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Cooperative Risk Management and Reduction: A New Framework for Nuclear Materials Security

SUMMARY

Thirty years since the creation of the Cooperative Threat Reduction program to address the potentially catastrophic implications of the collapse of the Soviet Union, it is time for policymakers and practitioners to adopt an updated paradigm to address today's nuclear security challenges. This paper proposes Cooperative Risk Management and Reduction (CRMR) as a model for nuclear security engagement centered on the principle of continuous improvement and an enhanced emphasis on the critical roles played by culture, institutions, treaties, and norms for sustaining nuclear security excellence.

Sam Nunn and Laura S. H. Holgate

20 YEARS OF NTI BUILDING A SAFER WORLD

Nuclear Crisis Averted

The countdown began: *Tri ... Dva ... Odin ...* On the count of *null* (zero), a twist of tiny keys triggered the detonation of 250 kilograms of explosives inside the shaft of an SS-19 missile silo. These keys, once used by Soviet missileers to launch nuclear-armed rockets at U.S. cities, were now being used to destroy one of the last remnants of the Khmelnytskyi missile complex in Ukraine. The year was 1996 and the authors, along with the late Senator Richard Lugar, stood on the edge of the smoldering silo, bearing witness to the impressive results of an innovative U.S. Department of Defense program to assist former Soviet republics to secure, minimize, or eliminate their dangerous nuclear legacies.

Photo: Defense Threat Reduction Agency

Senators Nunn and Lugar turning keys to eliminate an SS-19 silo, 1996.

That initiative, the Cooperative Threat Reduction (CTR) program, was conceived by Senators Nunn and Lugar in November 1991 to address the proliferation concerns associated with the collapse of the Soviet Union. As the "Evil Empire" disintegrated, the control, security, and safety of its vast nuclear arsenal, with an explosive firepower of more than 100,000 Hiroshima bombs, was suddenly in question. After 40 years of confrontation and success in deterring Soviet strength, the United States and the world now were being challenged and endangered by Soviet weakness. It was clear that a new way of thinking was needed to address this existential danger, one that would involve not confronting, but instead cooperating with our former enemy to defeat a common threat.

The smoldering silo at Khmelnytskyi was the embodiment of CTR. Working in partnership with former Soviet states, the U.S. government spent billions of dollars on projects to help them comply with arms control treaties and to reduce the risks that weapons of mass destruction (WMD) and associated infrastructure would end up in the hands of rogue states or terrorist organizations. It was a small price to pay to avert the devastating consequences of a terrorist nuclear attack.

What started as a U.S. Department of Defense program soon became the most successful nonproliferation program in modern history and served as a model of engagement for the world. During its 30-year history, CTR would extend its reach to more than 30 countries and help destroy more than 7,600 nuclear warheads, demolish more than 2,600 delivery vehicles, and secure nearly 100 production facilities for weapons and materials. The availability of assistance under CTR was critical to the decisions of Ukraine, Kazakhstan, and Belarus to renounce what would have been the world's third, fourth, and seventh largest nuclear arsenals. That we have not yet witnessed a nuclear terrorist attack is in no small measure a testament to the success of CTR and the people in the United States and partner countries who helped design, negotiate, implement, and oversee it.

Can the World Declare Victory? Yes … and No

Today's nuclear security challenges are markedly different from those that spurred the creation of the CTR program in the early 1990s. Today, the list of possible nuclear criminals has expanded beyond rogue generals, unscrupulous scientists, and terrorists to include hackers and disgruntled employees. Although few facilities like Khmelnytskyi are left to destroy, and fewer weapons and infrastructure left to be demolished or secured, the threat of nuclear and radiological terrorism has not disappeared. Indeed, in some respects, it has only become more difficult to detect and mitigate. Adding to the risk today: as the 2020 NTI Nuclear Security Index[1] demonstrated, momentum and high-level attention on nuclear security has waned with the end of high-profile initiatives like the Nuclear Security Summits. At the same time, malevolent actors continue to seek the means for catastrophic terror, and nuclear and radiological materials continue to be transported, handled, processed, and stored for weapons and for peaceful purposes. Increased global demand for access to the peaceful atom for nuclear energy and other beneficial purposes requires additional transportation of nuclear material and persistent vigilance against sabotage.

