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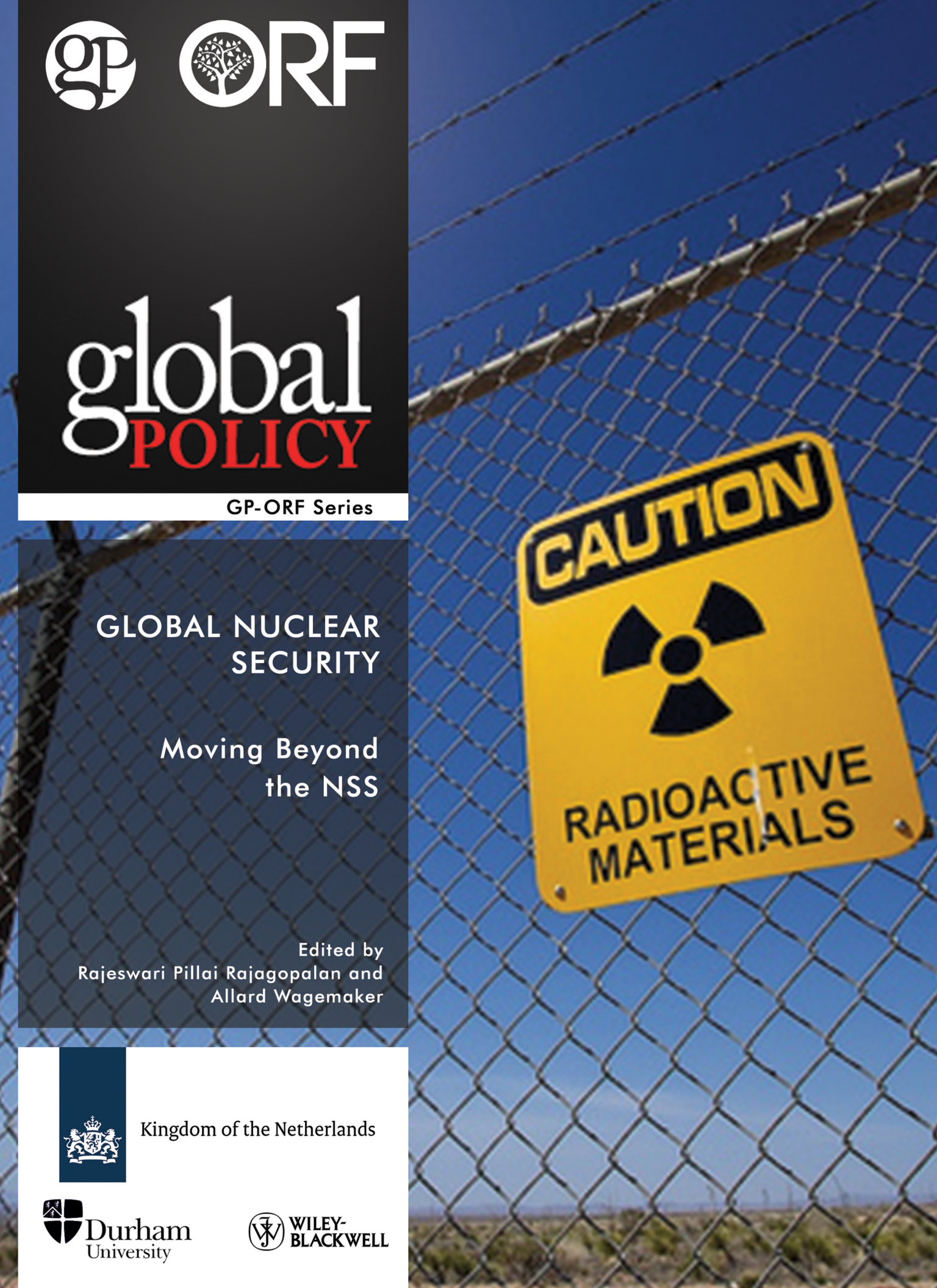
GLOBAL NUCLEAR SECURITY

Moving Beyond the NSS

Edited by
Rajeswari Pillai Rajagopalan and
Allard Wagemaker



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GLOBAL NUCLEAR SECURITY: MOVING BEYOND THE NSS

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Contributing Authors

Dr. Nicolas **Blarel** is Assistant Professor of International Relations at the Institute of Political Science, Leiden University in The Netherlands. He focuses on foreign and security policy issues in South Asia as well as relations between India and the Middle East. His most recent book is *The Evolution of India's Israel Policy: Continuity, Change, and Compromise since 1922* (Oxford University Press, 2015) and he co-edited the *Oxford Handbook of India's National Security* (2018).

Dr. Reshmi **Kazi** is Associate Professor at Jamia Millia Islamia (Central University). She specialises on nuclear security, nuclear non-proliferation, nuclear disarmament and issues of peace and conflict in South Asia.

Dr. Rajiv **Nayan** is a Senior Research Associate at the Institute for Defence Studies and Analyses, New Delhi. He specialises on nuclear issues and arms control.

Dr. Huib **Pellikaan** is a lecturer of Political Science at Leiden University. He teaches courses on Rational Choice Theory, Applying Game Theory in International Relations and Deterrence and Compellence in International Politics.

Dr. Rajeswari Pillai **Rajagopalan** is Distinguished Fellow and Head of the Nuclear and Space Policy Initiative at Observer Research Foundation. She joined ORF after a five-year stint at the National Security Council Secretariat (2003-2007), where she was an Assistant Director. Her research areas include Indian Security and Foreign Policy, Asian Military and Strategic Issues and Space and Nuclear Security.

Dr. R. **Rajaraman** is Emeritus Professor of Theoretical Physics at JNU, New Delhi. Apart from research in theoretical physics, he works on public policy issues in the nuclear area – both civilian and military. He is a former Co-Chair of the International Panel on Fissile Materials, former Vice President of the Indian National Science Academy and a current member of the Asia Pacific Leadership Network.

Dr. Allard **Wagemaker** is an officer-scholar in the Netherlands Armed Forces (Colonel in the Royal Netherlands Marine Corps). He currently holds the position of Associate Professor in War Studies in the Netherlands Defence Academy. His academic research focuses on Asia, and South Asia in particular, and on conflicts in the lower end of the conflict spectrum. He has been the Netherlands Defence Attaché for South and Central Asia working from New Delhi (2013-2017).

Dr. Niels van **Willigen** is associate professor of international relations in the Institute of Political Science at Leiden University. His academic interests include theories of international relations, foreign policy analysis, security studies (in particular peace operations, arms control, and European security) and international law.

GLOBAL NUCLEAR SECURITY

Time for A Proactive Approach

Dr. Rajeswari Pillai Rajagopalan and Dr. Allard Wagemaker

Nuclear weapons are a Faustian bargain: the likelihood of war decreases by greatly increasing the costs of war. Since the 9/11 terrorist attacks there has been a growing concern of the use of nuclear devices by others than states which makes the Faustian bargain a complex one. Terrorist organisations like al Qaeda and ISIS have a well-known desire to execute an 'American Hiroshima.' State-sponsored nuclear terrorism is possibly even harder to control than nuclear weaponry in the hands of states. Some have suggested that a nuclear-armed Iran would provide its proxy groups with dirty bombs. Nuclear security is a challenge in the twenty-first century as potential nuclear bomb materials are not only in the hands of states. Nuclear materials are vulnerable to theft and sale on the black markets. Suggestions that nuclear weapons like other weapons of mass destruction are past tense are a miscalculation: nuclear security requires a proactive approach because non-state actors – including terrorists, interstate criminal organisations and revolutionary actors – may acquire increasingly easily nuclear materials and the delivery means. This edited volume with six essays examining nuclear security mechanisms from different angles and perspectives, is very much about the need for a proactive global nuclear security approach: an urgent, twenty-first century phenomenon.

Nuclear security is a very serious challenge. The Bulletin of the Atomic Scientists has moved the doomsday clock closer to midnight on 26 January 2018, warning the world that it is as close to catastrophe as it has ever been. Growing nuclear threats and a lack of trust in political institutions makes that the doomsday clock is now two minutes to midnight… Starting in 1947 at seven minutes to midnight, the doomsday clock serves as a warning about nuclear weapons and tracks the world's vulnerability to existential threats. The Science and Security Board for the Bulletin of the Atomic Scientists assesses that nowadays the world is as threatening it has been since World War II. To call the world nuclear situation dire is to understand the danger and its immediacy. This can be explained relatively easily. In the current perilous world security situation, also hard to control non-state actors have access to nuclear materials and technology.

Securing nuclear materials and technology is not a new challenge however. Having existed since nuclear weapons were invented but came into sharper focus following the disintegration of the Soviet Union in 1991. Fears of nuclear technology and materials falling into wrong hands and even the possible unlawful transfer of nuclear expertise by Soviet scientists became increasingly a real threat. The perception of threat became even more serious after the 9/11 terrorist attacks in the US. The scale of the attacks raised the fears of the possibility of terrorists acquiring weapons of mass destruction (WMD), including nuclear materials. These threats are no exaggeration – the data from the International Atomic Energy Agency's (IAEA) Incident and Trafficking Database (ITDB) substantiates these concerns. In addition, bold calls by terrorist groups to acquire such materials in order to create mass panic, disruption and destruction cannot be ignored. Terrorist groups like al Qaeda and ISIS have demonstrated their intention of gaining access to these technologies and materials. These new worrying trends should get states and other stakeholders to debate and institutionalise new initiatives and measures that would prevent theft, pilferage and illegal possession of nuclear and radiological materials.

What is nuclear security, why does it matter and what needs to be done? For one, as explained above, the threat of nuclear terrorism is an important imperative. So far, terrorist incidents have been relatively low-tech. What if terrorists were to build a dirty bomb or, worse, what if they manage to build a fully functioning small rudimentary nuclear weapon and detonate it downtown? What would be the social, economic political and security impacts of such a nuclear terrorist attack look like? Two, unlike themes like nuclear non-proliferation and nuclear deterrence, serious concern about nuclear security is relatively recent. Hence, the institutional and legal architecture dealing with nuclear security are also at a nascent stage. But both nuclear and radiological materials are used by a number of different players including industries, hospitals and educational institutions, that has made access to these materials somewhat easier. Thus, the requirement for legal and regulatory processes at the national and international levels is real. At the global level, the Convention on the Physical Protection of Nuclear Materials (CPPNM) and the 2005 Amendment are great examples. The Convention, with two thirds of the states ratifying it, came into force on 8 May 2016. While the physical protection of nuclear and radiological materials is a critical aspect, there are an entire gamut of issues including nuclear transportation, nuclear smuggling, nuclear forensics, that call for focused attention. Maybe we also have to invert the dominant deterrence discourse as well, such that nuclear weapons and nuclear materials plus the accompanying infrastructures and mindsets are sources of insecurity in everyday life rather than just the means of protection. The everyday is invoked in overtly normative and political terms as desirable, fragile, contested.

The Nuclear Security Summit (NSS) was a successful initiative that brought together close to 100 countries but the NSS process has come to an end after the fourth Summit in 2016. There needs to be more sustained efforts involving multiple stakeholders to continue the momentum and attention. NSS was also important in the context of a stalemated Conference on Disarmament (CD) where security-related and arms control issues are traditionally discussed. CD has not seen progress in more than two decades – the last measure that was debated within the CD was the CTBT in 1996. Given the contested nature of great power relations, the situation is

unlikely to ease in the near future. The Nuclear Security Contact Group (NSCG) that was created at the 2016 Nuclear Security Summit is a useful step however, it is important that there is a somewhat more informal initiative that will also include more and varied stakeholders such as the civil society and industry which can also push the agenda. Using multiplicity of channels to advance and strengthen implementation of nuclear security goals while establishing a sustainable nuclear security architecture should be an important long-term target.

Further, the changing balance of power dynamics in Asia and beyond are also having an impact on broader global security questions and nuclear weapons have become a lot more salient in states' security doctrines. These trends will ensure the continued importance of nuclear weapons in national doctrinal strategies as states continue to amass their hard power capabilities. While this is not unique to nuclear security issues, that is not necessarily a consolation.

Meanwhile, the continuing threat of terrorism and potential use of nuclear and radiological materials by terrorists make the challenge of securing them even more pertinent for countries to debate and find solutions. Governments and other stakeholders including industries and civil society must recognise the reality that nuclear security is a global problem and that solutions cannot be found within the confines of a single state. Given the problematic nature of regional politics such as in Asia Pacific, it may not be even prudent to address this issue at the regional levels. However, regional mechanisms and institutions can be judiciously utilised to stimulate global conversations.

This volume contains six essays examining nuclear security mechanisms from different angles and perspectives. Traditionally, southern Asia has seen a big focus in terms of the threats and challenges, particularly because of the concentration of terrorist groups in the Afghan-Pakistan area but also because of the perception of Pakistan's loose nuclear controls, but scenario in Europe is also changing in recent years. The spike in the number of terrorist incidents across Europe and the reports of the ISIS' scouting for nuclear materials and weapons point to a worrying trend in the region. This volume also tracks these new challenges in terms of maintaining the global attention focused on nuclear security.

The first essay provides a broad overview of nuclear security in general. R Rajaraman explains in *Nuclear Security* on the one hand that security of nuclear weapons is imperative, on the other that securing of nuclear materials has become increasingly important. This became evident in the four Nuclear Security Summits, but the nuclear disarmament community has also expanded the scope of nuclear security by stretching the term nuclear material to include not just the weapon-useable fissile materials to cover all radiological materials, whether fissile or not. Rajaraman puts special attention on the security of all radiological materials which can be used to produce dirty bombs as well as on the security and safety of nuclear reactors, their input and spent fuel. He observes that although theft of a fully assembled bomb is unlikely, a serious security concern is the possibility of non-state actors assembling sufficient materials themselves to produce a dirty bomb, if not a nuclear weapon. This means that not only the control over fissile material fuel is important, but also various sophisticated components that go into such a nuclear weapon. What is even harder to control is the expertise to put the ingredients together. Although much has been achieved so

far, there are two separate lines of work for the years ahead according to Rajaraman. The first one is to continue with the initiatives taken by the four Nuclear Security Summits. The second is to take steps that go beyond the mandate of the Summits such as the 'declaration of materials stock' in combination with verification and necessary techniques of nuclear archaeology. Such an exercise will be valuable but they also need to be implemented despite all kinds of constraints. The challenge is compliance and finding methods of verification which are sufficiently non-invasive as to be acceptable to all – a political and technical challenge.

