2013 to "advise the Department of Energy (DOE) on future areas of emphasis for its nuclear nonproliferation activities by addressing the following questions:

1. *What are the current and likely future challenges to nuclear nonproliferation?*
2. *What should DOE be doing to help the United States Government (USG) prepare to meet those challenges?*
3. *What are DOE's current areas of emphasis in nuclear nonproliferation?*
4. *In what ways should DOE's nuclear nonproliferation efforts be modified and/or expanded?*
5. *What obstacles stand in the way of making the recommended changes in DOE's nuclear nonproliferation activities, and how might they be overcome?"*[1]

This interim report of the Task Force sets forth its findings and recommendations to date in five timely and important areas: (I) Setting Objectives and Priorities for DOE Nuclear Nonproliferation Programs; (II) Improving DOE Nuclear Policy Integration, Analysis, and Advocacy; (III) Strengthening DOE Relationships with Field Offices, National Laboratories, and Production Facilities; (IV) Continuing and Revitalizing U.S.-Russian Nuclear Security and Nonproliferation Cooperation; and (V) Developing and Implementing an Investment Strategy for Nuclear Nonproliferation Research and Development. (A more complete report is to be submitted at the end of 2014.)

The gist of the findings and recommendations to date in each area appears below. These recommendations are mutually reinforcing.

In addressing the problem of nuclear proliferation, it must be recognized that despite substantial recent progress, there are nations pursuing nuclear weapons, there remain nuclear stockpiles that are dangerously insecure, and there are terrorists eager to acquire and use nuclear weapons. Urgent actions are needed to meet these continuing threats.

[1] In keeping with our charge, we interpret nuclear "nonproliferation" to include the full set of U.S. efforts to prevent additional states or substate groups from acquiring nuclear weapons and the technologies and materials needed to make them, including efforts that some refer to as counterproliferation, weapons of mass destruction (WMD) counter-terrorism, or nuclear security. While most of DOE's nuclear nonproliferation activities are implemented by the semi-autonomous National Nuclear Security Administration (NNSA), our charge focused on DOE's efforts enterprise-wide, and we refer to these efforts as being undertaken by "DOE" throughout, except where we mean to refer solely to NNSA.

I. Setting Objectives and Priorities for DOE Nuclear Nonproliferation Programs

Findings

1. *DOE's nonproliferation efforts have made and are making substantial contributions to U.S. national security.*
2. *DOE's nonproliferation programs have undergone several years of substantial budget reductions, with further reductions proposed for fiscal year (FY) 2015.*
3. *DOE does not have a risk-informed analysis of priorities to guide its nonproliferation efforts.*
4. *The U.S. government does not yet have a compelling vision for the future of its nonproliferation efforts or how DOE's programs fit in that larger picture, though DOE has launched an effort to develop one.*
5. *DOE often does not make the case persuasively for its nonproliferation programs to the White House, Congress, or the public.*

Recommendations

1. **Lay out a vision and set priorities.** DOE and the rest of the U.S. government should articulate a compelling vision of the nuclear security and nonproliferation future they seek to achieve. DOE should then establish a consistent process to develop risk-informed priorities for its nonproliferation programs, seeking to invest resources wherever they can make the biggest difference in reducing risk to U.S. and world security. To facilitate this effort, DOE should work with other relevant government agencies to develop approaches to assessing the balance of risks and opportunities and developing a consistent, risk-informed set of priorities across the nonproliferation enterprise, integrated with the broader U.S. government nonproliferation effort.

   The Task Force anticipates that among the higher priorities would be: (a) maintain the rate of progress in nuclear security**;** (b) provide needed technical expertise and options to support critical nonproliferation and arms control negotiations, such as those with Iran and North Korea; (c) contribute to reducing the risk that additional countries or groups will acquire key nuclear weapons-related technologies; (d) strengthen international organizations that help support important U.S. nuclear priorities, particularly the International Atomic Energy Agency (IAEA) and its safeguards system; (e) provide intelligence insight on nuclear threats, integrating technical and political expertise as DOE laboratories did in the past; and (f) provide the policy tools needed for the future, including both research and development (R&D) on new verification and nonproliferation technologies and maintaining the facilities and expertise needed to address future challenges.

2. **Develop a roadmap for achieving the vision.** DOE should work with the rest of the U.S. government, preferably through a formal interagency process, to develop a roadmap to achieve the U.S. government's vision of the nuclear security and nonproliferation future. This roadmap should specify milestones, indicators of progress, requirements for funding, and any needed changes in organizational structure and authorities.
3. **Ensure adequate funding to achieve high priority goals.** DOE should strive to ensure that high priority goals, such as maintaining progress in nuclear security, receive adequate funding.
4. **Make the case.** For each program, DOE should explain the threat, what it plans to do, which risks would be reduced and how the planned programs compare to alternative efforts to achieve the same goals, what the life-cycle cost would be, and why DOE believes the specific approach and scope it plans to pursue are the optimal strategy. In particular, DOE should consider producing a biannual report to the President and Congress on non-weapons national security activities, especially non-proliferation, comparable to the report that NNSA currently produces on the nuclear weapons program.
5. **Prepare for the unexpected.** DOE should (a) undertake a study of possible game-changing surprises and the steps that might need to be taken in response; (b) work with Congress to establish a contingency fund and contingency capabilities to be used as unexpected opportunities or requirements arise.