These factors and more mean the future context for managing and reducing nuclear materials risks will bring new challenges. As the elimination of highly enriched uranium and plutonium has stalled, new production of weapons-usable nuclear materials is increasing. Mitigating climate change will require new kinds of nuclear energy in more locations. In addition, the relationship between the United States and Russia, who together still hold more than 90 percent of the world's nuclear weapons, has tipped away from cooperation toward competition and is no longer the main driver of global nuclear decision making.

This is why the world needs a refreshed strategy for fighting nuclear terrorism, one that reflects an update to today's playbook to tackle current nuclear challenges. It is time to build on the foundation of Cooperative Threat Reduction and expand it to a new formulation called Cooperative Risk Management and Reduction (CRMR).

[1] "Progress on Global Nuclear Security Has Slowed Significantly, According to 2020 NTI Index," NTI Nuclear Security Index, https://www.ntiindex.org/news/progress-on-global-nuclear-security-has-slowed-significantly-according-to-2020-nti-index.

Nuclear Security Challenges for the 21st Century

In 1991, more than 50 countries possessed weapons-usable nuclear materials. Thirty years later, that number has been reduced to 22. Notably, of these 22 countries, nine have nuclear weapons programs and most others face significant technical or political challenges to eliminating their materials. Only a few countries remain for which complete and permanent removal of weapons-usable nuclear materials is a near-term prospect. Although the United States and Russia jointly eliminated almost 800 metric tons of highly enriched uranium in the 1990s and early 2000s, efforts to eliminate excess plutonium have stalled. Meanwhile, France, India, Israel, Japan, North Korea, Pakistan, Russia, and the United Kingdom are increasing production of weapons-usable nuclear materials in both civilian and military programs, increasing the challenge of securing these materials.[2]

Global Fissile Materials Stocks—2021

Country	Highly Enriched Uranium, tons	Plutonium, tons
Russia	678	191
United States	562	87.7
United Kingdom	22.6	119
France	30	80.7
China	14	2.94
Pakistan	3.9	0.41
India	5.2	8.8
Israel	0.3	0.9
North Korea	0.7	0.4
Others	15	46.2
TOTAL	**1330**	**536**

Source: International Panel on Fissile Materials.

The expansion of nuclear energy globally to help diminish the acceleration of climate change at the same time will increase the number of nuclear installations, the amount of nuclear materials in use and transport, and the range of countries involved in civilian nuclear energy. So-called "advanced" reactor technologies may create new challenges owing to their smaller size, their fuel materials and forms, and where and how they are used. These changes are likely to stress national and international institutions involved in nuclear

[2] "Fissile Material Stocks," International Panel on Fissile Materials, http://fissilematerials.org.

materials security, and require greater engagement from the private sector to incorporate nuclear security considerations into designs and operations.

The bilateral partnership that launched CTR also has drastically changed. As a result of deteriorating U.S.-Russian relations and sustainability challenges inherent in the donor-recipient relationship, U.S. nuclear security cooperation with Russia has been suspended. If that cooperation resumes, it would take on a dramatically different character.

Taken together, these changes have important implications for future nuclear security activities. With some important exceptions, the days of U.S.-government funded, industrial-scale destruction of extant weapons and facilities—whether in former Soviet states or anywhere else in the world—are not likely to return any time soon.

Future nuclear security concerns likely will emanate from:

- **Enduring challenges** associated with existing stockpiles of fissile materials, radioactive sources, and nuclear warheads that will likely persist for the foreseeable future, as well as the reality that WMD knowledge can never be eliminated; and
- **Emerging technologies** that contain within themselves the potential for both benefit and harm, such as new nuclear reactor types, cyber, big data, artificial intelligence and machine learning, autonomous systems, advanced manufacturing, miniaturization, remote operations, and other technological advancements and disruptions.

These enduring and emerging challenges must be *managed* in ways that limit their inherent risks without overly constraining the inherent benefits of technology. This is the basic philosophy underpinning Cooperative Risk Management and Reduction as a modern and sustainable strategy for fighting nuclear terrorism.

Cooperative Risk Management and Reduction Defined

CRMR is a strategy and policy framework that views the theft or diversion of nuclear and radioactive materials as ongoing risks to be managed, ideally through cooperation with other states. The central goal of CRMR is to improve national and operator capacities for, commitment to, and implementation of long-term stewardship of nuclear and radiological materials wherever they exist.