The second essay, *Bilateralism and Nuclear Security* by Huib Pellikaan and Niels van Willigen, uses and elaborates on the theoretical insights from game theory in order to understand nuclear security in changing environment. The authors analyse a situation wherein "the relations between the US and Russia have deteriorated and smaller nuclear states like India and Pakistan have intensified their strategic nuclear arms race, North Korea's nuclear tests and ballistic missile programme is high on the international agenda and [other] nuclear weapon states are modernising their arsenals." Pellikaan and Van Willigen argue that, "it is highly unlikely that global nuclear security will ultimately be achieved through multilateral disarmament. (…) It is much more likely that states will opt for nuclear disarmament in a bilateral setting than in a multilateral setting." Using The Game of Chicken, they remark that addition of even one state to a bilateral setting could challenge the dynamics and thus "achieving nuclear security becomes much more problematic." However, this does not mean that the multilateral approach should be abandoned as the authors argue that the multilateral institutions and architecture are important contextualising factors that provide for "bilateral negotiations take place." On top, although both bilateralism and multilateralism are needed to have a strong international regime, "the choice for multilateralism or bilateralism is determined by the levels of transaction costs and member surplus." They conclude that, "there is no guarantee that an arms control policy, based on strategic dyads, will work, but it is a more realistic option, as evidenced from game theory argument and historical empirical evidence."

The third essay, by Nicolas Blarel, is an unconventional approach on the implications of terrorism for global nuclear security. Blarel focuses in *Mischief under the Nuclear Umbrella: Dynamics and Implications* on how non-state actors can (directly or directly) attempt to provoke conditions for a crisis between state actors that have nuclear capabilities. Moreover, he considers that, "the role of non-state actors in fomenting crises with escalatory potential between nuclear dyads needs to be further explored." He argues that there is an urgent but complicated and understudied task to understand and manage the problem of terrorist activity in the context of a nuclearised environment. He suggests the analysis and comparison of inter-state dynamics in reaction to crises in order to provide for policy recommendations for global efforts and mechanisms to further the risks of escalation. This is of urgent need as, in Blarel's opinion, "existing multilateral and bilateral control regimes need to adapt to the new risks (…) and address the complex security dynamics more effectively." He recommends, "the condemnation by international organisations of terrorist groups which exploit such nuclearized environments [as an] important means of emphasising the diplomatic and reputational costs for a sponsor or hosting state."

The fourth essay, *India's Contribution to Global*

Nuclear Security by Reshmi Kazi explores India's contribution towards attaining global nuclear security: not an easy task in a world with emerging threats like the rise of ISIS, proliferation risks emanating from Pakistan and China, as well as increasing demands of nuclear energy and technology. India is very much aware of these threats as well as the wide-spread proliferation of (dual-use) nuclear materials and technology. India has therefore taken cognizance of the threat of nuclear terrorism for which it has made distinctive exertions in strengthening its nuclear security. Especially the link between proliferation of dangerous, often dual-use, nuclear material and Pakistan remains a serious concern according to Kazi. While India accepts that nuclear security is a national responsibility, it is also a task it cannot achieve on its own: international cooperation is a fundamental requirement. The road to developing secure and sustainable mechanisms for a strong, global nuclear security regime is a difficult one. Moreover, in the current security dynamics, nuclear security is no longer a mere trepidation. In Kazi's view, nuclear security requires active measures and commitment as India demonstrates: commitment to attaining high-standards of nuclear security at the national level in combination with consistent efforts to strengthen nuclear security by contributing to a robust and sustainable global nuclear security architecture.

The fifth essay by Rajiv Nayan explores the role of export controls for nuclear security in India. Although export control and nuclear security have an old link, over the decades these controls have become 'safeguards plus.' They have also emerged as one of the tools in fighting nuclear terrorism. Nayan examines in *The Role of Export Controls for Nuclear Security* how export control mechanisms are contributing to and strengthening nuclear security globally while India is shaping its own export control mechanisms to reinforce nuclear security. The essay also delves into greater detail on, one of the most significant initiatives: the UN Security Council Resolution 1540 (2004) that has resulted in a fundament for the internationalisation of export controls. It directs member countries to formulate national laws and regulations to deal with illicit trafficking, end-user controls, brokering, transit, trans-shipment and re-export of nuclear material and controls on providing funds and services to terrorists. Besides the Nuclear Suppliers Group, the various Nuclear Security Summits underscored the need for export control to fight nuclear terrorism and promote nuclear security. India has played a significant and constructive role in all the four Nuclear Security Summits as well as in the International Atomic Energy Agency and the Global Initiative to Combat Nuclear Terrorism in order to provide an export control system which strengthens nuclear security in a pro-active manner. Although much has been achieved, India and the global nuclear community need to work even closer together, Nayan observes, to resolve all the complex issues that remain stumbling blocks in enforcing nuclear security. Nayan lists various recommendations to improve the export control mechanisms to become sophisticated tools in fighting nuclear terrorism.

The sixth and final essay by Rajeswari Pillai Rajagopalan examines the state of the play with regard to the global nuclear security architecture. In *Evolving a Global Nuclear Security Regime*, she details both the institutional and legal mechanisms at play and those that are required to strengthen the global nuclear security policies and practices. It is a complicated subject, which gained focused attention after the 9/11 terrorist attacks in the US with "the fear of terrorists

getting hold of nuclear and radiological materials heightened the threat to a new level." With media reports from early 2016 suggesting that terrorist attacks were planned on a nuclear facility in Belgium and in another incident that nuclear (medical) materials were stolen from research facilities in Belgium, these fears seem to have become a reality. Although each and every state underlines the need for nuclear security, achieving the same is a different story. While there are a few mechanisms including the Convention on the Physical Protection of Nuclear Material, these are not sufficient as yet to provide for an effective regime. The four Nuclear Security Summits (2010-2016) clearly have strengthened the awareness level and responsiveness of states to the issue of nuclear security. Despite these achievements and commitment at the political level, the challenge is how to keep the momentum going: the US leadership, strange as it may sound, is lacking. Current efforts and participation at the mid-level bureaucracy from the US side is not helpful either. The author, therefore, argues that "it is time to get realistic about what is feasible than what is desirable." Rajagopalan suggests in the final part of her essay a stimulating but realistic agenda for the short- and medium-term that will keep the spirit of the NSS alive and drive the global agenda to develop an effective and more binding nuclear security regime.

We hope that the Special Issue has provided some ideas for continuing the momentum around nuclear security, following the NSS process, and more importantly, that this is the beginning of a more active debate about nuclear security in Asia, Europe and beyond.

Last but not the least, we want to thank a number of individuals who made this volume possible. At the ORF, we want to specially thank Mr. Sunjoy Joshi, Chairman, ORF for his continued support and encouragement. Special thanks also to Dr. Samir Saran, President, ORF for being a constant source of support in this venture. However, the biggest thanks goes to all the authors and contributors, who despite their busy schedules, wrote the essays and presented them at the workshop held in The Hague. All of this would not have been possible without the generous funding support we received from the Embassy of the Kingdom of The Netherlands. Ambassador HE Fons Stoelinga and Dominique Kuhling deserve special thanks for not losing their faith in us as we trudged along.

Dr. Rajeswari Pillai Rajagopalan
Distinguished Fellow & Head,
Nuclear and Space Policy Initiative
Observer Research Foundation
New Delhi

Dr. Allard Wagemaker
Associate Professor in War Studies
Netherlands Defence Academy
Breda

NUCLEAR SECURITY

An Overview

Dr. Rajaraman

The term 'nuclear security' has come to be used in a very specific sense over the past decade – that of securing of nuclear material. This is evident from the deliberations of the four nuclear security summits. In turn, the term nuclear material has been enlarged by the nuclear disarmament community from its traditional meaning of weapon-useable fissile materials to cover all radiological materials, whether fissile or not. Further, the safety of civilian nuclear energy also has been conjoined, somewhat inappropriately, with the discussion on materials security. In other words, the security and safety of all nuclear material is important, especially in the aftermath of the Fukushima accident, and under the shadow of possible nuclear terrorism.

The security and safety of all nuclear material is important, especially in the aftermath of the Fukushima accident, and under the shadow of possible nuclear terrorism.

It is useful, however, to place the specific meaning of nuclear security in the larger context of all that the term nuclear security can cover. This is important as we look ahead to what should be done after the summit cycle. After all, the ultimate goal is reducing the nuclear threat in its totality.

This essay discusses four topics. The first part examines the security of nuclear weapons themselves, while the second looks at the security of fissile materials which can be used to assemble a nuclear weapon. The third part focuses on the security of radiological materials – fissile or not – which can be used to produce a dirty bomb. The last section analyses the security and safety of nuclear reactors, their input and spent fuel.

Security of Nuclear Weapons

Security of nuclear weapons is imperative. Next to the actual use of such weapons, the

biggest danger is that of some unauthorised person getting hold of a fully assembled nuclear weapon. The issue is hardly ever discussed in public – it is far too sensitive and shrouded in the highest levels of secrecy. It is also assumed that each nuclear weapon state will, in its own interest, take the greatest possible precautions to secure its weapons, deployed or in storage.

The only exception might be Pakistan. The Pakistani army guards its 100-odd nuclear warheads very responsibly and vigilantly against terrorists. These weapons are like its family jewels. But some analysts have expressed concern over the possibility of an "insider threat," where latent or "sleeper" fundamentalists from within the military could facilitate, if not organise, theft. The Pakistani army leadership is well aware of this danger and takes measures to screen its personnel and officers potentially posing such an internal threat, and isolating them from all sensitive positions. One would imagine that it is not easy to identify and isolate such individuals, without harming the innocent or creating resentment in the ranks. Possible indicators, such as increase in religious piety on the part of an individual or even developing fundamentalist beliefs do not, in and of themselves, imply that the person would support violent terrorism, or be willing to help terrorists get hold of a such a devastating weapon.

Security of Fissile Materials

Given that the theft of a fully assembled bomb is unlikely, the next most serious security concern is the possibility of non-state actors assembling a nuclear weapon themselves. Apart from fissile material fuel, there are several sophisticated components that go into a nuclear weapon, such as its special casing, electronics, conventional explosives and fuses arranged to fire in the right sequence. Although most of these would be difficult to acquire by a small rag-tag group of terrorists, a well-organised group like al Qaeda or ISIS may be able to induct or abduct the necessary experts, as well as assemble the ingredients needed for that purpose. More importantly, putting all these items together does not require a huge amount of space or massive machinery. Once the expertise has been acquired, these ingredients can in principle be put together in a garage or a small shed on a remote farm, or in the basement of a building.

Given that the theft of a fully assembled bomb is unlikely, the next most serious security concern is the possibility of non-state actors assembling a nuclear weapon themselves.

A much more difficult ingredient to obtain would be the fissile material needed for the weapon – either Plutonium (Pu) or Highly Enriched Uranium (HEU). Neither is available in nature and both have to be artificially manufactured. Pu is produced in nuclear reactors through the absorption of a neutron by the Uranium-238 isotope in the fuel rods. HEU is produced in an assembly of thousands of gas centrifuges. Both these processes require large buildings, with massive pipes and electrical cables feeding them, and cannot be unobtrusively undertaken in a normal basement or garage. Recall that initial clandestine attempts to produce HEU by Iran got found out despite the thousands of square kilometres of countryside at its disposal.

In other words, terrorist groups cannot easily hope to manufacture their own Pu or HEU without being discovered. Their only hope is to pilfer some from existing stocks. This too is not easy but a lot less difficult than stealing a fully assembled weapon. Besides, fissile materials needed for a terrorist's weapon need not be stolen in one go. It can be slowly accumulated by squirreling away small amounts pilfered over several months and from different sources. This is well within the reach of realistic possibility. Therefore, the safety and safeguarding of fissile materials have been the most important feature of nuclear non-proliferation efforts.

To appreciate the magnitude of this task, one must first look at the quantity and geographical distribution of fissile material around the world.

The Size of the Beast

To appreciate the magnitude of this task, one must first look at the quantity and geographical distribution of fissile material around the world. These data have been carefully gathered and made available in a reader-friendly manner by the International Panel on Fissile Materials (IPFM) in its annual reports. All the graphics and data below are taken from its 2015 Report.[1] Unfortunately, over the decades, several nations, especially the US and the former USSR, have produced and stocked vast quantities of both HEU and Pu.

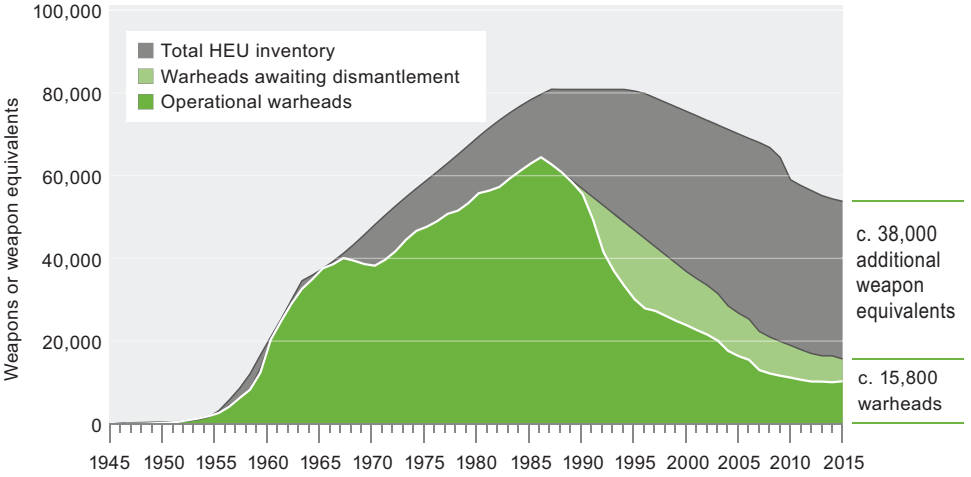
Global HEU Stocks

At the height of the Cold War, there were altogether about 2,000 tons of HEU in the world. The amount of HEU needed to make a reliable and workable warhead depends on its enrichment level and the sophistication of the technology used. At a rough average, some 25 kg is needed per weapon. Thus, the 2,000 tons of HEU could have fuelled up to 80,000 nuclear warheads. Much of this material was weaponised, and by 1985, there were over 63,000 nuclear weapons on earth. Since then the disarmament process has, in fits and starts, led to a reduction in warheads. Of course, the HEU from the dismantled warheads still remains weapon-worthy and has to be stored securely or defanged through down-blending. Down-blending refers to the dilution of the U-235 content in HEU down to 4-5 percent by mixing it with ordinary Uranium. This in effect is the reverse of Uranium enrichment.

Eventually the US and Russia started a programme to reduce their stock of HEU. In 1993, the two signed the Russia-US HEU Agreement, following which Russia started down-blending 500 tons of HEU that it had declared as excess to its military needs, at the rate of about 30 tons per year.[2] It was primarily shipped to the US to be used there for civilian reactor fuel. Since the programme converts HEU, which had been used to make nuclear weapons with yields measured in megatons into Low Enriched Uranium (LEU), which has then been used to produce electric power, measured in megawatts, this arrangement acquired the catchy name of the 'Megatons to Megawatts' Programme.