II. Improving DOE Nuclear Policy Integration, Analysis, and Advocacy

Findings

1. *Below the level of the Secretary and Deputy Secretary, there is no official or office within the Department responsible for looking at nuclear policy across the board.*
2. *DOE's policy role and voice in the national security interagency process is inconsistent, sometimes weak, and sometimes absent entirely.*

Recommendations

1. **Integrate nuclear policy within DOE.** Integrate responsibility for all aspects of nuclear policy within a single policy office. This could measurably strengthen DOE's role and voice in the interagency process, and in the USG debate and policymaking related to nuclear policy.
2. **Improve DOE's secure connectivity to the other national security agencies and the White House by ensuring that it has the equipment and procedures it needs for effective communications.**
3. **Strengthen the integration of science and technology expertise into nuclear policymaking.**

III. Strengthening DOE Relationships with Field Offices, National Laboratories, and Production Facilities

Findings

1. *The relationships among DOE headquarters, field offices, national labs, and production facilities are inadequate to ensure the health of the national laboratories and to maximize their contributions to nuclear nonproliferation.*
2. *A number of advisory groups and commissions currently are exploring ways to improve the health and management of the labs to support the full range of DOE missions.*

Recommendation

In light of the recommendations of the studies now in progress, DOE should as an urgent priority strengthen the relationship among DOE headquarters, field offices, national labs, and production facilities.

IV. Continuing and Revitalizing U.S.-Russian Nuclear Security and Nonproliferation Cooperation

Findings

1. *DOE's global work to improve nuclear security has substantially reduced the risk of nuclear terrorism, but there is more work to do.*
2. *The deterioration of U.S.-Russian relations resulting from the crisis in Ukraine makes nuclear security cooperation more challenging.*
3. *Continuing nuclear security cooperation with Russia remains critical to U.S. national security interests.*
4. *Nuclear security cooperation with Russia will not be easy, is likely to encounter delays, and will require creative approaches and sustained attention.*

Recommendations

1. **Continue nuclear security and nonproliferation cooperation with Russia.** DOE should make every effort to continue its nuclear security cooperation with Russia despite current tensions with Russia over Ukraine. Other U.S.-Russian cooperation that serves U.S. nonproliferation interests should also continue.
2. **Plan for different scenarios with Russia.** Given the crisis in Ukraine and heightened opposition in both the United States and Russia to any approach that smacks of

"assistance," DOE should develop plans to further U.S. interests in effective nuclear security under a range of scenarios.

3. **Develop a more equal approach in U.S.-Russian nuclear security cooperation.** With the era of large-scale equipment installation nearing its end, DOE should develop concepts for a new approach to nuclear security cooperation that could be implemented in the scenarios in which nuclear security cooperation is able to continue.
4. **Take a broader approach to consolidating nuclear material in the U.S. and Russia.** Political conditions permitting, DOE and Russia should work together to lay out strategic plans by which they can each accomplish their defense and civilian missions with the smallest number of locations with HEU or separated plutonium.

V. Developing and Implementing an Investment Strategy for Nuclear Nonproliferation Research and Development

Findings

1. *DOE's nonproliferation R&D program is critically important, and has provided major improvements in nonproliferation and arms control technologies.*
2. *DOE's approach of spreading nonproliferation R&D investment to large numbers of laboratories in small increments is inhibiting nonproliferation technology innovation within the labs.*
3. *DOE's nonproliferation R&D investments are inadequately coordinated within DOE and with other USG agencies.*

Recommendation

Formulate and implement a multiagency investment strategy for nuclear nonproliferation R&D. As indicated in the recent Defense Science Board study on "Assessment of Nuclear Monitoring and Verification Technologies," the U.S. government should develop a strategic investment strategy for R&D across the USG to create a more effective and efficient R&D capability that furthers U.S. national security interests and receives sufficient resources to succeed.

Introduction

The SEAB Task Force on Nuclear Nonproliferation (TFNN) was established by the Secretary of Energy on December 20, 2013 to "advise the DOE on future areas of emphasis for its nuclear nonproliferation activities by addressing the following questions:

1. *What are the current and likely future challenges to nuclear nonproliferation?*
2. *What should DOE be doing to help the United States Government prepare to meet those challenges?*
3. *What are DOE's current areas of emphasis in nuclear nonproliferation?*
4. *In what ways should DOE's nuclear nonproliferation efforts be modified and/or expanded?*
5. *What obstacles stand in the way of making the recommended changes in DOE's nuclear nonproliferation activities, and how might they be overcome?"*[2]

This document represents the interim report of the Task Force. (A more complete report is to be submitted at the end of 2014.) Herein, the Task Force sets forth its findings and recommendations to date in five timely and important areas: (I) Setting Objectives and Priorities for DOE Nuclear Nonproliferation Programs; (II) Improving DOE Nuclear Policy Integration, Analysis, and Advocacy; (III) Strengthening DOE Relationships with Field Offices, National Laboratories, and Production Facilities; (IV) Continuing and Revitalizing U.S.-Russian Nuclear Security and Nonproliferation Cooperation; and (V) Developing and Implementing an Investment Strategy for Nuclear Nonproliferation Research and Development. The recommendations are mutually reinforcing.

