Shaping the Future: Building Needed Dynamism Into The Nuclear Security Regime

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Abstract

Nuclear security is vital for global stability and prosperity, but the Nuclear Threat Initiative's 2023 Nuclear Security Index reports nuclear security is regressing in many countries with weapons-usable nuclear materials or nuclear facilities. This regression comes as nuclear security faces three dynamic challenges: (1) threats from those wishing to misuse nuclear material; (2) evolving technologies, including cyber and artificial intelligence; and (3) impacts of climate change that will threaten the integrity of nuclear facilities and systems built for a different time.

The amended CPPNM has the potential but not yet the processes to meet these ongoing challenges. The Convention needs a substantive process between and at Review Conferences to meet its requirement to assess the Convention's adequacy in light of the then prevailing circumstances (Article 16). This new process should include, inter alia: (1) assessing whether there are systemic issues, such as funding, that challenge states in meeting their obligations; (2) intersessional meetings to consider the Convention's adequacy for the evolving threat/technology/climate environment and report conclusions/proposals to the Review Conference; and (3) Review Conference assessment of and action on intercessional findings and recommendations.

This proposal, which is similar to the Nuclear Safety Convention's process, needs Ministerial support and oversight to be adopted and implemented effectively.

1. INTRODUCTION

Nuclear energy being used for peaceful purposes has positive and negative attributes. The positive attributes include medical, research, and industrial uses that have contributed to human well being and prosperity on virtually every continent for decades and promise to continue doing so indefinitely. Nuclear energy also has an increasingly important role in producing reliable base load electrical power without emitting greenhouse gases that contribute to climate change.

The principal negative attributes of nuclear energy are that some of the materials involved in its production and use are hazardous if not handled in a safe manner and could either inadvertently or deliberately cause widespread harm if not maintained in a sustainably secure way.

While each nation with nuclear energy activities is ultimately responsible for its safe and secure use, the international community also has a justifiable interest in national nuclear safety and security practices. This stems from the fact that careless or malicious use of nuclear material in one country could have profoundly negative consequences beyond its borders, with the potential for negative consequences regionally and globally. This shared interest in and commitment to promoting the safe and secure use of nuclear energy is reflected in several international agreements, including:

- The Convention on the Physical Protection of Nuclear Material (1979)(CPPNM) and as amended (2016);
- The Convention on the Early Notification of a Nuclear Accident (1986);
- The Convention on Nuclear Safety (1994)(CNS); and

- The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997).

The international community has recognized that global developments affect nuclear safety and security issues and practices. For example, after the 9/11 attacks and the discovery of terrorists' interest in nuclear materials, member states directed the IAEA to step up its nuclear security efforts[1]; subsequently, ongoing negotiations of an Amendment to the CPPNM (Convention) were completed and the Amendment adopted in 2005, entering into force in 2016.[2] Similarly, the 2011 Fukushima Daiichi nuclear power plant accident led to the adoption of the IAEA Action Plan on Nuclear Safety (2011) and to states party to the CNS adopting the Vienna Declaration on Nuclear Safety (2015).[3]

The IAEA's 2024 International Conference on Nuclear Security's theme of "Shaping the Future" is timely. There are a variety of ongoing global developments that will have the potential for challenging the security of nuclear material. The time to assess whether the international nuclear security architecture is adequate and has the processes needed to deal with these challenges is now, not after a problematic event that could cause widespread harm and shake public confidence in the value of peaceful uses of nuclear energy.

2. FUTURE CHALLENGES TO NUCLEAR SECURITY

2.1 Threats of malicious use by non-state actors

Non-state actors remain a threat to global stability and security. For example, an attack by a non-state actor was responsible for initiating the current war in the Middle East and another non-state actor is currently lobbing ballistic missiles and drones at civilian ships transiting the Red Sea. Still other non-state actors have made attacks in recent months in Pakistan, Iran, and Syria. Non-state actor attacks in Pakistan in 2023 killed an estimated 1,000 people.[4]

Non-state actors have in the past expressed interest in or made claims about acquiring nuclear material or weapons.[5] Some of these groups, such as ISIS and al-Qaeda, may be weaker today than they were in the last decade, but non-state actors remain active, committed to their objectives, and believe spectacular attacks command attention for their agendas. Unfortunately, there is nuclear material potentially available for such groups to use. NTI reports civil stockpiles of separated plutonium are growing rapidly and 22 countries possess one kilogram or more of weapons usable nuclear material.[6] According to the IAEA's Incident and Trafficking Database (ITDB), between 1993 and 2022, there were 341 incidents of material that either was or likely to have been connected to trafficking or malicious use, and 1,036 incidents of undetermined intent. Press reports have also identified cases of trafficking in nuclear materials.[7]