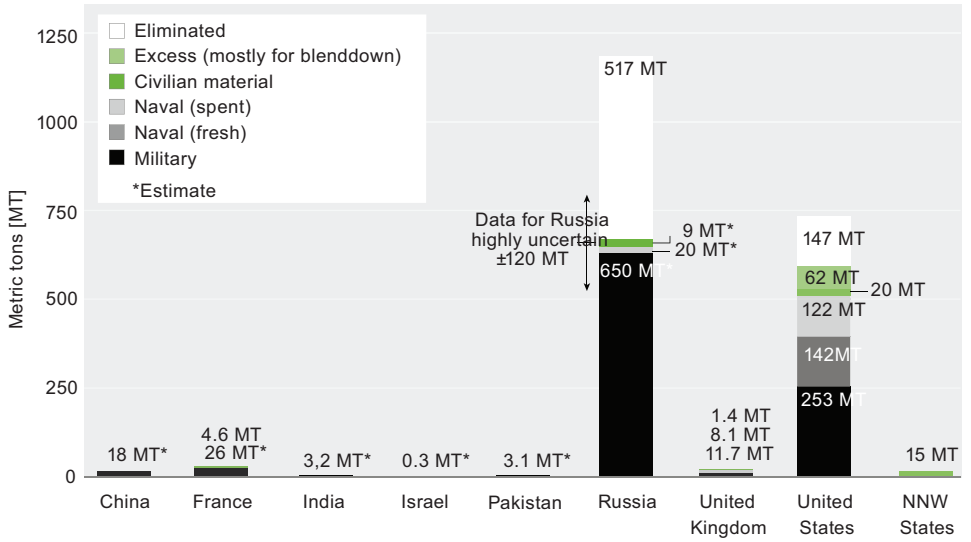
As of 2009, the global inventory of HEU totalled 1,610 tons with an uncertainty of 300 tons on either side. (This large uncertainty in the HEU

Figure 1: Global stocks of HEU over time



Source: Global Fissile Materials Report 2015 of IPFM (GFMR 2015) at www.fissileaterials.org

Figure 2: The distribution of HEU in the major stock holder nations



Source: Global Fissile Materials Report 2015 of IPFM (GFMR 2015) at www.fissileaterials.org

estimate was due to a lack of official information about Russia's historical production of HEU.) Thereafter, the down-blending and transfer of 500 tons of Russian HEU was completed by December 2013. The latest available IPFM estimate[3] of the global stockpile of HEU, updated up to end of 2014, is about 1370 ± 125 tons, still sufficient for tens of thousands of warheads.

Figure 1[4] depicts the growth and decline of the global inventory of HEU stocks. These are shown in terms of their weapon equivalents at an average of 25kg per warhead. The green portion refers to HEU in operational weapons,

the lighter green to HEU in weapons awaiting dismantlement and the black portion to excess stocks. Some of this excess has been reserved for naval reactor fuel, i.e. for nuclear submarines, aircraft carriers and ice breakers, and the rest is expected to be down-blended.

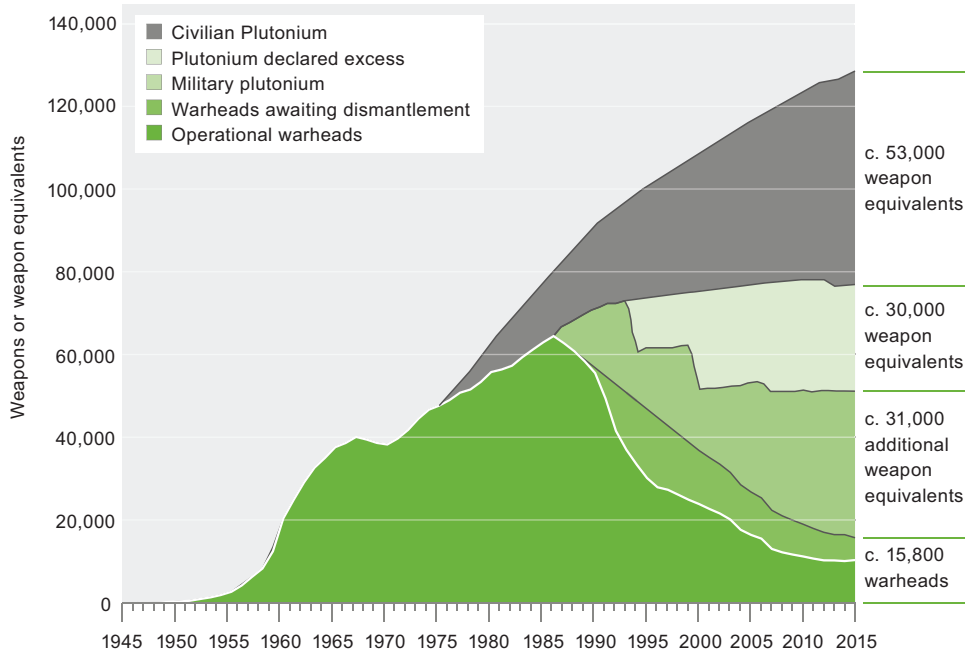
About 99 percent of this HEU is held by the Nuclear Weapon States (NWS). Among them, although the US and Russia possess the overwhelmingly large share, some other nations also have enough to make several hundred warheads each.

As seen in Figure 2, apart from the nuclear weapon states, some non-nuclear weapon states (NNWS) also have a "significant" quantity of HEU. The total amount possessed by them, about 15 tons, is small compared to what the NW states have, but in terms of the damage that it can do (if stolen by terrorists), it represents a serious risk. In principle, one can make as many as 600 weapons using those 15 tons. Of course, the stock in the hands of the NNWS is under IAEA-safeguards. But those safeguards are meant only to prevent them from being misused by the state itself. Safeguards, by virtue of the inventory auditing they involve, could expose loss due to theft but does not enhance security against such pilferage.

Global Plutonium Stocks

The world has accumulated large stocks of Plutonium over the decades, as shown in Figure 3. As of 2014, there existed about 500 tons of Plutonium that could fuel nearly 130,000 warheads, more than twice as much as the stocks of HEU can.

Figure 3: Global Plutonium stocks as of end-2014



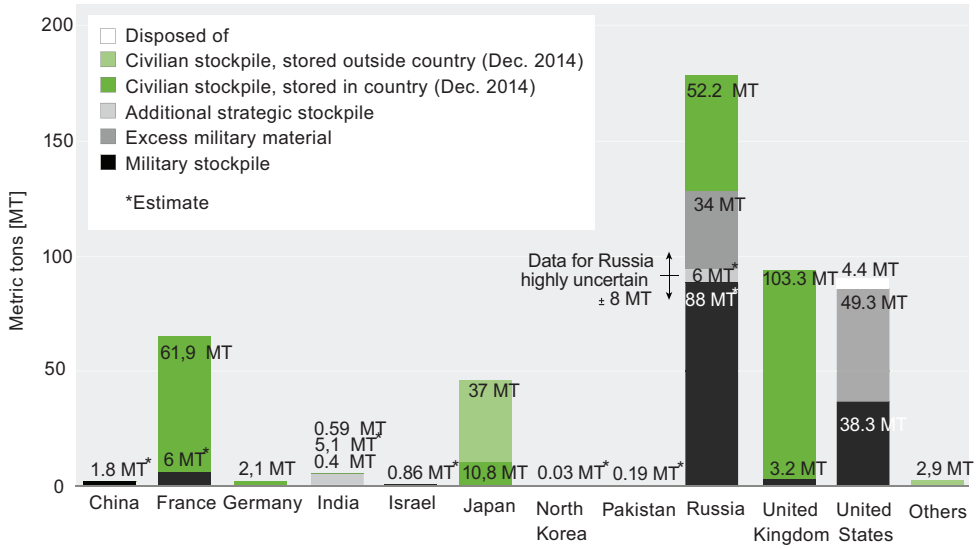
Source: Global Fissile Materials Report 2015 of IPFM (GFMR 2015) at www.fissileaterials.org

Note three key differences between the global HEU and Pu stocks. Although some of the HEU was produced for research purposes or creating radio-isotopes for medical use, it was only a relatively small fraction of the total HEU (See also Figure 2 – civilian stocks of HEU are relatively tiny). Most of the HEU was produced for military purposes, either nuclear warheads or naval reactors. Once the disarmament process started, the HEU excess to weapon needs was partly reserved for naval reactor use and partly down-blended. This has led to the reduction in HEU stocks (as seen in Figure 1).

The second difference is that U-235, the active ingredient of HEU, cannot be produced artificially and has to be extracted from the small 0.7 percent fraction contained in natural uranium through an elaborate process using centrifuges. But Plutonium is routinely produced in nuclear reactors.[5] The quantities so produced are very small. But still, if one were to run typical power reactors for a year, the fuel rods will have tens of kilograms of Plutonium deposited on them. This Plutonium can then be separated out in reprocessing units. That is how nuclear weapon states produced the material necessary for their Pu-based warheads.

The third key difference is that unlike HEU, Plutonium can be used not only for weapons but also as part of the Mixed Oxide (MOX) fuel for civilian power reactors. With the concern in the early decades of the nuclear age that the world may run out of Uranium, the motivation for producing Pu as potential reactor fuel grew, and with it came the notion of a "plutonium economy."[6] Thus spurred, some nations began to produce and stock large amounts of Pu. Prospects of generating Pu were enhanced by the development of fast breeder reactors, which could produce much more Pu than the standard thermal reactors. When appropriately designed and used, a fast breeder can have a "breeding

Figure 4: Global distribution of Pu stocks



Source: Global Fissile Materials Report 2015 of IPFM (GFMR 2015) at www.fissileaterials.org

ratio" greater than 1, i.e. it can produce more Pu than it consumes as input fuel. Although fast breeders generated a lot of technical problems and have not been widely used, the pursuit of more and more Pu produced in standard power reactors has been going on. As a result, as Figure 3 shows, civilian plutonium stocks alone have grown enormously, to about 53,000 warheads worth.[7] This is in addition to the Pu cores sitting inside deployed, stored and dismantled warheads.

The distribution of Pu in different countries is shown in Figure 4. Pu was produced not only by weapon states but also by some prominent non-nuclear-weapon states, especially Japan, to be used as reactor fuel. There has been some attempt to reduce stocks of Pu by using them, mixed with Uranium, as MOX reactor fuel. But the existing capacity of reactors for consuming such fuel is not sufficient to significantly reduce Pu Stocks. Thus, unlike the HEU stocks which have fallen by over 500 tons from their peak value, the stocks of Pu have continued to grow.

Securing Fissile Material Stocks

The vast quantity of of fissile material stocks distributed in several countries brings out the enormity of the task of securing them. For many decades, the attention of the international community focused on disarmament and the dangers of posessing and deploying nuclear weapons. The hazards posed by the widely distributed stocks of fissile materials were also known and addressed by various multilateral bodies and in UN resolutions. It was considered, however, as a specialised responsibility, to be handled by technical agencies like the International Atomic Energy Agency (IAEA) or national nuclear agencies. Consequently, it did not catch the attention of world leaders, nor was there serious diplomatic activity to address the danger of fissile material stocks.

The vast quantity of of fissile material stocks distributed in several countries brings out the enormity of the task of securing them.

However, with the increasing incidence of terrorism in the past two decades by well organised non-state or state-supported groups, the possibility of stealing or building a nuclear weapon has become a matter of urgent concern. This apprehension has been addressed in the last few years, especially by former US President Barack Obama, who took the lead by organising the first Nuclear Security Summit in 2010. It was a catalyst to draw the attention of world leaders to the importance of securing nuclear materials. This has since led to four Summits altogether, held biennially, starting in Washington folowed by Seoul, The Hague and Washington again. They were extremely successful in achieving their intended goals and set the following processes in motion:

- The Summits strengthened the hands of technical agencies which had for long been engaged in keeping fissile materials secure at the national and international levels.
- President Obama made a statesman-like decision by inviting not only the NWS under the NPT, but also the other nuclear weapon nations of India, Pakistan and Israel, as well as many states whose nuclear programmes and stocks of fissile materials were comparatively small. This made the Summit

The modality of working with "house gifts" whereby nations were free to pledge whatever measures they felt they could take to increase the security of their fissile materials was very innovative.

truly representative and comprehensive in its participation. The first Summit saw as many as 47 nations participating, of which 38 were represented by their Heads of State — reportedly the largest collection of Heads of State to be present in Washington since the founding of the UN.

- The modality of working with "house gifts" whereby nations were free to pledge whatever measures they felt they could take to increase the security of their fissile materials was very innovative. Arguably, it led to more commitments from several nations than the standard consensus based or majoritarian approaches could have.
- This also resulted in an acrimony-free conference with a unanimous communiqué, unusual when dealing with nuclear issues. As a result, the Summit encouraged participating states to act on nuclear materials security faster than they might have otherwise done. There was a fairly healthy competition among nations to offer the best gift baskets they could, subject to their security concerns and domestic political constraints.
- In all 60 such house gifts were pledged at the first Summit in 2010, of which about 90 percent had been reported as fulfilled by the next summit in 2012[8]. These included ratifying treaties, setting up centres of excellence and contributing to the IAEA Nuclear Security Fund.
- According to the 2016 Nuclear Threat Initiative (NTI) report[9], only 24 countries have HEU stocks of more than 1 kg, down from 32 such countries in 2012. This reduction is mostly due to some of these states returning the material that had been loaned to them by NW states. Since 2010, many states have also strengthened their nuclear security policies and practices.

Radiological Materials

The Fukushima reactor accidents in 2011 resulted in a worldwide resurgence of the fear of radioactivity. Radioactivity is colourless and odourless, does not show major external damage to the body at low doses and yet leads, years later, to cancer or horrific genetic damage. This makes it all the more mysterious and scary in the public mind.

Apart from radiation leaks from reactors, live or dead, there is also the threat of the so-called "dirty bomb" (technical name: a Radiation Dispersal Device (RDD)) being set off by terrorists. Such a dirty bomb refers to any container, say, just an ordinary suitcase, filled with radioactive material, which is exploded as part of a standard terrorist blast with conventional dynamite or RDX (Rapid Detonating Explosive). The material used in such an easy process could be a collection of any radioactive junk – bits of radiological sources stolen from cancer hospitals, research samples from universities, and so on. This is not fissile material – i.e. it cannot undergo fission and generate the immense explosion that a nuclear weapon creates. The dirty bomb is not an "atom bomb." i.e. it is not a nuclear fission weapon. The radioactive materials it uses are available in hundreds of

hospitals and research labs. These materials are far less seriously guarded than fissile materials. This makes their theft by terrorists much easier and more likely. Obviously, this is why terrorists may resort to using a dirty bomb, in the absence of a full-fledged fission weapon.

Consequently, at the second Summit in Seoul in 2012, there was considerable political pressure to include the security of all radiological materials, fissile or not, in the ambit of discussion. Added to this was the question of safety of nuclear reactors and other facilities. But while reactor safety and security of radiological materials are no doubt very important, it is not particularly useful to club them together with the security of fissile materials. Each is a different kettle of fish, for several reasons:

First, the potential damage they can cause is of altogether different magnitudes. A stolen five kg cache of some assortment of radioisotopes is far less catastrophic than a similar heist of five kg of Pu. The additional immediate fatality caused by the radioactive material in the bomb will not be significant. No doubt, there may be radiation-related illnesses developing later for people in the immediate vicinity. A fission bomb by contrast can kill 100,000 people in a populated area.