In addressing the problem of nuclear proliferation, it must be recognized that despite substantial recent progress, there are nations pursuing nuclear weapons, there remain nuclear stockpiles that are dangerously insecure, and there are terrorists eager to acquire and use nuclear weapons. Urgent actions are needed to meet these continuing threats.

The complete charge to the Task Force and a list of its members appear as Appendices A and B respectively.

[2] In keeping with our charge, we interpret nuclear "nonproliferation" to include the full set of U.S. efforts to prevent additional states or substate groups from acquiring nuclear weapons and the technologies and materials needed to make them, including efforts that some refer to as counterproliferation, weapons of mass destruction (WMD) counter-terrorism, or nuclear security. While most of DOE's nuclear nonproliferation activities are implemented by the semi-autonomous National Nuclear Security Administration (NNSA), our charge focused on DOE's efforts enterprise-wide, and we refer to these efforts as being undertaken by "DOE" throughout, except where we mean to refer solely to NNSA.

I. Setting Objectives and Priorities for DOE Nuclear Nonproliferation Programs

Findings

1. *DOE's nonproliferation efforts have made and are making substantial contributions to U.S. national security.*

   - DOE's efforts have dramatically improved nuclear security in Russia, the other states of the former Soviet Union, and a number of countries elsewhere, greatly reducing the risk that stolen plutonium or highly enriched uranium (HEU) will fall into the hands of terrorists – though risks remain, as discussed below.
   - DOE has helped over 20 countries eliminate all the weapons-usable nuclear material on their soil, eliminated such material from dozens of additional sites, and converted scores of research reactors so that they no longer use HEU as fuel.
   - DOE has provided crucial technical expertise to support U.S. arms control and nonproliferation negotiations, and continues to do so – including on critical issues currently being discussed in negotiations with Iran.
   - DOE has helped dozens of countries implement effective export controls on nuclear and dual-use technologies and helped with interdiction of thousands of dangerous technology transfers, forming a major part of the U.S. effort to stem black-market nuclear technology trafficking.
   - DOE has provided important technologies, training, and other support for the International Atomic Energy Agency (IAEA), strengthening global safeguards, security, and safety implementation.
   - DOE has developed a wide range of nonproliferation technologies, particularly focused on verification technologies, some of which are being applied today and some of which are available to support future negotiations.
   - Innovative efforts such as the Cooperative Monitoring Center have helped bring experts from countries with the potential for regional conflicts together to discuss verification and confidence-building measures. These ongoing efforts are vital tools for building relationships and understandings that can help reduce the risk of conflict and increase the potential for arms restraint.

2. *DOE's nonproliferation programs have undergone several years of substantial budget reductions, with further reductions proposed for fiscal year (FY) 2015.*

   The overall budget for DOE's nonproliferation programs has declined from over $2.2 billion in FY 2013 to an FY 2015 request of just under $1.6 billion, a reduction of over 30 percent. The FY 2015 request proposes to increase DOE's weapons activities by $544 million while decreasing its nonproliferation program by $399 million. Some of the nonproliferation reductions are the result of projects being completed or efforts being put on hold while DOE reviews its approach to them – most prominently including the uranium-plutonium mixed oxide (MOX) project for disposition of excess weapons plutonium, whose projected lifecycle costs have ballooned to over $30 billion. In a number of areas, however, including efforts to improve security for nuclear material around the world, it appears that important nonproliferation work is being slowed or canceled because of lack of funds. Overall, DOE's nonproliferation budget is now hundreds of millions of dollars a year less than these programs had been planning for only a few years ago.

3. *DOE does not have a risk-informed analysis of priorities to guide its nonproliferation efforts.*

   The Task Force made a concerted effort to determine DOE's nonproliferation priorities. Instead of priorities, we received a "laundry list" of everything DOE was currently doing in nonproliferation. These "priorities" are too numerous to provide effective strategic direction or efficient budgeting, or to enable DOE to build organizational capacity in the right places with limited resources. When everything is a priority, nothing is a priority.

   Setting clear priorities is always important, but it is all the more important today, when threats are shifting and budgets are declining. Priorities make clear what should receive more attention and resources, and why. The *process* of prioritization is also critical, fostering discipline and efficiency within DOE, deploying the best talent to tackle the most important issues, bolstering DOE's role in the interagency process, and enhancing nonproliferation efforts across the USG.

   Each nonproliferation program has developed a set of priorities for its own work. Many of these priorities are sensible. In a number of cases, however, these priorities are insufficiently risk-informed and differ significantly from one program to another. For example, in some cases the Global Threat Reduction Initiative (GTRI) has devoted millions of dollars to addressing material for which the Materials Protection and Accounting (MPC&A) program would not fund security upgrades, because of different judgments about the security risks posed by impure and modestly radioactive materials.

   Priorities for the work of individual programs do not solve the difficult problem of making choices among different programs. At present, it appears that priorities are set in substantial part on the basis of which program managers are most successful at selling their efforts to DOE leadership, the White House, and the Congress.

4. *The U.S. government does not yet have a compelling vision for the future of its nonproliferation efforts or for how DOE's programs fit in that larger picture, though DOE has launched an effort to develop one.*

   NNSA's Office of Defense Nuclear Nonproliferation has made a worthy effort to explore the challenges and opportunities it will face in the future. The Task Force sees NNSA's over-the-horizon review as a step in the right direction.