A few key assumptions underpin CRMR's strategic approach to nuclear materials. First, nuclear and radiological materials represent an ongoing risk to be managed by governments, nuclear industry, and civil society—they are not the exclusive purview of bureaucrats. Second, current threat-reduction models are victims of their own success, and therefore will have less impact in the future. Finally, the exclusive reliance on the responsibility of the state for nuclear security is no longer adequate; greater cooperation among governments and between government and industry will be needed to address new and developing challenges in nuclear security. These evolutions from current perspectives drive the imperative of an expansion from the CTR model to the new CRMR approach.

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This approach would require:

- Strengthening regulations and regulators;
- Improving nuclear security culture and practices;
- Building confidence among other countries and publics in the effectiveness of nuclear security practices;
- Integrating security-by-design when constructing new nuclear facilities;
- Holding operators accountable for their nuclear security responsibilities;
- Increasing involvement from civil society, such as the World Institute for Nuclear Security and the Nuclear Threat Initiative;
- Identifying internal nuclear security champions at the operator and state levels; and
- Updating the International Atomic Energy Agency and other international institutions, treaties, and norms to better support and sustain nuclear security excellence, based on the principle of continuous improvement.

CRMR retains the essential word *cooperative* from CTR, but whereas CTR was characterized largely by donor-recipient relationships, CRMR is characterized by peer-to-peer relationships. Under the CRMR model, the United States and others assume the role of nuclear security cheerleaders and consultants, rather than donors and managers.

CRMR replaces the word *threat* with *risk* to convey more clearly the mutual stake and trust required to reduce and manage risk. Furthermore, the technologies of concern going forward likely will have potential benefits along with potential for harm, and cooperation must also reflect the positive gains that derive from engagement on nuclear issues.

Lastly, CRMR adds the word *management* to *reduction* because total elimination of risky materials is not the most likely outcome, nor is it even desirable in all cases. By and large, the central challenge for governments and operators today is to effectively manage the risks associated with long-term stewardship of nuclear and radiological materials.

Put another way, for CTR to be successful, both sides must agree that specific objects or activities are problematic or unnecessary and need to be eliminated. CTR projects that implement an arms control agreement are the most obvious example of this point. The CRMR approach, by contrast, allows for cooperation when at least one side believes the objects or activities are beneficial and need to continue. Upgrading security of an HEU-fueled isotope production reactor whose owner is unable or unwilling to convert it to LEU fuel is an illustration of the CRMR approach.

CRMR could be used as a framework for cooperation and engagement on all types of nuclear materials, including those used for peaceful purposes and military materials.

Current CTR-inspired activities and programs would still be needed in this framework, but CRMR creates a broader universe for potential activities and a new framework for evaluation and program focus. CRMR could be used as a framework for cooperation and engagement on all types of nuclear materials, including those used for peaceful purposes and military materials. It also would address cooperation on the security of radioactive sources (such as cesium-137 and cobalt-60), which are found in more than 100 countries and used widely for beneficial medical, scientific, and industrial purposes. Where possible, those sources should be replaced with safe and effective alternative technologies. When it is not possible to replace these sources, risk management approaches would promote effective and sustainable protection. CRMR engagement also would entail capacity and knowledge sharing among a broader set of actors and would provide a new set of tools for foreign policy that could be used alongside sanctions and aid programs to incentivize or reinforce certain behavior.

Importantly, CRMR is not meant to be a new organization or department within any government. Rather, it is a philosophy that can inform and guide decisions made about nuclear security in various offices around the world. The United States still has the largest and most complex cooperative nuclear security activities, but the 30 other countries involved in the Global Partnership Against the Spread of Materials and Weapons of Mass Destruction as well as other countries with bilateral cooperation programs would also benefit from adopting a CRMR approach.

A New Paradigm

In a world where the risk of nuclear material being misused is always evolving, the nuclear security community must develop new paradigms for prioritizing and managing the risk associated with this nuclear legacy.

For CRMR to succeed, long-held assumptions that only certain members of the nuclear security community hold the solutions to challenges, the ability to address threats, or the insights to assess progress must be broken. Experienced nuclear states like the United States would need to understand and accept that smaller states or nuclear newcomers also have legitimate contributions to make. CRMR encourages responsibility for all through the lens of multidirectional risk rather than unidirectional threat, and states need to work together to manage risks from various different vectors, including internal threats. This requires greater cooperation born out of shared understanding of risk of negative consequences, rather than a donor-recipient dynamic.