Secondly, radiological materials in a typical civilian facility like a hospital or university laboratory are generally in very small quantities, as distinct from the stocks of Pu or HEU which can be in kilograms, if not tons. To offset this, the number of such places where radiological materials are kept is huge, spread in about 100 countries distributed among 13,000 buildings.[10] Because of these differences, the measures needed to secure general radiological materials are also quite different. Nuclear agencies of individual countries already maintain some registry of such materials spread in different locations in their respective countries. In addition, IAEA has various programmes and reports for counselling nations on best practices on this front, and has for long been monitoring their implementation.[11] Of course efficacy of these measures varies from country to country and needs continuous improvement. The enhanced importance given to this activity at the highest political level by the Summits should greatly help in this.

Limitations of the Summit Process

Without taking anything away from the Nuclear Security Summits, they can be viewed as a very well managed set of exercises in the art of the possible. Their success was in part derived from their goals being kept relatively modest, compared to the massive task of getting rid of all nuclear weapon dangers.

Consider the hierarchy of steps that need to be taken to reach that larger goal, listed below in increasing order of difficulty:

a) Voluntary strengthening of Safety and Security (S&S) measures in a non-binding manner by nations, without peer review (this is what the Summits achieved);
b) Sharing of S&S measures with other nations and peer reviewing them;
c) Declaring existing stocks of nuclear materials without, and later with, verification;
d) Stopping further production;
e) Reducing stocks of fissile materials;
f) Reducing arsenal of weapons (disarmament).

Only the first step was addressed at the Summits and the larger, more contentious issues were

avoided. The unanimous resolutions at the Summits, supporting their goal of securing nuclear materials, was a little like supporting Motherhood and Apple Pie. After all, which nation would mind participating amicably in a very prestigious Summit, called by the then newly elected and very charismatic President Obama, in which all that the participants had to do was make voluntary, non-binding offers to strengthen the security of their own nuclear materials – something that they would in principle like to do anyway? But that was all that the market could have taken. Pushing for stronger commitments, even at the fourth Summit in 2016, would not have succeeded.

The Way Ahead

There are two separate lines of work that need to be pursued now that the Summit sequence is over. The first is to continue with the initiatives taken at the Summits. The second is to renew efforts on the steps listed above, that go beyond the Summits' mandate.

Building on the Progress Made at the Summits

Needless to say, it is very important to ensure that the enthusiasm for nuclear materials' security does not peter out now that the Summit process is over. The work of the Summits should be continued and consolidated.

Nuclear materials security experts and diplomats had started thinking about this even before the start of the 2014 Netherlands Summit, when it was not clear whether or not a fourth Summit in 2016 would take place.[12] Subsequently much has been written listing the actions that need to be taken. Many of them revolve around the IAEA as the natural agency for continuing the initiatives of the nuclear security summit process after 2016. Some of the suggestions are:

- The IAEA could take initiatives such as a "one stop shop" for information about global nuclear security efforts.
- It could set up a "dashboard" on its website to track member states' nuclear security achievements, as it has done in the case of nuclear safety.
- To enable IAEA to do this, all the summiteers should bolster the IAEA's authority and resources by providing it more financial, technical and personnel support.
- Nations should ensure nuclear transparency, as elaborated upon below.

A very important aspect of nuclear security is not merely installing effective measures, but also letting the world know about these measures. There is, of course, some conflict between security and transparency. As pointed out by the Special Dutch Ambassador for Counterterrorism, Piet De Klerk, in an interview with the Arms Control Association: "*The question is how you can provide information on the quality and effectiveness of your nuclear security systems to others – neighbouring countries, the public, international organisations, treaty bodies, what have you – without giving away operational details.*"[13] Countries need to find ways of providing this information without compromising security in any way. Ambassador De Klerk offered the example of inviting an IAEA team to review the security measures and certify that a country has indeed followed up on IAEA's recommendations. Another alternative is for some subset of nations which feel they can trust one another to periodically peer review one another's security measures.

Depending on their history, different countries have different levels of comfort with transparency on nuclear issues. India went through a long period of nuclear isolation because of sanctions and more generally for being a non-NPT member.

Depending on their history, different countries have different levels of comfort with transparency on nuclear issues. India went through a long period of nuclear isolation because of sanctions and more generally for being a non-NPT member. In such a siege situation, mutual trust can be a casualty. As a result, India did not publicly declare many of the nuclear materials security measures that it had in fact put in place, leading to an inadequate appreciation of those measures. A couple of years ago this was corrected by our government with the release of its nuclear security and safety procedures.[14] Around the same time, Dr. Rajeswari Pillai Rajagopalan from ORF, also published a detailed report on the subject.[15] One hopes that these reports will be updated as further improvements take place, such as the establishment of our independent nuclear regulating agency, currently under legislative process.

Beyond the Summit: Declaration of Materials Stock

After voluntary pledges to tighten security of nuclear materials, the next logical step would be to get nations to voluntarily declare their holdings of fissile materials of different categories. Clearly, if nations are unwilling to do even that, then the prospects of their agreeing to any kind of Fissile Materials Cut-Off Treaty (FMCT) (with or without a cut-off in production) will remain distant. However, there is no need in the first instance to seek a similar declaration of all radioactive materials – it is less important and procedurally a much more cumbersome exercise for states and would muddy the waters.

A couple of countries have already released such information. The US and the UK have declared the sizes of their total HEU-stockpiles as of 2002 and 2004 respectively. In addition, the UK and France annually declare their respective civilian HEU stockpiles.[16] But no other country has done so. The willingness of a state to reveal its fissile materials' holdings will depend on several factors.

- The status of the build-up of their nuclear arsenal in comparison to what they perceive as necessary for their national security.
- If, in their perception, further enlarging their arsenals now or in the foreseeable future may be necessary, whether their existing stocks of fissile material are comfortably adequate for that build up.
- The state of "nuclear confidence" of the country and its level of trust in the rest of the nuclear community. This is a more nebulous criterion, but nevertheless a very important one. There could be concern that publicising the stocks could invite pressure to roll back or foreclose options of producing more.

Given these constraints, it is not going to be easy to bring about this next step of voluntary declaration. It is not known if these options were discussed at the Summits or at the meetings of

national Sherpas that preceded them. Perhaps President Obama, with the inputs he got from his advisers, foreign leaders and their Sherpas, had decided from the outset that including this next step of declaration in the deliberations of the Summit, even at a voluntary level without any verification, would have vitiated the harmonious atmosphere of consensus and cooperation that prevailed at the Summits.

Voluntary declarations are of course the first step. Sooner or later they will have to be augmented by verification of the declarations. Finding methods of verification which are sufficiently non-invasive as to be acceptable to all nations will be a difficult political and technical challenge.

There has been a verification pilot project undertaken by the Nuclear Threat Initiative (NTI) involving experts from around the world. The result of the deliberations, in a series of meetings over a year, was published as an NTI report in 2014. It dealt with the verification of not only fissile materials but also of warheads in the arsenal. All aspects of declarations including the declaration process, the verification issues and the necessary techniques of nuclear archaeology were discussed.[17]

Conclusion

To conclude, the strides made this decade in raising global consciousness about the hazards of loose nuclear materials, and also in actually securing them, has been impressive. Credit must be given to the Nuclear Security Summits, the political leaders who participated in them and the diplomats who worked hard to make them a success. Equally, the several non-governmental organisations and individuals who contributed the intellectual input towards that goal, like the NTI and the Partnership for Global Security, should also be applauded. The advances made at the Summits must be pushed forward, the various pledges made brought to completion and institutions like IAEA funded better to strengthen their work on overseeing security. And lastly, it is also time to move beyond the agenda of the Summits to the next level of challenges in eliminating nuclear dangers. It would be unfortunate if the success in securing civilian fissile materials leads to a sense of complacency about the remaining nuclear hazards.

The strides made this decade in raising global consciousness about the hazards of loose nuclear materials, and also in actually securing them, has been impressive. Credit must be given to the Nuclear Security Summits, the political leaders who participated in them and the diplomats who worked hard to make them a success.

Endnotes

1 See the Global Fissile Materials Report 2015 of IPFM (GFMR 2015) at www.fissilematerials.org

2 For more details on the establishment of this US-Russia agreement see https://fas.org/nuke/control/fmd/chron.htm

3 Global Fissile Materials Report 2015 of IPFM (GFMR 2015) at www.fissilematerials.org

4 Ibid, Figure 3 of report

5 The fission process in the reactor produces a large number of neutrons. Some of these impinge on the U-238 nuclei in the fuel rods and convert some of them to Plutonium-239 through the nuclear reaction neutron + U-238 → Pu-239

6 See: 'Passive Aggressive Fight Against Plutonium Economy Continues Unabated' https://www.forbes.com/sites/rodadams/2016/09/27/passive-aggressive-fight-against-plutonium-economy-continues-unabated/#465e5a02702d; 'Plutonium Economy,' https://www.researchgate.net/publication/236515275_Plutonium_economy

7 Weapons generally require fuel with over 90% of the isotope Pu 239.This is produced by running reactors in a special way ("slow burn"). But the Pu produced in standard power reactors contains a mixture of some other isotopes of Pu as well, such as Pu 240, Pu 241 etc. It is generally referred to as Reactor grade Pu. The presence of these other isotopes makes it less ideal for weapon purposes... However, although less than ideal, Reactor Grade Pu can also be used to build warheads but they may be less reliable

8 Michelle Cann, Kelsey davenport and Jenna Parker, *"The Nuclear Security Summit: Accomplishments and Processes,* An Arms Control Association and Partnership for Global Security Report, March 2016, see also: https://partnershipforglobalsecurity.org/2016/02/26/the-nuclear-security-summit-accomplishments-of-the-process/

9 See: 2016 NTI Nuclear Security Index Report, http://www.nti.org/analysis/reports/2016-nti-nuclear-security-index-report/

10 A very informative discussion of measures to secure radiological materials is given in the report, *Preventing Nuclear Terrorism: Continuous Improvement or Dangerous Decline?*," Matthew Bunn, Martin Malin, Nickolas Roth, and William Tobey, Managing the Atom Project, Belfer Center, March 21, 2016.

11 See for instance*: "Nuclear Security Recommendations on Radioactive Material and Associated Facilities"* , IAEA Nuclear Security Series No. 14 (2011), and: http://www-pub.iaea.org/books/IAEABooks/8616/Nuclear-Security-Recommendations-on-Radioactive-Material-and-Associated-Facilities

12 See for example Trevor Findlay, "*Beyond Nuclear Summitry: The Role of the IAEA in Nuclear Security Diplomacy After 2016"* (Cambridge, Mass.: The Project on Managing the Atom, Belfer Center for Science and International Affairs, Harvard University, March 2014)

13 See: https://www.armscontrol.org/act/2013_12/Securing-the-2014-Summit-An-Interview-With-Dutch-Nuclear-Security-Summit-Sherpa-Piet-de-Klerk

14 "Nuclear Security in India," Ministry of External Affairs, Government of India booklet (2014)

15 "Nuclear Security in India" (2015), by Rajeswari Pillai Rajagopalan, Observer Research Foundation (ORF), New Delhi. See: http://securitystrategyrajagopalan.blogspot.in

16 GFMR 2015, op cit

17 "Verifying Baseline Declarations of Nuclear Warheads and Materials," NTI Report 2014 http://www.nti.org/media/pdfs/WG1_Verifying_Baseline_Declarations_FINAL.pdf

BILATERALISM AND NUCLEAR SECURITY

Dr. Huib Pellikaan and Dr. Niels van Willigen

The nuclear threat is a security dilemma in international politics,[1] and cooperation under a security dilemma is not just an academic or theoretical problem. It is foremost a policy problem that needs to be solved by foreign policy decision makers. However, to come up with a policy that increases nuclear security – which is to say, reduces nuclear arms – it is necessary to take a closer look at the dilemma. Following the work of Mancur Olson,[2] global nuclear security is best seen as a global public good in which states have an incentive to behave as free-riders. Refraining from any voluntary contribution to nuclear disarmament does not necessarily spring from self-regarding motives. It could be the result of a rational calculation that the policy of an individual state has no significant effect on the global nuclear threat.

This paper argues that it is highly unlikely that global nuclear security will ultimately be achieved through multilateral disarmament. It maintains that the global nuclear threat is best tackled through strategic dyads. It is much more likely that states will opt for nuclear disarmament in a bilateral setting than in a multilateral setting. In a bilateral setting, it is not possible to behave as a free-rider. The states involved are no longer pursuing an abstract global public good, but are addressing immediate national and bilateral security concerns. This paper elaborates on this argument by drawing on theoretical insights from game theory and by referring to the bilaterally driven nuclear disarmament process since the end of the Cold War.

Deterrence, Arms Control and Disarmament

Since the dawn of the nuclear age, deterrence has been a key component of strategic thinking. Political leaders from all over the world believe that deterrence is an effective strategy for protecting national security. A policy of 'peace through strength' led to a unilateral build-up of armaments and therefore to a mutual arms race during the Cold War.[3] The belief in deterrence also prevented the total elimination of nuclear weapons after the Cold War ended. Deterrence assumes that decisions are made in accordance with a rational cost-benefit calculus and that the

costs for the aggressor will exceed any possible gain.[4] Deterrence theory (in the broadest meaning of the term, also including non-nuclear deterrence and extended deterrence) has been tested on many different occasions, from very different angles, and with contradictory outcomes.

The debate between Huth and Russett on the one hand and Lebow and Stein on the other, in particular, became the focus of much attention among deterrence theorists. Huth and Russett found that extended deterrence was successful in about 60 percent of the 67 cases that they investigated.[5] Lebow and Stein attacked the findings of Huth and Russett, which sparked a debate on the effectiveness of deterrence.[6] The debate is still ongoing and has not yet led to unambiguous answers on whether deterrence works, and if so, under what circumstances.[7] What is clear at least is that Wohlstetter's remark in 1959, that deterrence is 'neither assured nor impossible,' is still valid.[8] Among theorists of the neorealist school of international relations as well as in most foreign policy circles, there is still a widespread belief in the effectiveness of deterrence. These beliefs are aptly summarised by the neorealist thinker Kenneth Waltz who claims that "nuclear weapons are in fact a tremendous force for peace and afford nations that possess them the possibility of security at reasonable cost."[9] This position led Waltz to advise policy makers to allow Iran to have nuclear weapons as it would restore stability in the Middle East.[10] However, the assuredness with which claims like these are made ignores that 'deterrence (…) is not automatic'[11] and underestimates the uncertainties and contingencies that influence the effectiveness of deterrence.