   What is ultimately needed, however, is a comprehensive and compelling U.S. government nuclear nonproliferation vision that includes a view or views of the future state of the world that the U.S. seeks to achieve; a strategic roadmap that lays out the key steps, specific goals, and organizational, human capital, and budgetary resources needed to achieve success; and measures and feedback systems to assess progress and make midcourse corrections.

5. *DOE often does not adequately make the case for its nonproliferation programs to the White House, Congress, or the public.*

   As already noted, DOE's nonproliferation programs have suffered years of budget reductions. DOE is not likely to get increased funding until it can make a stronger case to the White House and the Congress on the value proposition from its nonproliferation programs, outlining the risks to U.S. national security that could be reduced with additional funds and the risks that will likely increase without those funds.

   The Task Force heard criticism from White House and Congressional experts that DOE was often unable to articulate what the effects would be of cutting back or increasing funding for particular programs by 10-20 percent. Similarly, they reported that DOE was often unable to explain how it had decided what the scope of its efforts in a particular area should be, how much the planned efforts would reduce risk, and what the effect on risk of a smaller or larger effort would be. As one example, DOE has not effectively articulated how much the total risk of nuclear and radiological trafficking would be reduced if it helped countries install and operate radiation detection systems at all the sites where it plans to do so, and how that risk reduction would change if the number of sites was decreased or increased.

Why the Challenges Persist

We do not yet fully comprehend the factors driving DOE's difficulty in establishing clear priorities for its nonproliferation efforts. It is clear there are multiple drivers. The following discussion should be considered as preliminary hypotheses.

First, establishing priorities in this complex area is inherently difficult. Reasonable people will disagree over whether installing security upgrades for a research reactor with a modest stock of HEU does more or less to reduce risk than spending the equivalent amount of money training a

developing country's experts to strengthen their ability to detect and stop illicit shipments of nuclear technologies, to take one of countless examples.

Second, no one wants to have their program called out as a lower priority than others – and in some quarters, doing so seems likely to serve only to identify places the budget could be cut. Not articulating priorities is seen by some as a way to avoid further budget reductions.

Third, as discussed elsewhere in this report, DOE does not have an office or process with the staff and mandate to develop cross-cutting policies concerning the many different areas of nuclear technology it handles, from nuclear weapons to nuclear waste. While recent years have seen increased coordination among the senior leaders of efforts on nonproliferation, nuclear energy, and nuclear weapons, overall each of these activities largely proceeds in its own stovepipe – and within the nonproliferation effort, each individual program is largely operating within its own stovepipe as well, attempting to optimize its ability to achieve its own objectives with its own resources.

Fourth, DOE has been subject to the vagaries of shifting priorities determined elsewhere, from the Congressional decision to cut off scientist engagement to the White House decision to call a pause in Second Line of Defense installations.

Fifth, the pressures of day-to-day management of programs inherently make it difficult to draw back and ask larger questions about priorities and long-term strategies. In the midst of a battle to take a particular hill, it is very difficult to have perspective on how much that hill matters to victory in the larger war. This is one reason why the task of developing cross-cutting priorities is likely to require a separate group, not charged with ongoing management of DOE's nonproliferation effort, as discussed elsewhere in this report.

Recommendations

1. **Lay out a vision and set priorities.** DOE and the rest of the U.S. government should articulate a compelling vision of the nuclear security and nonproliferation future they seek to achieve. DOE should then establish a consistent process to develop risk-informed priorities for its nonproliferation programs, seeking to invest resources wherever they can make the biggest difference in reducing risk to U.S. and world security. To facilitate this effort, DOE should work with other relevant government agencies to develop approaches to assessing the balance of risks and opportunities and developing a consistent, risk-informed set of priorities across the nonproliferation enterprise, integrated with the broader U.S. government nonproliferation effort.

   DOE priorities should be aligned with national priorities, based on both the scale of the risk to be addressed and the degree of the opportunity for DOE to contribute to reducing it. There are some large risks, for example, where other agencies are in the lead, and DOE needs only a modest investment to provide support; there may be other cases where there

is a substantial risk to be reduced but little near-term opportunity to convince the relevant countries to take the action needed to reduce it. Setting these priorities will require difficult judgments among quite disparate types of risks and activities, particularly as some programs that seem to offer little near-term risk reduction may lay important foundations for the long term.

The Task Force anticipates that among the higher priorities would be: (a) maintain the rate of progress in nuclear security**;** (b) provide needed technical expertise and options to support critical nonproliferation and arms control negotiations, such as those with Iran and North Korea; (c) contribute to reducing the risk that additional countries or groups will acquire key nuclear weapons-related technologies; (d) strengthen international organizations that help support important U.S. nuclear priorities, particularly the International Atomic Energy Agency (IAEA) and its safeguards system; (e) provide intelligence insight on nuclear threats, integrating technical and political expertise as DOE laboratories did in the past; and (f) provide the policy tools needed for the future, including both R&D on new verification and nonproliferation technologies and maintaining the facilities and expertise needed to address future challenges. (The Task Force intends to include in its more complete, year-end report detailed recommendations on priorities for DOE's nuclear nonproliferation efforts.)