Nuclear security, at the national and global level, will need to address the threat from non-state actors for many years to come. That threat will be dynamic. Non-state actors will look for vulnerabilities in installations, transit arrangements, personnel, or, perhaps increasingly, cyber space to get access to nuclear material. They will seek that material to use – or threaten to use – for attacks to advance their objectives, not to stockpile it. Additionally, nuclear-related acts or threats by non-state actors in one state may not affect only that state but could result in regional or even global consequences.

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[1] https://www.iaea.org/sites/default/files/gc/gc50-13_en.pdf and https://www.iaea.org/topics/security-of-nuclear-and-other-radioactive-material/nuclear-security-plan

[2] https://www.nti.org/wp-content/uploads/2022/01/01.-History-and-Development-of-CPPNM-and-A.pdf

[3] https://www.iaea.org/sites/default/files/cns_viennadeclaration090215.pdf and https://www.iaea.org/sites/default/files/actionplanns.pdf

[4] https://www.voanews.com/a/report-terrorist-attacks-kill-nearly-1-000-pakistanis-in-2023-/7419344.html

[5] https://www.rand.org/pubs/research_briefs/RB165.html#:~:text=Subnational%20groups%20such%20as%20al,purchase%20or%20build%20nuclear%20weapons. and https://ctc.westpoint.edu/the-islamic-state-and-wmd-assessing-the-future-threat/

[6] https://www.ntiindex.org/wp-content/uploads/2023/07/2023_NTI-Index_Report.pdf pages 8 and 9.

[7] https://www.iaea.org/sites/default/files/22/01/itdb-factsheet.pdf; and https://www.militarytimes.com/news/your-military/2015/10/07/nuclear-smugglers-sought-extremist-buyers-investigation-uncovers/

Staying abreast of non-state actor threats requires sustained attention and timely information sharing by those with responsibilities for nuclear security at the national and global level.

2.2 Evolving and disruptive technologies

Science, technology, national law and international agreements evolve at very different speeds. For example, the Amendment to the CPPNM required eleven years to enter into force once it had been negotiated, but it took only a few years for smart phones to go from being a novelty to a necessity. National governments and international organizations are consistently behind in responding to developments related to technological innovation. The most recent example is the way governments and regulators are scrambling to understand and respond to the rapid commercialization of artificial intelligence, which promises positive and negative disruptions as it becomes widely available to anyone with a computer.

While nuclear science and engineering have longer lead times for change than computer technologies and applications, they are no less dynamic in producing innovations. But in addition to managing and incorporating their own technological changes, nuclear operators need to deal with the impact of broader technological changes on their operations – including on their security practices and vulnerabilities. There are any number of ways developments in cyber technology, material science, and artificial intelligence could benefit nuclear energy operations and research, but there are similarly any number of ways those same developments could create new vulnerabilities for the security of nuclear material.

Keeping up with technological change is an ongoing challenge for national and global efforts to ensure the security of nuclear material and will require timely information sharing and action to be effective.

2.3 Cascading impacts of climate change on the built environment

Most, if not all, existing structures, e.g., buildings, roads, bridges, ports (air and sea), and railroads, around the globe were designed and built based on the parameters of a stable climate system. But, as the Intergovernmental Panel on Climate Change (IPCC) reported in 2022,[8] the climate system is no longer stable. The IPCC said that climate change impacts and risks are becoming increasingly complex and more difficult to manage. That is because multiple climate hazards will occur simultaneously and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions. To further complicate the challenge, these developments are occurring as nuclear energy use is spreading to areas without long experience in protecting complex installations and systems against adverse natural conditions.

The IPCC expressed high confidence that "key infrastructure systems including sanitation, water, health, transport, communications and energy will be increasingly vulnerable if design standards do not account for changing climate conditions." The UN Environmental Program, the European Union, and the U.S. Congress, among others, are beginning to pay attention to the implications of the impact of climate change on different aspects of the built environment.[9] National governments and the international community will need to address in the coming years the potential of cascading vulnerabilities and possibly failures of a fundamental element of the nuclear security system: the buildings that contain nuclear material and the infrastructure systems that support them.