Since deterrence is a policy that maintains the nuclear threat rather than reducing it, an alternative approach is needed. This is where nuclear arms control comes in. Nuclear arms control is strongly connected to deterrence theory. Schelling and Halperin defined arms control as a foreign policy instrument to limit the arms race between opposing states. According to the authors, arms control is aimed at (i) 'the avoidance of a war that neither side wants,' (ii) 'minimizing the costs and risks of the arms competition,' and (iii) 'curtailing the scope and violence of war in the event it occurs.'[12] This conceptualisation makes nuclear arms control part of nuclear strategy in which deterrence plays a key role, but in which there can also be a place for what can be called functional disarmament (as opposed to general and complete disarmament). Deterrence is central to arms control and arms control without deterrence is unthinkable.[13] This becomes very clear not only from the writings of early thinkers about arms control, such as Schelling and Halperin, and Bull,[14] but also in the position of the four former US-politicians who gave the call for worldwide abolishing of nuclear weapons in January 2007 in the *Wall Street Journal*. George Schulz, Henry Kissinger, Sam Nunn and William Perry (nicknamed the 'Four Horsemen of the Nuclear Apocalypse') have always emphasised the importance of keeping a 'credible deterrent' while working towards global zero.[15]

Where arms control differs from mere deterrence is in its inclusion of functional disarmament. Functional disarmament is disarmament that serves the objectives of arms control. The Strategic Arms Reduction Talks (START) I and II are examples of arms control treaties that include agreements on disarmament. Disarmament in START I and START II (which never entered into force) was functional, because it was designed to help maintain a nuclear balance between the US and the Soviet Union.

Since national security (and not disarmament) is the primary objective of arms control, it could even involve the increase of arms if that leads to a better balance.[16]

Thus, functional disarmament stands in contrast to the third approach to the nuclear threat, which is general and complete nuclear disarmament. Next to the initiative of the 'Four Horsemen,' this approach is amongst others reflected in the Baruch Plan of 1946, US President Reagan's call for a world free of nuclear weapons in the 1980s, the 1996 report of the Canberra Commission on the Elimination of Nuclear Weapons,[17] US President's Obama's call for 'Global Zero' (see below) and the recently formed International Campaign to Abolish Nuclear Weapons (ICAN).[18] General and complete disarmament has a utopian connotation, because it assumes that states will rationally decide to eliminate a category of arms that clearly have strategic benefits. To different degrees, general and complete disarmament was successful with certain categories of weapons, including chemical weapons, biological weapons, anti-personnel landmines and cluster munitions. However, nuclear weapons form a different category. Not only because they provide strategic deterrence, but also because they bring prestige and influence to states that have them. That makes the general and complete disarmament approach hard to realise. The conclusion of the Treaty on the Prohibition of Nuclear Weapons (TPNW) in July 2017 is an important step forward in stigmatising the possession of nuclear weapons. However, its direct effect on the actual number of nuclear weapons in the world was limited, since the nuclear weapons states and their allies decided not to participate.

This paper argues that given the ambiguous findings on the effectiveness of deterrence and the utopian nature of general and complete disarmament, arms control is arguably the best approach towards increasing nuclear security. Arms control is based on (bounded) rational decision-making and risk analysis of possible future scenarios linked to national security. The arms control approach is consequentialist – i.e. based on utilitarianism – and it includes the logical possibilities of two extreme outcomes, namely nuclear security in case of success, and nuclear destruction in case of failure. Historically, the reduction of nuclear weapons was the result of bilateral initiatives between the US and the Soviet Union/Russia. The already mentioned START I and START II were preceded by the Strategic Arms Limitations Talks (SALT) in the 1970s and followed by the Strategic Offensive Reduction Treaty (SORT) in 2002. Also, the Intermediate-Range Nuclear Forces (INF) treaty was a bilateral agreement (and exceptionally also an example of general and complete disarmament, since it abolished an entire category of nuclear weapons). All these bilateral agreements were focused on American and Soviet/Russian national security considerations in the first place. That the

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agreements also contributed to global nuclear security was a (very positive) side effect.

It is different with the two multilateral agreements, which include general and complete disarmament provisions, namely the nuclear Non-Proliferation Treaty (NPT, 1968) (that includes Article 6 as the general and complete disarmament provision) and the TPNW (2017). These multilateral treaties aim for increasing global nuclear security through general and complete nuclear disarmament as a global public good (although it should be noted that this is much more the case with the TBNW than with the NPT). In the next sections, we use game theory to show why adopting a multilateral global public good approach is less effective than pursuing a bilateral national security approach.

The Problem of Nuclear Security as a Global Public Good

Following the call of the 'Four Horsemen,' former US president Barack Obama launched the ambitious goal for a nuclear-free world in April 5, 2009, in Prague, which became known as 'Global Zero.' This policy was a long-term strategy to abandon nuclear weapons and Obama was well aware that there was no easy fix. Like the TBNW, Global Zero represented an attempt at general and complete nuclear disarmament. This approach sees global nuclear security as a global public good. However, Olson[19] identified that a global public good is difficult to realise. If we assume that even if there is only one unwilling state, which does not share the common interest of global nuclear security, then the likelihood of attaining global nuclear security is very low. This is what US ambassador to the United Nations, Nikki Haley, referred to when she rhetorically asked whether anyone believes that North Korea would agree to support a global ban on nuclear weapons.[20]

On the other hand, even if we assume that there is no unwilling state and that all states share the common interest of global nuclear security, multilateral complete and general disarmament is not the logical outcome. Since global nuclear security is a global public good, it follows that rational and self-interested nuclear weapons states will not make voluntary contributions to realise it.[21] Even in an alliance of like-minded countries, such as NATO, the logic of collective action produces free-riding behaviour. Several studies confirm the thesis of Olson and Zeckhauser[22] that a large ally like the US shoulders the defence burden of smaller allies in an alliance.[23] It illustrates how widespread the problem of collective action is, which is explained by the observation that "it is commonly observed that small groups seem better able to cooperate amongst themselves than do large groups."[24]

Since global nuclear security is a global public good, it follows that rational and self-interested nuclear weapons states will not make voluntary contributions to realise it.

Olson's logic of collective action rules out a unilateral, voluntary contribution to general and complete disarmament by nuclear weapons states, even if all states were to benefit from it. Instead, it is more likely that free-riding and cheating will occur. Olson's argument is

supported by game theory, which shows that multilateral approaches are impaired by non-cooperative behaviour. We use the theoretical insights from the Chicken Game to illustrate this. The term 'Chicken Game' was coined by Bertrand Russell who compared the Cold War nuclear brinkmanship of US Secretary of State John Foster Dulles with a game of 'Chicken': 'Since the nuclear stalemate became apparent, the governments of East and West have adopted the policy which Mr. Dulles calls 'brinkmanship.' This is a policy adapted from a sport which, I am told, is practiced by some youthful degenerates. This sport is called 'Chicken!.'[25]

The original game as described by Russell has two players, each of whom has two strategies to avoid a collision (between car drivers, for example): Swerve (C) or Drive Straight (D). Figure 1 illustrates the Chicken Game in which the highest preference of each player is to be the winner (4) and the lowest preference is a frontal collision of the cars (1). The second preferred outcome is that both players swerve to avoid a crash (3) and the third preference is to be the 'Chicken!' which indicates the car driver who decides to swerve whereas the other car driver decides to drive straight (2). The preference ordering of each player is therefore 4 > 3 > 2 > 1. The distribution of the payoffs of the players leads to the payoff matrix shown in Figure 1.

Russell uses the metaphor of the Chicken Game to discredit political leaders who behave like irresponsible boys in the nuclear stand-off. This is not necessarily the case in all strategic interactions. In Game Theory, the Nash equilibrium – conceptualised by the mathematician John Forbes Nash – is a stable state reached between players, but where no player has an incentive to change the strategy that has led him to the equilibrium. But there are two Nash equilibria in the above matrix: outcome (4, 2) and outcome (2, 4). If the game had only one equilibrium, each player would have chosen the strategy that leads to it. The problem with the Chicken Game is that there are *two* equilibria, and each equilibrium is on the path of one of the two strategies. If each player wants to realise the equilibrium with his highest payoff, then player 1 will play strategy (D) (Defect) and player 2 will play strategy D as well and the result will be a frontal collision (1, 1). Both players end up with the worst possible outcome if each player aims at his personal best Nash equilibrium. This means that realising a Nash equilibrium is no longer a useful maximising rule for making a rational choice when there are multiple equilibria.

One way to avoid the negative outcome of the Chicken Game is by using so-called 'mixed

Figure 1: Chicken Game

		player 2	
		C swerve	D drive straight
player 1	C swerve	3, 3	2, 4
	D drive straight	4, 2	1, 1

strategies' to realise a mixed strategy Nash equilibrium. In this case, each player randomises his strategy to avoid the frontal collision of the Chicken Game. When players randomise their strategies, they are indifferent between their strategies and transform the Chicken Game into the Matching Pennies game.[26] The solution to the Matching Pennies game is that each player should choose a probability of 0.5 for each strategy (because the players are indifferent between their strategies). So, the notion of mixed strategies is like distributing for each outcome a lottery ticket with 25 percent chance of becoming the actual outcome of the game. This solution of a mixed equilibrium should be rejected, because responsible political institutions and leaders will ignore the option if the game represents a conflict situation that involves nuclear weapons. One could extend Einstein's expression 'Gott würfelt nicht' (God does not play dice)[27] by stating that political leaders of a nation do not play dice when it comes to using nuclear weapons.

Once the Nash equilibrium and the mixed strategy Nash equilibrium are no longer guidelines for maximising utility, there is only one rational solution left: the 'maximin strategy.' The maximin strategy for each player is the strategy that avoids the worst possible outcome for that player.[28] The maximin strategy is aimed at maximising one's minimum gain and leads to the status quo that existed during the Cold War (3, 3) as the solution of the game. During the Cold War, the two major powers cooperated in spite of their differences to avoid nuclear war. However, if one increases the number of players from two to three or even more, and thus switches from a bilateral to a multilateral setting, the game changes fundamentally. We explain the dynamics of the multilateral setting by discussing a three-person Chicken Game as represented by the cubes in Figures 2 and 3.

In the three-person Chicken Game, the positions of Players 1 and 2 remain the same and Player 3 makes a choice between Strategy C (cooperate) on the front of the cube and Strategy D (defect) at the back of the cube. The payoffs of the three players are presented in the three-dimensional cube and the distribution of the payoffs of the players in the cube in Figure 3 is based on the same rules as in Figure 1. In the rows, the payoffs of player 1 are presented first, the payoffs of player 2 second and the payoffs of

Figure 2: A three-dimensional three-person game: the cube

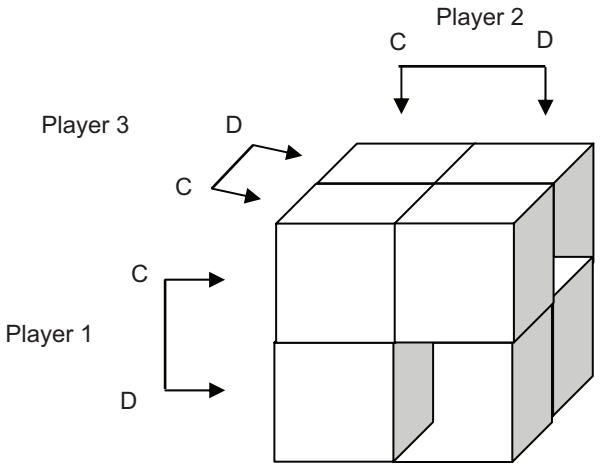
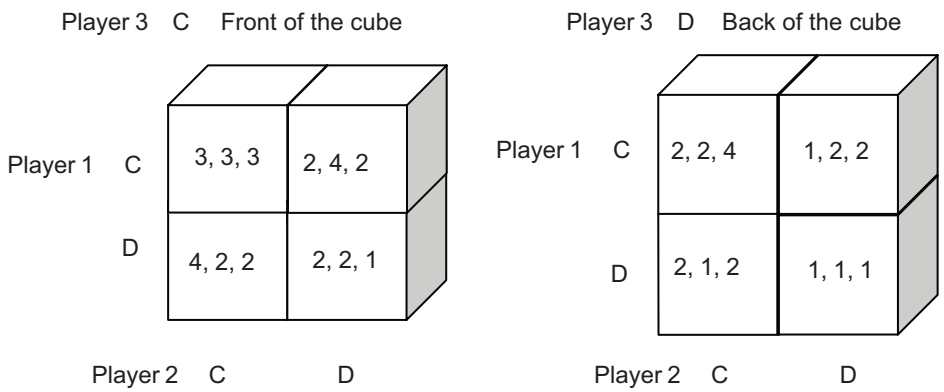


Figure 3: The three-person Chicken Game



player 3, third. The three-person Chicken Game does not have mutual cooperation as a solution. Each player in the three-person Chicken Game has a *weak* dominant strategy Defect and the outcome of the game is mutual defection, the cell at the back of the cube at the bottom right cell (1, 1, 1).

This game is a simple example showing that the best move of a player changes if the setting changes from a two-person situation to a three-person situation. If we add more players, the strategy Defect will become a *strong* dominant strategy. The game illustrates that the best move in a security dilemma depends on the number of players. The setting of a two-person Chicken Game represents a situation of a bilateral kind, while the three-person game shows what will happen in a multilateral situation. The potential willingness to cooperate will decrease when the number of players (states) increases.

Bilateral and Multilateral Nuclear Security

In the former section, we represented a game-theory argument showing that in a bilateral situation, (bounded) rational actors opt for a maximin strategy. It leads to a suboptimal outcome (the security dilemma does not disappear), but it is at least an outcome under which actors are prepared to cooperate in nuclear arms control arrangements to avoid the worst outcome, which is nuclear war. This theoretical argument is supported by historical empirical evidence. As mentioned, the SALT, START, INF and SORT initiatives were bilateral and were responsible for decreasing the number of nuclear weapons to a fourth or a fifth of the stockpile in the heyday of the Cold War. Multilateral initiatives such as the NPT, or the still non-operational Comprehensive Nuclear Test Ban Treaty (CTBT), have been relatively successful in limiting the spread of nuclear weapons and reducing the number of nuclear tests respectively, but they have not contributed to nuclear disarmament. Nonetheless, multilateral initiatives such as these are often considered the better option and morally preferable over bilateralism. In this view, bilateralism and multilateralism are seen as mutually exclusive diplomatic processes. Bilateralism would primarily promote the 'particularistic interests' of states whereas multilateralism would be norm-driven, diplomacy based on 'generalised

Multilateral initiatives such as the NPT, or the still non-operational Comprehensive Nuclear Test Ban Treaty (CTBT), have been relatively successful in limiting the spread of nuclear weapons and reducing the number of nuclear tests respectively, but they have not contributed to nuclear disarmament.

principles of conduct' producing 'diffuse reciprocity.'[29]

The dichotomy between bilateralism and multilateralism is a false one. Thompson and Verdier[30] have convincingly shown that in many instances both bilateralism and multilateralism are needed to have a strong international regime. They point out that multilateralism also has its inefficiencies, which in the end cause states to opt for bilateralism in addition to the multilateral agreement(s) that they have concluded. While the clear advantage of multilateralism lies is in lowering transaction costs, its disadvantage is that it creates member surplus. Thompson and Verdier explain member surplus as the difference between the multilaterally agreed upon incentives provided by the treaty and the individual incentives of the participating states. Because the scope of the incentives of a multilateral treaty is determined by the state that has the highest compliance costs and thus is least willing to participate, there are always individual states that would have signed the treaty even if the incentives were less advantageous. Since multilateralism offers one general deal for all, there are always states that have a member surplus. Verdier mentions Mexico, Ecuador, Peru, Bolivia, Senegal, and Morocco as countries that 'would probably have given up the nuclear-weapon option for much less than offered by the NPT.'[31] At the same time, the NPT also includes countries that needed extra compensation in the form of multilateral security guarantees (Norway, for example, by NATO) or bilateral security guarantees (Japan, for example, in the form of an alliance with the US) before they would support the NPT.[32] Member surplus is not an issue in bilateral agreements, because it is inherent to the bilateral process that two states can tailor the agreement.