2. **Develop a roadmap for achieving the vision.** DOE should work with the rest of the U.S. government, preferably through a formal interagency process, to develop a roadmap to achieve the U.S. government's vision of the nuclear security and nonproliferation future. This roadmap should specify milestones, indicators of progress, requirements for funding, and any needed changes in organizational structure and authorities.

3. **Ensure adequate funding to achieve high priority goals.** DOE should strive to ensure that high priority goals, such as maintaining progress in nuclear security, receive adequate funding.

   Given the immense consequences of a nuclear terrorist attack and the modest costs of nuclear security, the basic U.S. policy should be to provide sufficient funding so that no effort that shows promise of being able to make a significant and lasting reduction in the risk of nuclear terrorism will be delayed because money is not available to implement it. The ongoing shift toward less emphasis on installing equipment and more emphasis on convincing countries to take action themselves will mean lower spending levels in the future – but the reduction should not come at a pace that would slow important nuclear security efforts. The U.S. government should develop a plan to ensure, as rapidly as practicable, that all nuclear weapons and weapons-usable nuclear materials worldwide are sustainably and effectively protected against the full range of plausible adversary threats, and should provide the full funding that is needed to implement that plan. Nuclear security, however, should not be thought of as an effort that will be "finished" at a particular moment, but as

an objective that will require on ongoing focus on continuous improvement for as long as nuclear weapons and materials continue to coexist in the world with terrorists seeking mass destruction.

4. **Make the case.** For each program, DOE should explain the threat, explain what it plans to do, which risks would be reduced and how the planned programs compare to alternative efforts to achieve the same goals, what the life-cycle cost would be, and why DOE believes the specific approach and scope it plans to pursue are the optimal strategy. In particular, DOE should consider producing a biannual report to the President and Congress on non-weapons national security activities, especially non-proliferation comparable to the report that NNSA currently produces on the nuclear weapons program.
5. **Prepare for the unexpected.** DOE should (a) undertake a study of possible game-changing surprises and the steps that might need to be taken in response; (b) work with Congress to establish a contingency fund and contingency capabilities to be used as unexpected opportunities or requirements arise.

II. Improving DOE Nuclear Policy Integration, Analysis, and Advocacy

Findings

1. *Below the level of the Secretary and Deputy Secretary, there is no official or office within the Department responsible for looking at nuclear policy across the board.*

   - DOE's policies related to the U.S. nuclear weapons stockpile are shaped in Defense Programs; its policies focused on nonproliferation are shaped in Defense Nuclear Nonproliferation; its policies focused on nuclear energy and nuclear waste management are shaped in the Office of Nuclear Energy (though that is largely a research and development organization rather than one focused on broader policy issues facing nuclear energy); its policies with respect to the development of the naval fuel cycle are developed within Naval Reactors.
   - Each of these offices is developing and implementing policies that have effects on each other. In the absence of an office where all aspects of nuclear policy are considered together, decisions and strategies are adopted that may undercut objectives in a separate sector of nuclear policy. Yet no current office within the Department (except for the Secretary's office) is positioned to integrate and mediate the sometimes competing interests of the different nuclear programs.
   - There are currently two main policy offices within the Department of Energy: the Office of International Affairs and the Office of Energy Policy and Systems Analysis. Neither office currently has the staff expertise or mandate to handle nuclear policy issues across the broad set of nuclear issues.

- Decisions taken with respect to the US nuclear stockpile are often not examined in the context of nonproliferation policy objectives. Indeed, they sometimes compete with U.S. nonproliferation goals. Similarly, efforts in DOE's nuclear energy program also have effects on nonproliferation.

2. *DOE's policy role and voice in the national security interagency process is inconsistent, sometimes weak and sometimes absent entirely.*

    - Traditionally, DOE has been seen as an also-ran on national security after the "main" security agencies, National Security Council (NSC), State, Defense, and intelligence. DOE is often seen more as an implementing agency than as one with a major role in developing policies. But given its role in maintaining the U.S. nuclear weapons stockpile, its broad nonproliferation activities (larger than those of any other agency), the deep technical expertise of its laboratories and facilities, and the creative ideas that sometimes originate from those wells of experience and expertise, DOE has the potential to play a more significant and useful role in the interagency policy process than it does today.
    - The Department of Defense dominates the decision process related to nuclear weapons requirements and policies. The Department of State is the dominant interagency voice on nonproliferation policy. This is true despite the fact that DOE, among all agencies, should be uniquely positioned to integrate a wide range of aspects of nuclear policy and could bring to bear the unparalleled technical expertise of its laboratories.
    - The Task Force was told of a number of cases in which DOE played a smaller policy role than was justified by its engagement in the issue; did not bring its full technical expertise to the interagency discussion; or offered the view from only one part of DOE rather than an integrated departmental perspective.
    - In some cases, DOE is simply not invited to participate. For example, DOE was not represented in Syria chemical weapon (CW) discussions, even though issues such as arranging secure shipments relate to nuclear work DOE has been doing in many countries.

Why these challenges persist

Because DOE lacks a lead office for creating a single coherent and compelling nuclear policy that integrates interests from the Department's nuclear energy, nonproliferation, and nuclear weapons programs, DOE's interests are sometimes represented narrowly in interagency security discussions.