Assessing and responding to the impacts of climate change on nuclear security will require focused attention, information sharing, and timely action at both national and global levels.

[8] https://www.ipcc.ch/report/ar6/wg2/chapter/summary-for-policymakers/

[9] https://www.unep.org/news-and-stories/story/5-ways-make-buildings-climate-change-resilient
https://climate.ec.europa.eu/climate-change/consequences-climate-change_en
https://www.gao.gov/blog/2018/06/26/climate-change-adaptation-at-u-s-military-bases-around-the-world

3. IS THE NUCLEAR SECURITY REGIME UP TO THE COMING CHALLENGES?

The IAEA's Nuclear Security Review 2023 assessed trends in nuclear security in 2022, including its activities with member states, and reported they showed "the international community is committed to further advancing nuclear security around the world."[10] The Nuclear Threat Initiative's (NTI) Nuclear Security Index for 2023 (Index), on the other hand, assessed for the first time since the Index was launched in 2012, that despite some areas of progress, "nuclear security conditions are regressing in the dozens of countries and areas with weapons-usable nuclear materials and nuclear facilities."[11]

The IAEA's upbeat nuclear security assessment is presumably based on its engagement on nuclear security practices with member states. The NTI's assessment of concern, however, is based on publicly available evidence for 175 countries with nuclear-related activities. NTI notes, for example, that global nuclear security has regressed in such areas as: (1) countries and areas with weapons-usable nuclear materials and nuclear facilities have made little progress in improving their security culture and insider threat protections; (2) the amount of weapons-usable plutonium at civilian reactors has grown rapidly; (3) 34% of countries and areas with nuclear facilities have no regulatory requirements for protecting nuclear infrastructure during a natural or human-caused disaster; (4) support for political and legal commitments to improve nuclear security is faltering: and (5) support for the IAEA is inconsistent.[12]

Despite the progress seen by the IAEA, we believe the NTI Index's assessment is a harbinger of longer-term problems for global nuclear security. The reason is the NTI Index's findings underscore our assessment that there is a structural vulnerability in the nuclear security regime as it currently functions: that is the regime is essentially static, while the challenges with which it must deal are dynamic.

The key international agreement on nuclear security is the Amended CPPNM.[13] This agreement outlines a variety of commitments undertaken by states party to the agreement, e.g., to establish national laws and regulations for securing nuclear material on the basis of a specific set of "Fundamental Principles of the Physical Protection of Nuclear Material and Nuclear Facilities," (Fundamental Principles). State parties agree to share their national laws and regulations with the IAEA, which "shall" share them with other state parties to the Convention. However, any cooperation among state parties to the Convention or with the IAEA in addressing nuclear security needs or novel issues is purely voluntary. There is, for example, no requirement that state parties seek IAEA assessments of how they are applying the Fundamental Principles of nuclear security. The principal opportunity for state parties to cooperate and take stock of nuclear security is found in the Convention's Article 16, which calls for a conference of the parties five years after the Convention enters into force to review its implementation and *"its adequacy…in light of the then prevailing circumstances."* Article 16 goes on to say that future such conferences may be held at intervals of not less than five years.

The first Review Conference was held in 2022. It included limited substantive engagement on current and/or near-term nuclear security challenges, and concluded without an intersessional work plan related to Article 16 or any potential nuclear security challenge or vulnerability stemming from technological change, non-state actor threats, or climate change impacts. It was agreed the next Review Conference would be held in six years.[14]

A lot can – and generally does – happen in six years. There could be, for example: more than one generation of development in technologies, such as artificial intelligence; catastrophic developments wrought by climate change; and/or significant new non-state actor threats -- or possibly some combination of all three. Given the dynamic reality within which nuclear security must operate, waiting six years for state parties to the Amended CPPNM to assess and act on potential challenges to nuclear security is like trying to win a 100-meter dash by walking. To avoid nuclear security breaches or worse, the nuclear security regime needs to shift from its current static approach and become as dynamic as the multiple challenges it faces.