The choice for multilateralism or bilateralism is determined by the levels of transaction costs and member surplus. The higher the transaction costs and the lower the member surplus, the more attractive multilateralism becomes. The opposite is also true: the lower the transaction costs and the higher the member surplus in case a multilateral approach would be chosen , the more attractive bilateralism is. The nuclear non-proliferation regime is illustrative of the third possible outcome in which transaction costs and member surplus are both high and in which bilateralism and multilateralism both occur.[33] Verdier argues that the 'inefficiency of multilateralism' is a cause for bilateralism.'[34] It explains, for example, why bilateral security guarantees were made to non-nuclear weapons states in addition to the NPT. This argument can be taken one step further by pointing to the regularly occurring practice of bilaterally preparing and implementing multilateral agreements. The roots of the NPT, for example, lie in an informal bilateral agreement between the USSR and the US in 1966. At the time,

only these two major powers were involved, and the UN's Committee of Disarmament was excluded.[35] Thus the origins of the multilateral NPT include bilateral elements. It shows that bilateral agreements can be a necessary first step to creating multilateral agreements.

Conclusion

Strategic dyads, bilateralism, functional disarmament and arms control are all important for progress towards nuclear security. However, that does not mean that the multilateral approach should be abandoned. Multilateral structures provide the context within which bilateral negotiations take place. The norms and principles of the nuclear non-proliferation regime are important guidelines for bilateral initiatives. New informal initiatives such as the Non-Proliferation and Disarmament Initiative (NPDI), which among other objectives, aims to strengthen the IAEA safeguards system and increase transparency in nuclear disarmament, are crucial for keeping up diplomatic pressure on nuclear weapons states. However, it is very unlikely that multilateral agreements will sufficiently contribute to nuclear disarmament. In spite of the existing multilateral agreements and the recent adoption of the TNPW, the pace of nuclear disarmament has slowed down, relations between the US and Russia as the largest nuclear powers have deteriorated, India and Pakistan have intensified their strategic nuclear arms race, North Korea's nuclear tests and ballistic missile programme is high on the international agenda and nuclear weapons states are modernising their arsenals. Within this context, disarmament is more likely to succeed within a bilateral context of strategic nuclear rivalry rather than within the multilateral context of general and complete disarmament initiatives such as the TPNW. When nuclear security is approached as a global public good, problems associated with collective action, such as free-riding, occur. The Game of Chicken illustrates that even when only one additional state is added to the bilateral setting, achieving nuclear security becomes much more problematic. There is no guarantee that an arms control policy, based on strategic dyads, will work, but it is a more realistic option, as evidenced from the game theory argument and historical empirical evidence.

When nuclear security is approached as a global public good, problems associated with collective action, such as free-riding, occur. The Game of Chicken illustrates that even when only one additional state is added to the bilateral setting, achieving nuclear security becomes much more problematic.

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MISCHIEF UNDER THE NUCLEAR UMBRELLA

Dynamics and Implications

Dr. Nicolas Blarel

This essay focuses on the implications of terrorism for global nuclear security, but from a different perspective than the existing literature. Generally, academics and policy-makers discussing the links between terrorism and nuclear weapons have focused on the potential for nuclear proliferation through non-state networks, or of terrorist attacks on nuclear infrastructure. What has been neglected is how non-state actors can (directly or indirectly) attempt to provoke the conditions for a crisis between state actors which have nuclear capacities. Recent crises in South Asia, Eastern Ukraine and the Middle-East have demonstrated that non-state actors can have a disruptive effect in the context of disputes between states. While terrorism and non-state activity might emerge from varying sources across the regions, this essay argues that inter-state dynamics in reaction to these crises need to be analysed and compared. The objective of this paper is to offer a comparative analysis of the management of such terrorist-initiated crises as well as to provide policy recommendations for global efforts and mechanisms to further limit the risks of escalation.

While nuclear weapons deter state leadership from going to war for various reasons, can we assume that non-state actors operate on the same working assumptions?

Discussions of nuclear proliferation within academics and policymakers' circles have generally focused on the nuclear theft threat.[1] Until now, global joint efforts to prevent and counter nuclear smuggling through the Global Partnership, the Global Initiative to Combat Nuclear Terrorism (GICNT) and the Nuclear Suppliers Group, have been relatively successful. Nevertheless, the debate on nuclear-armed terrorism, which has dominated the recent Nuclear Security Summits, tends to partly distract our attention from other actions by non-state actors that raise the risk of nuclear war, the consequences of which would far exceed the results of terrorist attacks. While nuclear

weapons deter state leadership from going to war for various reasons, can we assume that non-state actors operate on the same working assumptions? While nuclear-armed terrorism is improbable, it is also necessary to consider other "nuclear" options for non-state militant actors.

For instance, the increasing numbers of cross-border terrorist strikes on military and civilian targets on Indian soil have led to fears of triggering escalation, which could culminate in a nuclear conflict between India and Pakistan.[2] Similarly, the proliferation of insurgent non-state actors in other regions with nuclear-armed rivals has created concerns about the implications of crises initiated by terrorist actions. The proliferation of insurgent non-state actors in the former Soviet republics have increasingly nurtured tensions between Russia and the Eastern European states and NATO allies, leading to renewed concerns about escalation.[3] Finally, while most scholars have emphasised the adverse consequences of a nuclear proliferation cascade initiated by a latent or nuclear-armed Iran, few have considered how nuclear aspirations and tensions in the region have informed the actions and strategies of non-state actors like Hezbollah.[4]

These kinds of incidents seem to demonstrate the limits of utilising traditional theoretical approaches like deterrence stability to analyse contemporary nuclear terrorism dynamics. How does one cope with non-state actors who are either supported by a nuclear-weapon state (NWS) or are based on the home territory of a NWS? To date, academic studies of nuclear deterrence, proliferation, and stability have focused upon dyadic confrontation and the possibility of large-scale wars, while neglecting the role of non-state actors in provoking crises under the nuclear umbrella.

Existing deterrence theories might even produce opposite effects in varying contexts. The South Asian security context, for instance, presents a much more complex environment than a simple dyadic confrontation between India and Pakistan. First, it involves a series of previously overlooked non-state actors that have increasingly shaped the strategic calculations of New Delhi and Islamabad. The crises of December 2001, of November 2008, and more recently of September-October 2016, were all set off by attacks from non-state actors. This paper investigates the implications of these complex nuclearised environments involving multiple state and non-state actors.

This paper proceeds in four sections. The first section outlines the major attempts to move beyond traditional models of nuclear stability that are less applicable to complex environments involving regional rivalries and non-state actors. The second discusses the need to expand the concept of nuclear terrorism to take into account the role of non-state actors under the nuclear umbrella. The third section draws insights from the literature on the deterrence of terrorism to model the dynamics between states and sub-state actors in nuclearised regional contexts. The final section suggests avenues of further research.

Moving Beyond Traditional Assumptions

The notion of deterrence and its theoretical foundations emerged from the experience of the US-Soviet nuclear confrontation. Much of this literature has focused on bipolar opposition, and on the implications of the nuclear revolution in reducing large scale wars. Traditional theories of nuclear deterrence relied on the assumption that nuclear competition confronted

two unitary, rational actors. Building on these notions, nuclear 'optimists,' such as Kenneth Waltz, argued that the continued proliferation of nuclear weapons had the potential to reduce the recurrence of conflict.[5] The argument was that the possession of nuclear weapons raised the costs of conventional conflicts, increased the risks of escalation, and therefore *deterred* leaders from engaging in war against nuclear-armed states. By contrast, other scholars have been more sceptical about the alleged stabilising effects of nuclear weapons, notably in the context of preventive wars, crisis instability, and accidental nuclear detonation.[6] According to these nuclear 'pessimists,' the possession of nuclear weapons actually contributes to greater levels of international instability.

The spread of nuclear weapons to new players in the 1990s, which were not superpowers in the international order, also encouraged scholars to reassess the conventional wisdom. Moving away from the US-Soviet confrontation and parsimonious models derived from game theory[7], some scholars attempted to resume the debate on the effects of nuclear deterrence on stability in new dyadic settings like the India-Pakistan nuclear confrontation.[8] However, by trying to translate the same theoretical debate to new and different contexts, the existing scholarship has overlooked some important factors, especially whether nuclear proliferation may have varying effects on the behaviour and strategies of international actors other than the state. Waltz and Sagan debated over whether the aggregate spread of nuclear weapons had been good or bad for international and regional systems as a whole, but did not seriously consider whether nuclear proliferation may have actually increased the strategic space for non-state actors.

Building on traditional deterrence assumptions, some have argued that while nuclear weapons did not *prevent* the outbreak of bilateral crises, they did *limit* the escalatory potential of these crises. For instance, India's restraint in different crises such as the Kargil war and the December 2001 terrorist attack on its Parliament reflected its overriding concern to limit escalatory potential so as not to provoke a nuclear Pakistan.[9] Some of the mentioned factors which disturbed traditional nuclear stability arguments were not only the existence of a longstanding regional rivalry and territorial dispute between India and Pakistan[10] but also the increasing activity of non-state militant outfits.[11] The conditions of regional rivalries and non-state militancy are hardly specific to the South Asian subcontinent but can be equally observed in Eastern Europe and the Middle East.

Building on this, some scholars have emphasised the differential effects of nuclear proliferation over certain regions and actors. This scholarship claimed that not all nuclear states act the same way and that state intentions ultimately inform the way nuclear-armed states behave. New studies tried to explain how the possession of nuclear weapons actually facilitated limited or proxy wars.[12] These works build on the concept of "stability-instability paradox" to criticise the strategic stability argument of deterrence.[13] Some scholars have argued that the conditions of this phenomenon were, for instance, present in South Asia: the nuclearisation of the subcontinent could be perceived as an insurance policy against the most dangerous types of escalation, thereby encouraging war-making below the nuclear threshold.[14]

This new scholarship, sometimes labelled as 'strategic pessimism,' posed a stronger challenge to the optimist's core logic by arguing that the acquisition of nuclear weapons not only did not

limit conflict, but had adverse effects. In regions with conventional military balances which had been correlated with a relative absence of major conflicts, nuclear weapons could actually embolden states with traditional revisionist ambitions into risk-acceptant behaviour, which could then lead to the outbreak of lower-level crises.[15]

Strategic pessimism's main theoretical contribution has been to provide new access points to trace and understand the initiation and escalation processes of nuclear crises that were mainly ignored by a deterrence literature which had largely concentrated on nuclear weapons capacities and emphasised the relatively benign outcomes of nuclear disputes. Nevertheless, it can be argued that this scholarship has not systematically analysed the origins and consequences of non-state activity which decisively affects deterrence calculations. While the growing role of non-state actors in provoking nuclear standoffs has been mentioned in the South Asian subcontinent[16], it was not elaborated upon. Non-state actors are only integrated in both approaches as proxies presumed to act more or less directly at the behest of a revisionist Pakistani state. This mostly state-centred point of view then overlooks the possibility of crises with escalatory potential provoked by non-state actors with independent agendas. This paper argues that future studies will have to assess the interference of non-state actors on nuclear security in a more systematic manner.

A Different Facet of Nuclear Terrorism? Non-state Actors and Crisis Escalation

Most studies looking at terrorism with nuclear implications in the post-cold war period have concentrated on the possibility of a terrorist attack using a nuclear bomb.[17] This scholarly and policy attention to nuclear terrorism followed the revealed intention of some terrorist groups, including Al Qaeda, to procure and use a nuclear device.[18] The relevance of nuclear terrorism was further emphasised because these groups operate in, or are located close to, states with a proliferation record, or a history of questionable nuclear security practice like Pakistan.[19]

However, there is a consensus among academic and policy analysts that the concern over nuclear-armed terrorism has often been exaggerated.[20] For instance, Keir Lieber and Daryl Press argued that states would only consider transferring nuclear weapons to non-state groups if this allowed them to escape some of the existing constraints of deterrence. According to this logic, nuclear attack by proxy is a way to attack a common enemy while evading the risks of conflict escalation and the costs of possible retaliation. However, Lieber and Press concluded from their study that neither a terrorist group, nor their state sponsor, would remain completely anonymous after a nuclear attack. Consequently, they claimed that attribution of nuclear attacks remains possible, including in the cases of terrorists using the bombs. Conscious of the risks of proliferation and of direct traceability to them, Pakistan (and especially its army command and control structure) has, for example, closely and openly cooperated with the US to safeguard its nuclear arsenal.[21]

Consequently, most accounts of nuclear terrorism have failed to include other types of support that Nuclear Weapons States (NWS) can provide non-state actors – such as the provision of a nuclear umbrella. As a result, while nuclear proliferation to non-state actors is unlikely, nuclear terrorism can take other understudied

forms. The mainly accepted definition is the one given by the International Convention on the Suppression of Acts of Nuclear Terrorism (ICSANT), held in 2005, which specified the act of nuclear terrorism as "the use or threat to use nuclear material, nuclear fuel, radioactive products or waste, or any other radioactive substances with toxic, explosive, or other dangerous properties…. in order to kill or injure persons, damage property, or the environment, or to compel persons, States, or international organizations to do or to refrain from doing any act."[22] This conceptualisation is limited as it does not take into account the possibility that non-state actors may seek to advance their own agendas through operations under the nuclear umbrella. Non-state actors can, for instance, operate from within NWS, thereby limiting the possibility of direct reprisals following their attacks. This is a component of nuclear terrorism which needs to be further studied.