DOE's fundamental added value to policy discussions comes from the expertise and operational capacities of its laboratories. Yet DOE has limited science and technology (S&T) expertise within the policy offices called upon to represent DOE at interagency discussions. As a result, DOE is

not always able to represent and leverage the deep expertise available from the labs within the context of interagency discussions.

One of the key mechanisms for bringing laboratory experts into DOE headquarters has been the use of Intergovernmental Personnel Act (IPA) transfers. This instrumentality is now used infrequently, partly because of concerns over conflict of interest. (One interviewee described the IPA process as "broken.") In the absence of analysts with strong technical credentials, DOE's policy making is informed primarily by foreign affairs specialists who are not best positioned to represent the core strengths of the DOE complex or technical aspects of issues related to nuclear policymaking.

Recommendations

1. **Integrate nuclear policy within DOE**. Integrate responsibility for all aspects of nuclear policy within a single policy office. This could measurably strengthen DOE's role and voice in the interagency process and in the USG debate and policymaking related to nuclear policy.

   While the Task Force unanimously agrees on the need for an integrated policy office, there are competing views on where that office should be located within the Department. We offer the following options for consideration by the Secretary of Energy: (1) merge these functions into the existing DOE Office of Energy Policy and Systems Analysis; (2) create an office of nuclear security policy in DOE; or (3) create an office of nuclear security policy in NNSA.

   In examining these options, DOE should consider:

   - Whether the current organizational structure of DOE policy offices is effective or whether a more systemic overhaul is needed.
   - How the proposed nuclear policy office will ensure sufficient attention to longer-term thinking and planning.
   - What are the most appropriate and effective counterpart offices in relevant USG agencies to maximize interagency coordination and collaboration.
   - What key levers will enhance prospects for success of the policy office. These include providing appropriate professional incentives to attract top staff, fostering a culture that values effective policy and planning, selecting the right leadership, and communicating the importance of the office to DOE's mission.

2. **Improve DOE's secure connectivity to the other national security agencies and the White House by ensuring that it has the equipment and procedures it needs for effective communications.**
3. **Strengthen the integration of science and technology expertise into nuclear policymaking.**
   - Examples of mechanisms by which this integration might be accomplished include:

- Recruiting regular technical talent from the labs through the Intergovernmental Personnel Act (IPA) mobility program on rotating two to three year assignments.
- Creating a senior technical advisor or "Science Council" of several advisors within both the Office of Defense Nonproliferation and the newly established Integrated Policy Office. These advisors would serve in full-time positions and report directly to the head of those offices.
- Establishing standing advisory committees to provide independent review and advice to the same key offices on a regular basis.

III. Strengthening DOE Relationships with Field Offices, National Laboratories, and Production Facilities

Findings

1. *The relationships among DOE headquarters, field offices, national labs, and production facilities are inadequate to ensure the health of the national laboratories and to maximize their contributions to nuclear nonproliferation.*
2. *A number of advisory groups and commissions currently are exploring ways to improve the health and management of the labs to support the full range of DOE missions.*

Why these findings matter

A robust, technically strong, and well managed DOE laboratory system is vital to achieving many of the non-proliferation objectives discussed in this report. The laboratories provide crucial technical support to all agencies involved in formulating U.S. national security missions, including nonproliferation policy and executing nonproliferation programs. Given the dynamic nature of the threat environment, it is essential that the national labs maintain the human capital, budgetary resources, and organization necessary to continue developing innovative capabilities and maintain the technical expertise required for their national security missions. All initiatives that are considered to improve the relationship among the elements of the DOE/NNSA system should devote special attention to assure that nonproliferation and other national security requirements are met as well as the requirements of the weapons research development test and evaluation (RDT&E) program. Although specific recommendations and analyses lie outside the scope of this report it is clear that a healthy lab system consists of three key components: a top-flight work force of experts who are technically knowledgeable about nuclear activities around the world; sufficient budgetary resources for capabilities to address priorities; and a management system that ensures this technological expertise is effectively and efficiently utilized by all relevant elements of the U.S. government.

Recommendation

In light of the recommendations of the studies now in progress, DOE should as an urgent priority strengthen the relationship among DOE headquarters, field offices, national labs, and production facilities.

IV. Continuing and Revitalizing U.S.-Russian Nuclear Security and Nonproliferation Cooperation

Findings

1. *DOE's global work to improve nuclear security has substantially reduced the risk of nuclear terrorism, but there is more work to do.*

   Terrorists cannot make a nuclear bomb if they cannot get the needed nuclear material. Securing and accounting for nuclear material – or removing it entirely from sites around the world – are critical steps to reduce the danger of nuclear terrorism. DOE's work with Russia, the other states of the former Soviet Union, countries in South Asia, China, and other countries around the world have reduced major risks to U.S. security. Substantial risks remain in countries around the world, however, that must be addressed.