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[10] https://www.iaea.org/sites/default/files/gc/gc67-inf3.pdf

[11] https://www.ntiindex.org/wp-content/uploads/2023/07/2023_NTI-Index_Report.pdf p. 7

[12] https://www.ntiindex.org/wp-content/uploads/2023/07/2023_NTI-Index_Report.pdf , pp.5-6

[13] https://www.iaea.org/sites/default/files/publications/documents/infcircs/1979/infcirc274r1m1c.pdf

[14] https://www.iaea.org/sites/default/files/22/04/english_acppnm_rc_2022_4_outcome_document_approved.pdf and https://www.iaea.org/sites/default/files/22/04/english_acppnm_rc_2022_inf_3_provisional_programme_of_work.pdf

4. BUILDING NEEDED DYNAMISM INTO THE NUCLEAR SECURITY REGIME

The governance of an activity within a dynamic environment, such as nuclear security, requires: (1) standards; (2) assessment of standards implementation and effectiveness; (3) timely reporting on assessments to a competent authority; and (4) a mechanism for making and implementing needed changes. The seeds of a dynamic nuclear security regime exist within the text of the Amended CPPNM, which meetings of the ministerial-level International Conference on Nuclear Security can complement. Those seeds are found in Articles 2A (3), 14,16, and 20; they just need to be harvested by state parties to the Convention with the support of the IAEA.[15]

4.1 The seeds of a dynamic nuclear security system

Article 2A(3) of the Convention says state parties, in implementing their Convention obligation to develop a domestic nuclear security regime, shall, to the extent possible, apply the Fundamental Principals, which it lists. While each of the Fundamental Principles is important, Fundamental Principles (C), (G), and (J) are the most dynamic. They make clear that state parties' nuclear security regimes should have legislative and regulatory requirements that include a system of evaluation and a complementary system of inspection to verify compliance with requirements, that levels of protection should be based on current threat assessments, and that quality assurance policies and programs should be established to assure compliance with requirements.

The Fundamental Principles build dynamism into a state party's nuclear security regime. Articles 14 and 16 can, in turn, draw on those obligations for a state party as the basis for a more dynamic approach within the Convention's review process. Article 14 requires state parties to inform the IAEA of the laws and regulations established to meet their obligations under the Convention. It also says the IAEA shall communicate this information periodically to all state parties. Article 14, among others, builds transparency and sharing of information into the global nuclear security regime.

Article 16 establishes a first Review Conference, with the possibility of subsequent meetings, at which state parties meet to review the Convention's implementation and "its adequacy as concerns the preamble, the whole of the operative part and the annexes in the light of the then prevailing situation." The state parties at the Convention Review Conference, along with the IAEA as the Convention's depositary, have the raw material for reviewing implementation of the Convention from the material state parties shared with the IAEA on their implementation actions (Article 14). That same material could also be useful for reviewing whether the Convention remains operationally "adequate" "in the light of the then prevailing circumstances," which means the circumstances at the time of the Review Conference, not the time the Convention was negotiated. Those circumstances would logically include the existing challenges to the goals and purposes of the Convention, such as threats from non-state actors, changing and/or novel technologies, and climate change impacts on the built environment of nuclear security infrastructure.

Finally, the Convention's Article 20 outlines the procedure by which state parties can seek to amend the Convention should they find it necessary. The potential for amendments means that the Convention can be updated to respond to changes in the threat, technological, or physical environment that would affect the sustainable security of nuclear material.

4.2 Harvesting the seeds of dynamism through the Convention's review process

State parties to the Convention can harvest its potential dynamism by developing a substantive intersessional process to examine, assess, and prepare issues for consideration and possible action at the Convention's Review Conference. State parties will require support from the IAEA for such a process, which would be consistent with its role as depositary for this Convention, as well as such other agreements as the CNS. Such a process would be geared to preparing for the Review Conference's consideration of: (1) the Convention's implementation; (2) the Convention's adequacy in the then prevailing circumstances; and (3) progress towards the Convention's universalization. Meeting these objectives could involve the following steps:

[15] https://www.iaea.org/sites/default/files/publications/documents/infcircs/1979/infcirc274r1m1c.pdf