The most immediate threat is the role of non-state groups acting with complete impunity because of the nuclearised environment. There has been a long history of Pakistani-sponsored militants against Indian interests starting immediately after Independence. The resort to these non-state proxies can be explained by two factors. First, due to limited internal resources and extraction capabilities, the Pakistani government has sought to counter-balance the dyadic asymmetry with India by resorting to militant proxies.[23] Second, more recently, Christine Fair also argued that the Pakistani army's strategic culture has also led Pakistan to favour Islamic militant groups – such as Lashkar-e-Taiba (LeT) and Jaish-e-Mohammad (JeM) – as regular instruments to contest India's hegemony and the territorial status quo in Kashmir.[24]

Over time, further emboldened by the nuclear umbrella as strategic pessimists have argued, Pakistan-backed militant groups have launched increasingly aggressive terror operations in India.[25] Examples are the LeT attack on the Indian Parliament while it was in session on December 13, 2001, and a series of carefully planned attacks against civilians in Mumbai in November 2008. Accused by India of helping and harbouring terrorists, Pakistani authorities have either denied links with the perpetrators of the attacks, or placed their leaders under house arrest, like Hafiz Mohammed Saeed, the head of the LeT's charitable front organisation.

While Pakistan has originally benefited from this asymmetric warfare strategy, scholars now argue that militant organisations like the LeT no longer completely share the aims and/or serve the interests of their sponsor and host state.[26] A group like the LeT now has a broader global ideological agenda, going beyond revisionist territorial ambitions in Indian Kashmir.[27] Some jihadi organisations in Pakistan like the Tehrik-e-Taliban (TTP) have also turned against the Pakistani government because of its cooperation with US anti-terrorism efforts.[28] However, one would need to disaggregate the varying levels of influence that Pakistan has over these different groups – direct (Afghan Taliban and the Haqqani network), indirect (LeT) or limited (JeM).[29]

Pakistan is hardly the only country to have used non-state actors in the context of nuclearised environments. Other states have resorted to the same means to promote their strategic agendas, whether it was to attempt to revise the territorial status quo, expand their regional influence, or to weaken a rival. Iran has historically used Hezbollah to advance its interests in Lebanon and Syria. The US had supplied the Afghan Mujahedeen with extensive operational support

against the USSR in the 1980s.[30] More recently, Russia has also resorted to supporting non-state proxies to try and maintain or extend its political influence within the former Soviet Union. The use of non-state groups was explicitly designed to contain the conflict locally and to limit the possibility of escalation, as there still are major disparities between Russian forces and a conventionally superior and nuclear-armed NATO.[31]

As a result, whether a terrorist group is operationally and ideologically autonomous, or the proxy of a state actor, it is fair to say that the most imminent threat will come from major diplomatic crises with escalatory potential instigated by these non-state actors. Under conditions of persistent bilateral tensions and significant crisis instability, the escalatory conditions are ripe for terrorists to either operate (as a proxy) with impunity through the protection of the nuclear umbrella, which inherently limits any possible military reprisals.

Coping with Terrorism under the Nuclear Umbrella: Insights from the Scholarship on Deterrence of Non-State Actors

Nuclear postures are traditionally designed to discourage another state from taking military action by making the prospect of costs outweigh prospective gains. But what happens if a third party such as a transnational non-state actor (like LeT) enters the equation? In the traditional logic of deterrence, the deterring state signals credible nuclear threats, which then make terrorist attacks– sponsored or originating from the deterred state – prohibitively expensive. Instead, the fear of nuclear escalation offers limited strategic options for retaliation.

Whether a terrorist group is operationally and ideologically autonomous, or the proxy of a state actor, it is fair to say that the most imminent threat will come from major diplomatic crises with escalatory potential instigated by these non-state actors.

Non-state groups can be undeterred for two main reasons. First, these groups may can have no national and/or ideological links to the host-state and may not share the same interpretation of the costs and benefits that are presumed to guide state authorities.[32] (Adler 2009). Second, these non-state actors are well-equipped to resist conventional retaliation due to their small and secretive structures, and because of the absence of a traceable "return address" against which states can directly retaliate. In a nuclearised environment, terrorist groups can also evade direct military retribution because of the probability of a subsequent escalation.[33] Because of these two factors, non-state actors are not directly affected by considerations of nuclear stability and security.

This situation leads states to react in varying ways to preserve the credibility of their nuclear deterrent. States can, for instance, choose to recast the strategic interaction into a traditional deterrence confrontation between two states. A strategy of coercive diplomacy on the host-state can be implemented to emphasise the important risks of permitting continued terrorist attacks

being organised from its soil. To some degree, India attempted to use this traditional deterrence strategy during the 2001-2002 crisis to pressure the Pakistani government into reining its home-based terrorist groups.[34] Another possibility is for states to perform a limited retaliatory strike on terrorist groups within the host-state's territory. The assumption is that such a limited and targeted strike can limit the possibility of crisis escalation. The Indian government also opted for this strategy of surgical strikes on carefully selected terrorist targets across the border following the attack in September 2016 by the Pakistan-based JeM on an Indian Army base located in the Kashmir town of Uri.[35] The situation in South Asia is hardly unique and India's strategic dilemma is comparable to the one facing other states coping with transnational terrorism such as Israel.[36] Under what conditions are reprisals against terrorist groups considered 'limited' and not leading to military escalation? How can states be deterred from sponsoring and/or harbouring terrorist factions?

The long-term risks of directly using, or being indifferent to, terrorist groups operating on one's territory, need to be highlighted to the sponsor or hosting state. Terrorist groups are situational partners and can prove difficult to control. For instance, terrorist organisations in Pakistan have increasingly begun to act autonomously and in ways which are directly undermining Pakistani national interests – such as targeting political leaders and security personnel, or developing ideological agendas which exceed Pakistan's objectives of bogging down Indian forces in Kashmir.[37] Similarly, Russia's proxy strategy has proven costly as non-state actors in Ukraine shot down Malaysian Airline flight MH17, prompting both the US and the EU to increase sanctions against Moscow. While terrorism under the nuclear umbrella is seemingly beneficial in the short term for certain states discontented with the territorial and military status quo, it also implies important costs in the long term.

Conclusion: Nuclear Security in a Complex Environment

Understanding and managing the problem of terrorist activity in the context of a nuclearised environment has proved a complicated and understudied task. The first claim of this paper is theoretical: the role of non-state actors in fomenting crises with escalatory potential between nuclear dyads needs to be further explored. Nuclear terrorism should be re-conceptualised to include this additional and more likely option that terrorists can resort to. Admitting the rise of new kinds of actors whose organisational structure, motivations and strategies differ sharply from those of the states backing them, is also recognition of the theoretical and policy challenges to traditional nuclear security.

Second, existing multilateral and bilateral control regimes need to adapt to the new risks. Encouraging regular and institutionalised dialogue between nuclear rivals may provide opportunities to address the challenges posed by complex security dynamics more effectively. This is not a completely unique situation, as it could be argued that the US and USSR faced similar issues in the initial stages of their nuclear weapons programmes. While it could be argued that Cold War models did not explicitly integrate the problem of non-state actors, the two rivals did learn to rein in the actions of their bloc allies and to put into place dialogue mechanisms to limit any escalation. Further research in early Cold War doctrines, command and control mechanisms, and gradual understandings of red

lines can provide some important insights.[38] As the probability of unprovoked crises increases, countries need to establish direct channels of communication to limit the risk of escalation. Repeated and unremitting interactions can help create the conditions of a nuclear learning process, which could ensure greater caution in policy and attempts at resolving the underlying bilateral disputes which generally feed the legitimacy of terrorist groups.

Finally, the condemnation by international organisations of terrorist groups which exploit such nuclearised environments is also an important means of emphasising the diplomatic and reputational costs for a sponsor or hosting state. The recent BRICS Xianmen declaration of 4 September 2017 condemning a series of extremist groups, including the Haqqani network, LeT, and JeM, as well as President Donald Trump speech of 21 August 2017 criticising Pakistan's negative influence in Afghanistan, have led to a public debate in Pakistan over the strategic and political merits of its policy towards non-state proxies.[39]

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INDIA'S CONTRIBUTION TO GLOBAL NUCLEAR SECURITY

Dr. Reshmi Kazi

Emerging threats in the form of the Islamic State of Iraq and Syria (ISIS), proliferation risks emanating from Pakistan and China, along with increasing demands for civil nuclear energy and technology, present a complex matrix that makes the threat of nuclear terrorism a tangible possibility. India takes cognisance of this threat and acknowledges "the magnitude of the potential danger of terrorists finding their way, while acting on their own or with the help of revanchist elements, to nuclear instruments."[1] The primary objective of India's nuclear security policy is to prevent, detect and effectively respond to any unauthorised access, divergence or sabotage of nuclear weapons, materials, or their associated facilities.[2] This objective outlines the fundamental and essential agenda of India's nuclear establishment to prevent the occurrence of any nuclear incident. In conformity with this objective, India has made distinctive exertions in strengthening national efforts on nuclear security.

The threat of use of dangerous nuclear materials by terrorists is gradually emerging as a tangible reality. This paper explores India's commitment to building improved and upgraded robust nuclear security architecture at the national and global levels. To achieve this, India has undertaken various initiatives, and is oriented towards their implementation in a systematic manner. Finally, this paper attempts to study how India is contributing to developing a sustainable mechanism to mitigate nuclear risks, and combat one of the greatest threats to global security.

India's Contribution to Strengthening Nuclear Security

India's nuclear programme, which has been ongoing for more than five decades now, remains remarkably unmarred by any single untoward incident. The credit largely goes to India's pragmatic nuclear policies. India has a meaningful approach to nuclear security, which strongly emphasises reduced salience on the acquisition of nuclear weapons and materials. India perceives nuclear technology and nuclear materials primarily as a resource for meeting a part of its electricity requirements.[3] The word "primarily" implies that India has a committed

intent of using nuclear materials and technology for social and economic development.

This is not to say that India's nuclear ambitions lack any strategic purpose. The stress, however, is on the limited utility for purposes other than social and technological development.[4] India's nuclear programme is premised upon this cardinal understanding. Any state policy that intensifies the salience of nuclear weapons provides a potential pathway for horizontal and vertical proliferation of nuclear weapons. However, a nuclear policy that projects and maintains a modest utility and demand for nuclear materials and technology will be significantly diminishing the probability of their illicit diversion and consequent proliferation risks. India adheres to a dedicated nuclear policy that is devoid of any vigorous nuclear material and technology production, which considerably mitigates proliferation concerns. This, in essence, underscores India's responsibility to identify and assess nuclear security threats, and adopt the highest physical protection measures to safeguard its nuclear assets.[5]

Despite having had no untoward nuclear security incident, India has been perseverant in continuously improving and upgrading its national nuclear security. Nuclear security is an ongoing process that should be pursued without complacency. India continues to strive towards implementing higher standards of nuclear security. At the 2016 Nuclear Security Summit (NSS), India committed to joining three "gift baskets."[6] These included a 'contact group,' comprising 53 countries, entrusted with the responsibility of monitoring the implementation of the various decisions of the Summit. India has expressed willingness to sign the Joint Statement on Strengthening of Nuclear Security Implementation, circulated by the International Atomic Energy Agency (IAEA) as INFCIRC/869.[7] This will be a new mechanism for improving security of nuclear materials and facilities, development of proliferation-resistant technologies and strengthening of export controls. India is also willing to support a "countering nuclear smuggling" mechanism that aims to dismantle nuclear black markets and halt smuggling of nuclear and other radioactive materials. This mechanism will function through an exchange of credible information and implementation of strict national laws. It is a useful mechanism for fostering nuclear security diplomacy among stakeholders.

India has also agreed to be part of the network of Nuclear Security Training and Support Centres (NSSCs) and Centres of Excellence (CoEs). Honouring its commitment at the 2010 NSS, India has set up the Global Centre for Nuclear Energy Partnership (GCNEP), where off-campus courses have already begun. The School of Nuclear Security Studies, part of the GCNEP, started on-campus courses from August 2017 in Bahadurgarh, Haryana.[8] The CoE is an effective mechanism to implement the outcomes of the NSS process. It plays a commendable role in reinforcing institutional and enforcement measures to strengthen security of nuclear and radioactive materials and their related technologies. The GCNEP is reflective of India's nuclear security culture and also its rising nuclear security standards.

For the purposes of this paper, nuclear security is defined as, "the prevention and detection of, and response to, theft, sabotage, unauthorised access, illegal transfer or other malicious acts involving nuclear or other radioactive substances or their associated facilities."[9] India has laid out a specific roadmap dedicated to attaining this objective by developing robust nuclear security

India's roadmap to nuclear security comprises five elements – governance, institutions, technology, international cooperation, and nuclear security practice and culture.

architecture. The aim is to protect people, property, and the environment, and provide the highest standards of security. India's roadmap to nuclear security comprises five elements[10] – governance, institutions, technology, international cooperation, and nuclear security practice and culture. Various measures have been undertaken in each of these five aspects.

Nuclear Security is a National Responsibility

India deems nuclear security an integral aspect of national sovereignty that demands national responsibility. It believes implementation of national action plans and effective international cooperation is an essential requirement to prevent terrorists from endangering nuclear security and destabilising regional stability and international peace. The IAEA has said that it is the responsibility of each state to implement effective national systems for nuclear security that will reinforce the peaceful use of nuclear energy, and contribute to international efforts to mitigate the threat of nuclear terrorism.[11] India has reinforced the IAEA recommendations by accepting all its 13 universal instruments as essential benchmarks for a state's commitments to combat international terrorism. India is party to the Convention on the Physical Protection of Nuclear Material (CPPNM) of 1980 and has ratified the 2005 Amendment to the CPPNM as well. By adhering to these international legal instruments, India has demonstrated its commitment and responsibility to "establish, implement and maintain an appropriate physical protection regime applicable to nuclear material and nuclear facilities under its jurisdiction."[12] India is also a signatory to the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT) of 2005. India's adherence to, and support of, these international legal instruments demonstrates its commitment to pursuing measures that facilitate implementation of the highest standards of physical protection for its nuclear materials and facilities against any unauthorised access or sabotage. It also demonstrates India's willingness to cooperate with the international community to build an improved and upgraded nuclear security system.

India's Legal and Regulatory Governance

The legal basis of nuclear security in India is the Indian Atomic Energy Act (AEC), 1962, that extends legislative and regulatory governance to all usage of radioactive substances and technologies and nuclear installations. The AEC regulates both the safety and security of sensitive nuclear and radioactive materials, which consequentially facilitates developing an interface between safety and security. The Act contributes in formulating and regulating laws and rules governing export controls of nuclear and radioactive substances and related technologies. India has also set up separate institutions dedicated to ensuring the security of its nuclear facilities. For example, there is the

Nuclear Control and Planning Wing (NC&PW), whose primary function is to harmonise the safeguards, export controls and nuclear-related activities within the Department of Atomic Energy (DAE). The NC&PW, in collaboration with the Ministry of External Affairs, assists in international nuclear security cooperation. The DAE has also brought out a security manual of security of critical infrastructure for its various critical facilities.[13]

Again, there is the Computer Information and Security Advisory Group (CISAG), which was designed to ensure protection against extensive application of information technology and cyber threats. India also has a Crisis Management Group (CMG), whose responsibility is to inspect and assess all information relating to any nuclear and radiological incidents within the country. There is a conscious and continued effort to counter and reduce cyber attacks, and facilitate better functioning of instrumentation systems at various installations. The CISAG and CMG constitute a fully developed system, playing a definitive role in improving and upgrading nuclear security.