2. *The deterioration of U.S.-Russian relations resulting from the crisis in Ukraine makes nuclear security cooperation more challenging.*

   In both Washington and Moscow, the political context for cooperation has completely changed. In both capitals, hostility is running very high and many cooperative efforts have been cut off or put on hold. While neither Russia nor the United States has yet cut off nuclear security cooperation, both houses of the U.S. Congress have passed legislation calling for such cooperation to be cut off, and the Russian government has been moving slowly on some important efforts.[3] Russia's actions in Ukraine are unacceptable and require a firm response – but the U.S. retains a vital interest in ensuring that Russian nuclear stockpiles are effectively and sustainably secured. The United States has the same vital interest in other countries – and a variety of political difficulties are inhibiting nuclear security cooperation elsewhere as well. But it is in Russia that the situation has fundamentally changed; hence, the Task Force has chosen to focus on nuclear security cooperation with Russia in this interim report.

[3] In general, this legislation would prohibit DOE cooperation, including nuclear security cooperation, unless the administration certified that certain conditions were met. Congress has not yet developed the final version of the certification requirements, which would determine whether the legislation really slowed or stopped this cooperation or not.

3. *Continuing nuclear security cooperation with Russia remains critical to U.S. national security interests.*

   Two decades of nuclear security cooperation with Russia have resulted in tremendous improvements in security and accounting for Russia's vast stockpiles of nuclear weapons and materials. The risk of nuclear theft has been greatly reduced. But the job is not done. Russia continues to have the world's largest stockpiles of nuclear weapons, separated plutonium, and highly enriched uranium (HEU), in the world's largest number of buildings and bunkers – and a variety of vulnerabilities remain that a sophisticated conspiracy could exploit.

   Russia and the United States have the world's largest nuclear stockpiles and nuclear complexes, and the world's largest reservoirs of experience in providing security and accounting for nuclear weapons and the materials needed to make them. They bear a special responsibility for nuclear security, as the U.S. and Russian presidents have repeatedly agreed. Effective nuclear security for all stockpiles worldwide will be almost impossible to achieve without Russia and the United States working together – on improving and sustaining nuclear security in their own countries, helping other countries improve their nuclear security, and strengthening the global nuclear security framework. Just as the United States cooperated with the Soviet Union to build the global nonproliferation regime even when the two countries were locked in a global cold war, the United States must seek ways to cooperate with today's Russia where doing so serves U.S. national interests.

   DOE's efforts in nuclear security are an investment in U.S. security, not a favor to Russia. Indeed, much of the Russian government is unenthusiastic about this cooperation, seeing it as unwanted American intrusion into Russian nuclear secrets.

4. *Nuclear security cooperation with Russia will not be easy, is likely to encounter delays, and will require creative approaches and sustained attention.*

   As noted earlier, this cooperation is already encountering rocky political waters in both capitals. In the lead-up to the expiration of the Nunn-Lugar umbrella agreement in mid-2013, cooperation virtually ground to a halt as Russian officials waited to see what would happen. Even since the follow-on agreement was completed, providing a firm legal foundation for nuclear security cooperation, Russian officials have been slow to move forward. Although leaders at many nuclear sites remain eager for continued cooperation with the United States, these efforts have lost the popularity they once had in Washington and Moscow.

   Even if it survives the current political crisis, U.S.-Russian nuclear security cooperation is entering a new phase that will require new approaches. The phase that was focused on major equipment installations and construction of new security systems is nearing its end. The future will be much more focused on sustaining and improving what has been put in

place, including effective regulation, sharing best practices, strengthening security culture, and building sustainability. It will be reducing U.S. investments coupled with efforts to motivate Russia to take additional steps on its own. And it may be focused on working together to help other states improve their nuclear security. This different focus of nuclear security work will cost less, but it will require different approaches, including a shift away from a donor-recipient approach to a more equal approach, with resources and ideas coming from both sides. Achieving that will not be easy.

There is a legitimate question as to why Russia should not be paying for its nuclear security itself, more than two decades after the collapse of the Soviet Union, and with a Russian budget deficit far smaller than the U.S. budget deficit. But at present Russia is not making the needed investments in nuclear security areas the United States views as critical, or putting in place a regulatory structure as strong as the U.S. government believes is necessary. The work of securing these stockpiles will not get done to the standards necessary unless the United States continues to invest – while simultaneously working aggressively to persuade the Russian government to increase its own investment and strengthen its own rules.

Recommendations

1. **Continue nuclear security and nonproliferation cooperation with Russia.** DOE should make every effort to continue its nuclear security cooperation with Russia despite current tensions with Russia over Ukraine. Other U.S.-Russian cooperation that serves U.S. nonproliferation interests should also continue.

2. **Plan for different scenarios with Russia.** Given the crisis in Ukraine and heightened opposition in both the United States and Russia to any approach that smacks of "assistance," DOE should develop plans to further U.S. interests in effective nuclear security under a range of scenarios.

   These scenarios should include:

   - A positive scenario in which the crisis over Ukraine is resolved and the United States and Russia return to relations that permit a range of cooperative work;
   - A scenario in which the crisis continues but nuclear security cooperation is able to continue;
   - A scenario in which the crisis continues and only very limited nuclear security cooperation is possible; and
   - A scenario in which nuclear security cooperation with Russia becomes impossible.

   For each of these scenarios, DOE should prepare a plan for the activities to be pursued, the tactics and approaches to be used, and the budget allocations required to support the work.

For now, DOE should budget for a significant level of continuing nuclear security work in Russia – but should also prepare plans for other uses of those funds if these efforts are greatly constrained or delayed.