- A substantive, agenda-driven intersessional process. This could be organized as an intersessional meeting of state parties that uses regional group discussions to set the stage for plenary discussions and recommendations.
  - The first part of an intersessional meeting would consider Convention implementation. In place of making "national statements," as was done at the initial review conference,[16] each state party would be asked to submit a Country Report informed by its Article 14.1 submissions to the Depositary and any updates since its last submission. Country Reports would focus on challenges to implementation, whether and how they were overcome, actions taken that may be good practices others may wish to use, and any systemic issues that make it difficult to meet Convention obligations, such as funding. These reports would be discussed in regional group sessions, which could also be informed by the IAEA's experience of working with member states on implementing and updating nuclear security standards. The implementation country group discussions could also address issues, including systemic ones such as funding, related to universalizing the Convention.
  - The second part of an intersessional meeting would focus on the adequacy of the Convention, particularly with regard to such dynamic challenges as non-state actors threats, changing and novel technologies, and climate change's impact on the built environment supporting nuclear security. This meeting could hear from experts from state parties, the IAEA, other international organizations, academia, or NGOs. This portion of the meeting would also be informed by the results of the regional group consideration of implementation issues, particularly any that might bear on the adequacy of the Convention.
- The intersessional discussions on implementation would lead to a draft report identifying common challenges, good practices, and any systemic issues requiring longer-term work between or at Review Conferences. Considering whether there is a need for more funding than currently available mechanisms provide to assist with Convention implementation and help drive progress for universilization is a possible example of a longer-term systemic issue for the Review Conference.
- Based on the intersessional discussions, the leadership of the intersessional process, with the support of the IAEA, would develop a draft substantive agenda of key issues for the Review Conference to consider and, potentially, act on. The IAEA, as depositary, would share reports of the intersessional meetings and the draft substantive Review Conference agenda with state parties well before the next Review Conference to support preparations for engagement and decision-making at the Review Conference.
- The Review Conference would use country group discussions to build on, refine, or update the intersessional work, with decisions or recommendations reserved for plenary sessions.
- To consolidate its work and prepare for the next round of intersessional discussions, the Review Conference, with the support of the IAEA, should produce the following:
  - A report on common challenges and good practices related to implementing Convention obligations and universalizing the Convention. State parties would be asked to report in the future on what they have done to address any identified challenges that affect them;
  - A report that summarizes the adequacy discussions and that identifies potential adequacy challenges that require further review;
  - A report on any systemic issues state parties believe need to be addressed to support implementation and universalization of the Convention;
  - A proposed set of implementation, universalization, systemic, or adequacy issues to be worked on during the intercessional period before the next Review Conference.

[16] https://www.iaea.org/sites/default/files/22/04/english_acppnm_rc_2022_inf_3_provisional_programme_of_work.pdf

5. BRINGING THE AMENDED CPPNM IN LINE WITH OTHER NUCLEAR AGREEMENTS

The proposals above are designed to help the state parties better meet the purpose of the Convention as well as their implementation of it by providing a structure to its review and assessment process. They are a practical way to make the Convention and its processes as dynamic as the challenges to nuclear security with which they must deal. These suggestions will help the state parties anticipate and deal constructively with challenges to nuclear security, rather than reacting to problems after they occur.

Some might argue the above proposal is burdensome for state parties, but state parties to the Convention are also parties to the CNS and many, if not all, are parties to the Joint Convention mentioned above. Each of these agreements has state parties sharing reports of their activities under the agreements, as well as identifying challenges and issues that need to be worked on and then reporting on what they have done at a subsequent meeting.[17] The U.S. Government Accountability Office, which is part of the Congressional Branch of the U.S. government, examined the CNS some years ago and found state parties thought the CNS was useful overall and found the country reports and discussions of them were among the CNS' most useful contributions to nuclear safety.[18]

Others might argue there is no requirement in the text for a substantive intersessional process between Review Conferences, but the state parties to the Convention can organize the Review Conference in any way that helps them meet its requirements (Article 16) and the Convention's purpose (Article 1A). In our view and experience, State parties are not and should not be prevented from organizing their work and meetings in ways they find effective for implementing an international agreement.

These proposals address a glaring gap in the Convention: it is on a linear course to deal with what is likely to be an era of exponential change for nuclear security. If not corrected, the gap between what is needed and the current course could produce nuclear security breaches and damaging consequences for global and regional stability and prosperity, as well as undermining public acceptance of peaceful nuclear energy uses. The proposed fix to this mismatch of existing process with what is needed is relatively easy and consistent with the way other nuclear-related international agreements operate, i.e., by regularizing a substantive intercessional process between Review Conferences.

Ministers attending ICONS 2024 would make a substantial contribution to positively shaping the future – and effectiveness – of the nuclear security regime by endorsing this proposal and driving support for its implementation during the intercessional period leading to the 2028 Review Conference.

[17] https://www.iaea.org/sites/default/files/23/04/23-01280e_cns8_9rm2023_08_final.pdf and https://www.iaea.org/sites/default/files/jc-rm7-04-rev2-summary-report.pdf

[18] https://www.gao.gov/assets/a303702.html