CRMR also would require placing more emphasis on human interactions. CTR began with a focus on weapons destroyed, equipment provided, and material secured. Over time, the value of the human connections made through these engagements was recognized, but because it was hard to measure their impact, they were marginalized. CRMR places a premium on human interactions: connections made, people trained, knowledge shared, and capacity built. Greater programmatic flexibility would be required to conceptualize, implement, and assess CRMR, because it does not rely upon the familiar item-oriented framework. It would require patience, as human interactions require more time and different ways of spending of money than deploying or securing equipment or materials. CRMR also would encourage broad engagement from all relevant sectors of the government, industry, and civil society.

Comparing Cooperative Threat Reduction and Cooperative Risk Management and Reduction

Characteristics	Cooperative Threat Reduction	Cooperative Risk Management and Reduction
Motivation	Urgent threat	Sustainable operations
Design	Ad hoc	Systematic
Definition of Failure	Security incident	Mission failure engendered by a security incident
Applicability	Particular	Universal
Practitioners	Governments	All enterprises
Duration	Finite	Indefinite

Source: William H. Tobey, Director, U.S.-Russia Initiative to Prevent Nuclear Terrorism, Harvard Kennedy School.

"CTR Classic" Still Needed

Although most goals of CTR as originally conceived have been met, stubborn challenges remain for which "CTR Classic" still holds promise. If North Korea agreed to denuclearize, for example, it would almost certainly need international assistance to implement meaningful steps toward eliminating its nuclear, biological, and chemical arsenals. The CTR tools of the post-Soviet period could be readily adapted to support permanent reduction of global threats on the Korean Peninsula, dividing responsibilities among key stakeholder countries.

Beyond North Korea, permanent threat reduction by removing and eliminating nuclear and other radioactive materials will continue to be necessary, in some cases accompanied by conversion to less dangerous technologies. Unforeseen circumstances, such as those involving the destruction of Syria's declared chemical weapons, may call on the CTR repertoire with short notice. CRMR approaches, executed properly, would maintain the operational and bureaucratic "muscle memory" to execute CTR projects if and as they arise.

Accountability in a New Paradigm

Although some measurements used to evaluate CTR may still prove useful, a wider set of assessment tools would need to be developed to support CRMR. This would require a careful rethink of indicators for projects, as well as humility and realism about what a project can really claim as direct accomplishments. It also would require flexibility to balance internal needs for consistent indicators across programs in one government, while allowing for the development of jointly agreed indicators between different governments. A CRMR approach also creates the platform for a risk-informed allocation of resources.

Not everything that is important to nuclear security is readily measured. The landscape of both danger and mitigation efforts is constantly changing, and correlating how much any specific action reduces risk is difficult because many inputs to any given outcome exist. Putting a quantitative value on partnerships is particularly difficult, but these relationships are essential to cooperation and progress.

To measure accountability, stakeholders would have to accept that there may not be specific measurements or metrics that provide a clear picture of what progress is being made. Instead, indicators should be chosen and designed to build incentives for problem solving. Case studies can supplement qualitative indicators by providing lessons learned and paths forward to greater improvements. As CRMR shifts relational dynamics from donor-recipient to peer-to-peer, indicators of progress should be discussed and agreed among all participants rather than imposed by one side.

Adopting a New Approach to Nuclear Security

Adopting CRMR would require all participants to rethink how to measure progress, what defines success, and how partners are involved in those judgments.

CRMR could provide a useful organizing principle for countries around the world to apply domestically and in relations with other states. States that are less familiar with nuclear security could use CRMR as a guiding principle to organize their nuclear security governance, and it could provide a basis for increased collaboration and cooperation among relevant ministries or departments. States with more advanced nuclear security frameworks could use CRMR to realign their support to other states and focus on more collaborative projects.

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In the United States, adaptation would not be restricted to implementing governmental departments and programs; CRMR can reach across different departments and even branches of the U.S. government and would require Congressional appropriators and authorizers to reexamine how success and progress in nuclear security activities are defined and mandated.

CRMR would need high-level champions within different areas of the government to advocate for this expanded approach to nuclear security. CTR was born on Capitol Hill and then built upon by successive presidential initiatives. CRMR could be initiated through a legislative act or an Executive Branch initiative, but both branches of the U.S. government would need to embrace the idea in order to move forward and receive appropriate funding.

CRMR is a strategy for the present and for the future. The authors believe that this approach to nuclear security will foster peaceful uses of nuclear materials while strengthening measures to prevent its misuse and the potentially catastrophic consequences, and we encourage the United States and others to adopt it now.