3. **Develop a more equal approach in U.S.-Russian nuclear security cooperation.** With the era of large-scale equipment installation nearing its end, DOE should develop concepts for a new approach to nuclear security cooperation that could be implemented in the scenarios in which nuclear security cooperation is able to continue. Both Russia and the United States continue to face serious nuclear security challenges. Both can benefit from learning from sharing experience and best practices. Hence, if the political situation makes it possible, Russia and the United States should undertake an ongoing, long-term nuclear security cooperation effort, focused on helping other countries improve their nuclear security and on exchanging ideas, visits, and technologies to make further improvements in their own nuclear security arrangements.

4. **Take a broader approach to consolidating nuclear material in the U.S. and Russia.** Russia has a vastly outsized infrastructure of buildings and bunkers with weapons-usable nuclear material, the largest in the world. The United States has greatly consolidated its own holdings of weapons and materials in the last two decades, driven in part by the high costs of meeting post-9/11 nuclear security requirements for each site where potential nuclear bomb materials exist. This effort has resulted in hundreds of millions of dollars a year in annual security savings. While Russia has consolidated its complex as well, with some help from DOE, it has not gone as far.

   Political conditions permitting, DOE should undertake a much broader discussion with Russia about consolidation. DOE and Russia should work together to lay out strategic plans by which they can each accomplish their defense and civilian missions with the smallest number of locations with HEU or separated plutonium.

V. Developing and Implementing an Investment Strategy for Nuclear Nonproliferation Research and Development

Findings

1. *DOE's nonproliferation R&D program is critically important, and has provided major improvements in nonproliferation and arms control technologies.*

   DOE's nuclear nonproliferation program, based primarily in its multiple laboratories, provides the core science and technology needed for new and improved devices, detectors, and protocols. More than 75% of the program's budget is allocated to the laboratories for R&D and for execution of U.S. government nonproliferation efforts at home and abroad. DOE's contributions to U.S. nonproliferation efforts stem largely from its ability to engage

the nation's leading experts, including those working on the problems of chemical and biological weapons proliferation, in nuclear nonproliferation activities. Accordingly, DOE and the U.S. government as a whole have a fundamental interest in ensuring the health and vitality of the DOE laboratories. Yet the Task Force consistently heard concerns from laboratory officials and others that the Department's management of the enterprise often impedes scientific and technical progress.

2. *DOE's approach of spreading nonproliferation R&D investment to large numbers of laboratories in small increments is inhibiting nonproliferation technology innovation within the labs.*

   In particular, concerns were raised about the absence of a strategic approach to R&D investments and that the system for managing R&D across the enterprise is smothering innovation. For example, DOE's nonproliferation R&D program has evolved to a program that is spreading small amounts of funding across more than a dozen laboratories and facilities. In fact, as a regular practice, the only source of funding for breakthrough innovations in the labs is coming not from projects initiated by the Department, but from laboratory directed R&D (LDRD). The current management system rewards exquisite, tightly controlled project management instead of technology innovation, which is inherently riskier.

3. *DOE's nonproliferation R&D investments are inadequately coordinated within DOE and with other USG agencies.*

   There is also inadequate coordination between DOE and other USG agencies (in particular the Defense Threat Reduction Agency (DTRA) R&D programs), and only modest incentives to integrate the effort in a broader national R&D strategy. As a result, the technical outcomes and abilities of the labs are being diluted and there is no integrated, innovative R&D program across the whole of government. A serious look at performers and priorities is required to avoid inappropriate adjustments to programs and priorities going forward.

Why these challenges matter and persist

The present DOE nonproliferation R&D program appears balkanized. Resources are spread across all the DOE labs, not just the weapons labs. This is appropriate to access capabilities not strongly or essentially demonstrated in the weapons labs (e.g., new fuel element design) or to access unique capabilities developed by other agencies at particular labs (e.g., the DoD investments at the Pacific Northwest National Laboratory), but it is not credible that eight or nine labs actually have essential or unique capabilities in all areas. DOE should strive for a program with fewer but appropriate performers who are maintained at a level above critical mass.

DOE is the principal developer of technical tools for verification and monitoring and is usually the demonstrator of them to at least prototype status as part of developing deployment and operational plans. The Department of State at the policy end of the problem and DoD/DTRA and Department of Homeland Security (DHS)/Domestic Nuclear Detection Office (DNDO) with fielding and operational roles abroad and domestically must be properly coupled to the assessment of risk and opportunity if DOE's R&D programs are to provide the highest value per dollar invested.

Recommendation

Formulate and implement a multiagency investment strategy for nuclear nonproliferation R&D. As indicated in the recent Defense Science Board study on "Assessment of Nuclear Monitoring and Verification Technologies," the U.S. government should develop a strategic investment strategy for R&D across the USG to create a more effective and efficient R&D capability that furthers U.S. national security interests and receives sufficient resources to succeed.

A logical structure for the strategy is to identify the components of the tasks to be performed, the special operating competencies of each of the organizations identified above, and their R&D activities in support of each task. A past successful model for such coordination, albeit on a much smaller scale, is the way in which DOE/NNSA, DTRA, DHS, the Federal Bureau of Investigation (FBI) and the Intel community assessed and coordinated their activities in an integrated post-detonation nuclear forensics program. This coordination has involved not just the R&D components of the program, but also those operational components that are stressed and tested in realistic exercises.