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The affiliations listed are for the purpose of identification only and reflect participant affiliation as of 2019. Participants included:

Maegon Barlow, Office of Radiological Security, Global Materials Security, National Nuclear Security Administration

Matthew Bunn, James R. Schlesinger Professor of the Practice of Energy, National Security, and Foreign Policy, Harvard University

Jessica Bufford, Program Officer, Materials Risk Management, NTI

Beth Cameron, Vice President for Global Biological Policy and Programs, NTI

Joyce Connery, Board Member, Defense Facilities Nuclear Safety Board

Madelyn Creedon, Independent Consultant

Rita Guenther, Senior Program Officer, Committee on International Security and Arms Control, National Academies of Sciences

Jennifer Heimberg, Senior Program Officer, Nuclear and Radiation Studies Board, National Academies of Sciences

Rebecca Hersman, Director, Project on Nuclear Issues, Center for Strategic and International Studies

Corey Hinderstein, Vice President for International Fuel Cycle Strategies, NTI

Laura S. H. Holgate, Vice President for Materials Risk Management, NTI

Roger Howsley, Executive Director, World Institute of Nuclear Security

Jill Hruby, Sam Nunn Distinguished Fellow, NTI

Bonnie Jenkins, Non-resident Senior Fellow, Brookings Institution

Susan J. Koch, Independent Consultant

Dmitry Kovchegin, Independent Consultant

Daniel Lipman, Independent Consultant

Paul Longsworth, Vice President, Fluor Corporation

Micah Lowenthal, Director, Committee on International Security and Arms Control, National Academies of Sciences

Daniel Miller, Office of Cooperative Threat Reduction, Bureau of International Security and Nonproliferation, U.S. Department of State

William Moon, Independent Consultant

Samantha Neakrase, Senior Director, Materials Risk Management, NTI

William C. Ostendorff, Class of 1960 Distinguished Visiting Professor, U.S. Naval Academy

Robert Pope, Director for Cooperative Threat Reduction, Defense Threat Reductionn Agency, U.S. Department of Defense

Leon Ratz, Senior Program Officer, NTI

Deborah Rosenblum, Executive Vice President, NTI

Nickolas Roth, Senior Research Associate, Project on Managing the Atom, Belfer Center for Science and International Affairs, Harvard University

Lynn Rusten, Vice President for Global Nuclear Policy Program, NTI

Lawrence J. Satkowiak, Director, Global Security & Non-proliferation, Oak Ridge National Laboratory

Hayley Severance, Senior Program Officer, NTI

Douglas Shaw, Senior Advisor for Special Projects, NTI

Renee Sonderman, Director, Office of Weapons of Mass Destruction Terrorism, Bureau of International Security and Nonproliferation, U.S. Department of State

William H. Tobey, Senior Fellow, Belfer Center for Science and International Affairs, Harvard University

Katherine Vogler, Senior Advisor, Office of International Nuclear Security, Global Materials Security, NNSA

Jaime Yassif, Senior Fellow, Global Biological Policy and Programs, NTI

About the Authors

Sam Nunn is co-founder and co-chair of NTI. He served as chief executive officer of NTI for 16 years, until June 2017, and continues as strategic advisor, bringing his deep experience and expertise to NTI projects. He served as a U.S. Senator from Georgia for 24 years, from 1972 to 1996. In addition to his work with NTI, Nunn has continued his service in the public policy arena as a distinguished professor in the Sam Nunn School of International Affairs at Georgia Tech and as chairman emeritus of the board of the Center for Strategic and International Studies in Washington, DC.

Laura S. H. Holgate is vice president for Materials Risk Management at NTI, responsible for designing and executing NTI's activities to prevent nuclear terrorism, such as reducing quantities and enhancing security of nuclear and radiological materials around the world, promoting cooperation between the United States and key partners on nuclear and radiological security, and strengthening the global nuclear security architecture. Previously, Holgate served as U.S. Representative to the Vienna Office of the United Nations and the International Atomic Energy Agency and as special assistant to the president and senior director for weapons of mass destruction terrorism and threat reduction on the U.S. National Security Council.

About the Nuclear Threat Initiative

NTI is a nonprofit global security organization focused on reducing nuclear and biological threats imperiling humanity. www.nti.org

1776 Eye Street, NW | Suite 600 | Washington, DC 20006 | **@NTI_WMD** | **www.nti.org**