On the legislative side, India has harmonised its Special Chemicals, Organisms, Materials, Equipment and Technologies (SCOMET) list with that of the Nuclear Suppliers Group (NSG). India aspires to be a member of existing technology control regimes to contribute to strengthening the nuclear security system and further bolstering its non-proliferation objectives. In 2005, India enacted the Weapons of Mass Destruction (WMD) and their Delivery Systems Act that provides "overarching and integrated legislation prohibiting unlawful activities in relation to WMD and their delivery systems." The 2005 Act fulfilled[14] India's mandatory obligations under the United Nations Security Council (UNSC) Resolution 1540[15]. India has also established a Counter Nuclear Smuggling Team that criminalises individuals or group of individuals involved in illicit trade of nuclear or radioactive material for malevolent purposes. This institutional mechanism has a multi-agency approach, coordinating with concerned ministries, departments and agencies. The objective is to address and combat the global threat of nuclear smuggling through effective response mechanisms. The team meets frequently and conducts table-top exercises to improve its capabilities.

No doubt, countering nuclear illicit trafficking can only be successful through regional and international cooperation. Thus, ahead of the 2016 NSS, an Interpol Counter Nuclear Smuggling conference was held in France in January 2016, emphasising mitigation of the illicit trafficking of nuclear and other radiological materials through "comprehensive, coordinated response from key global actors."[16] As a cooperative partner of Interpol's Radiological and Nuclear Terrorism Prevention Unit and the World Customs Organization, India played a constructive role in shaping the Action Plan at the 2016NSS. India has committed to effective cooperation on interdiction of nuclear material trafficked outside of regulatory control. Further, India supports the international law enforcement agency's efforts to trace the movement of transnational criminals involved in the smuggling of nuclear or other radioactive materials. India thus supports the NSS's objective of combating nuclear smuggling and strengthening global nuclear security.[17]

Radioactive sources have vast applications in day-to-day life, and must be adequately safeguarded from any misuse or illicit diversion into terrorists' hands. The Atomic Energy

Regulatory Board (AERB) has established stringent guidelines as safeguard measures to diminish the probability of terrorists using radioactive materials. The regulatory body through continuous oversight insists on the development of a dedicated cadre of efficient and highly trained specialised manpower for the purpose.[18] The stringent regulatory practices and standards adopted by the AERB to protect India's weapons and usable nuclear and radiological materials, was peer reviewed by the IAEA's Integrated Regulatory Review Service (IRRS) Mission in March 2015. The peer review certified that the AERB takes full benefit from operational experience, with the aim of continuously enhancing its regulatory framework and processes.[19] It recognised the strength of AERB's regulatory practices and capabilities. The IRRS acknowledged the AERB as an experienced, knowledgeable and dedicated regulatory body for the protection of the public and the environment.[20] At present, India is persevering to transform the de facto functional independence of AERB into de jure autonomy through a Nuclear Safety Regulatory Authority (NSRA). The relevant bill is under consideration for re-introduction in Parliament. The draft bill specifies measures to enhance AERB's functional autonomy, and further upgrade operational policies to regulate nuclear and radiation safety.

The AERB has proficiently functionalised the e-LORA (e-Licensing of Radiation Applications) system to facilitate the automation of regulatory processes related to the licensing of facilities using radiation at any stage.[21] The objective is to enhance efficiency and transparency, while operationalising a paperless licensing process for radiation facilities all over India.

To further reinforce the legislative framework, India has formed the National Investigation Agency. The NIA, set up through the NIA Act, 2008, promulgated in the aftermath of the November 2008 Mumbai terror attacks, is a counter terrorism law enforcement and investigation agency at the national level. The NIA has played a crucial role in timely busting of several ISIS terror modules operating in the country, and has initiated investigative proceedings to trace the terror roots. It is invested with powers to deal with offences pertaining to the Atomic Energy Act, the Unlawful Activities (Prevention) Act and the Weapons of Mass Destruction (WMD) and their Delivery Systems Act, 2005.[22] The NIA Act takes into account India's obligations to the CPPNM. The NIA aims to become a centre of excellence in counterterrorism and other national security related investigations by developing a highly trained, partnership oriented workforce.[23] The agency seeks to create a database of all terrorist related information matching the best international standards. India's national legislative requirements are harmonised with its commitment to the international community to build strong nuclear security architecture.

Relevance of Science and Technology

The relevance of science and technology in implementing the best standards of physical protection cannot be overlooked. The "overall objective is to reduce the magnitude of the problem of security of nuclear materials."[24] India has embarked upon vigorous efforts to develop and employ sophisticated technology to defend itself against nuclear terrorism. As stated in India's National Progress Report on the Nuclear Security Summit 2016, Indian nuclear scientists have suggested use of Low

Enriched Uranium (LEU) instead of High Enriched Uranium (HEU) to pre-empt the threat arising from the misapplication of HEU. India's technological initiative to substantially mitigate the dangers from unauthorised use of weapons-grade fuel is in sync with the aims of the global nuclear security community. The CIRUS nuclear reactor in India, which used HEU, was thus shut down permanently in 2010. The planned replacement reactor will not use HEU.[25] In another instance, efforts are underway in India to set up a facility to produce medical grade Molybdenum-99 (Mo-99) by the uranium fission route using LEU targets.[26] In short, India has a closed fuel cycle that ensures security measures for nuclear materials to the highest protection standards. India's efforts in developing proliferation-resistant technologies are a significant contribution to strengthening nuclear security.

India has sophisticated detection architecture to prevent, detect and respond to any nuclear or radiological incidents and accidents. There is a network of 24 Emergency Response Centres (ERCs) dedicated to detect and respond to any nuclear or radiological emergency. Efforts are on to install more radiation portals and detection equipment to maintain vigil on all passenger vehicles, as well as cargoes at all the major sea ports and airports. The Bhabha Atomic Research Centre (BARC) and DAE officials handled the Mayapuri incident of 2010 with utmost sensitivity to prevent any large-scale panic in Delhi.[27] India remains committed to developing and promoting the technological dimension of nuclear security not only to combat the threat of nuclear terrorism but also to safeguard against cyber intrusion and sabotage.

India perceives international cooperation as a fundamental requirement to maximise the benefits of individual states' responsibilities, and build robust and sustainable global nuclear security architecture.

India and Global Collaboration

While accepting that nuclear security is a national responsibility, India perceives international cooperation as a fundamental requirement to maximise the benefits of individual states' responsibilities, and build robust and sustainable global nuclear security architecture. India recognises the importance of sharing best practices, training methods and expertise to enhance awareness of nuclear and radiological dangers. India has upheld efforts to foster international collaboration, and has supported IAEA activities in furthering effective cooperation among all stakeholders to strengthen nuclear security. India extended support to the fifth revision of the INFCIRC/225 recommendations on physical protection of nuclear material and nuclear facilities. India is a participant state in the IAEA's Incident and Trafficking Database (ITDB), and has actively encouraged international cooperation for sharing of information on illicit trafficking of nuclear and radioactive material. It has supported and voluntarily adopted the provisions of the IAEA Code of Conduct on the Safety and Security of Radioactive Sources. India has cooperated with, and supported, the review of its Pressurised Heavy Water Reactors by the "Operational

Safety Review Teams" (OSART) mission conducted by IAEA experts.

India proposed a workshop on IAEA's International Physical Protection Advisory Service (IPPAS) with the agency's experts in 2016.[28] The IAEA-GCNEP National Workshop on IPPAS from 04-06 December 2017 in Haryana,[29] conducted an international training course on the Physical Protection of Nuclear Material and Nuclear Facilities. Its purpose was to apprise participants of the existing concepts and current technologies pertaining to physical protection of nuclear materials that will assist them to establish and implement appropriate security programmes in their respective countries in sync with the Convention on the Physical Protection of Nuclear Material and its 2005 Amendment. Similarly, in the IAEA International Conference on Nuclear Security in December 2016, India acknowledged, "the extent of the critical danger [of nuclear terrorism] and emphasised upon the need to be equally clear about the depth, breadth and clarity of [India's] response."[30] In 2013, India contributed $1 million to IAEA's Nuclear Security Fund and had proposed to contribute a similar amount in 2016 as well. In addition, India made a voluntary contribution of $100,000 in 2015 for the modernisation of IAEA's nuclear applications laboratories in Seibersdorf, Austria under the ReNuAL project.[31]

As part of rendering support to the international community for evolving robust policies on nuclear terrorism, India is a Party to the Global Initiative to Combat Nuclear Terrorism (GICNT) and has contributed in all three working groups of the GICNT in the areas of Nuclear Detection, Nuclear Forensics, and Response and Mitigation. On 8-10 February 2017, the Implementation and Assessment Group (IAG) of the GICNT met in New Delhi. Given the changing threat dynamics, India recognised that if access to nuclear technology changes a country's behaviour, it would expectedly also impact non-state calculations.[32] India believes that with expanding globalisation, it would be a futile effort to combat the threat of nuclear terrorism in isolation. The GICNT provides an effective forum to build a cadre of nuclear security experts who can contribute to developing a consistent and coherent approach to building varying degrees of security for nuclear and radiological materials and enhance the physical protection of nuclear facilities to combat nuclear terrorism. The 2017 IAG-meeting held seminars on important topics like International Assistance Requests that primarily focused on the outcomes of the workshop at "Kangaroo Harbour,"[33] Australia, in May 2016 – where best practices in managing the challenges associated with requesting and receiving international assistance on nuclear security were discussed. A seminar on the legal framework focused on the hurdles encountered in adapting national legal codes to address criminal activities involving radioactive materials.[34] The IAG-meeting also discussed existing challenges to source security and determine if the GICNT should support related activities.[35] Notably, various sessions at the IAG-meeting emphasised the importance of developing sustainability programmes for national nuclear security frameworks including operational training, strengthening knowledge management programmes and meeting challenges involved in the adoption and implementation of national legislation for building robust global nuclear security architecture.[36] An important aspect of the February 2017 IAG-meeting was the emphasis laid by Dr R. B. Grover, Member, Atomic Energy Commission of India, on the importance of developing proliferation resistant technological options that strengthen nuclear security.[37] It is equally important to improve and

upgrade the security of radioisotopes that could be separated from spent fuel as a measure to mitigate the threats to nuclear security.

GCNEP – India's Nuclear Centre of Excellence

To achieve the objectives of a safe and secured nuclear system and combat the existing challenges to physical security of nuclear materials and facilities, India announced the establishment of the GCNEP in 2010. The GCNEP is visualised as a state-of-the-art facility premised upon international participation from the IAEA and other interested foreign partners. The GCNEP has signed memorandums of understanding and other cooperation arrangements with the IAEA, France, Russia, the US, the UK[38] and Vietnam.[39] This centre will become an important platform for India to interact with the world community in all aspects of peaceful uses of nuclear energy, including nuclear security, safety and non-proliferation.[40] The GCNEP seeks to promote support international cooperation in nuclear energy applications and facilitate the establishment of "extensive facilities" related to advanced education, research and training in the field of proliferation-resistant nuclear system designing in nuclear power plants, nuclear security, radiological safety, nuclear material characterisation and applications of radiation technologies and radioisotopes.[41] The centre will also focus on improved technologies for cutting-edge nuclear energy systems, advanced nuclear forensics and establishment of accreditation facilities for radiation monitoring. It is expected to be an effective forum to highlight India's progress and development in the field of nuclear safety, security and advanced nuclear and radiation technologies. It has already conducted several programmes to build capacity in technology training and human resource development for the purposes of enhanced nuclear security. The GCNEP is expected to provide a platform for research to participants from India as well as foreign countries. Its agenda also includes imparting training to Indian and international participants on various aspects of nuclear and radiological terrorism; conducting international seminars and group discussions by experts; and conducting of courses in association with interested countries and the IAEA. The CoE has played an important role in its security outreach, imparting training to more than 300 national and international participants from around 30 countries on important aspects of nuclear security. These include physical protection of nuclear materials and facilities, radiological emergencies, nuclear forensics, insider threats, vulnerability assessments, transportation security, cyber security, disaster management and response mechanisms. The GCNEP will have five specialised schools[42] that, "promote safe, secure and sustainable nuclear energy for the service of mankind through global partnership,"[43] thus upholding India's pledge to be a "responsible nation with advanced nuclear technology"[44] by harnessing ways to explore international nuclear best practices.

Nuclear Security Culture

India's nuclear security efforts are oriented towards developing sustainable nuclear security architecture with the primary objective being prevention, detection and response to any nuclear or radiological emergency. The purpose is to prevent occurrence of any nuclear incident including diversion, sabotage, or unauthorised access or other malicious acts involving nuclear or other radioactive materials or their associated

facilities. India believes that the expansion of nuclear power also requires a well-structured specialised human resource development programme.[45] Towards that end, the nuclear security culture in India is firmly grounded on the fundamental premise which ensures that personnel, organisations and institutions remain consistently vigilant. It is equally important that stringent security measures are implemented and practiced by the personnel manning the various departments of the nuclear establishment in India. An effective and sustainable nuclear security culture must be embedded in the rules, legislations, regulations, intelligence agencies, threat assessment departments, cyber units, and response and mitigations facilities. A robust nuclear security culture essentially requires every single person in a facility being conscious of nuclear security, and aware that each one of them is responsible for the security. This is the core essence of the nuclear security culture in India. The objective is to establish proficient domestic nuclear governance, accountability, transparency, safety and security as core tenets of responsible nuclear culture, capable of generating confidence among the members of the international community about the high standards of India's nuclear security policies.

Conclusion

The road to developing a secure and sustainable mechanism for a strong nuclear security system is a difficult one. Since security cannot be 100 percent foolproof, the roadmap for nuclear and radiological security drawn by India is not a final one. India's objective is to develop essential mechanisms and take appropriate measures to upgrade and improve the nuclear security framework on a constant and continuous basis. To achieve this objective, the security culture of the country must reflect the efficacy of its security framework. The IRRS-team recommended that there is a need for India to focus on, "certain issues warranting attention or in need of improvement" and was of the view that, "consideration of these would enhance the overall performance of the regulatory system."[46] These "issues" include promulgation of a national policy for safety, a radioactive waste management strategy; independent regulatory body status to the AERB, increased frequency of routine on-site inspections at nuclear power plants and developing an emergency response role for the AERB.[47] India takes the recommendations in all seriousness and is engaged in improving and upgrading in these areas. In addition, India is currently engaged in upgrading its detection architecture and response mechanisms to prevent and respond to any nuclear or radiological incident, anywhere in the country. India also considers it important to formulate a national policy and strategy for managing radioactive wastes. As a responsible nuclear weapons state, India has demonstrated its commitment to attaining high-standards of nuclear security at the national level. India's consistent efforts to strengthen nuclear security indicate its intent to build robust and sustainable nuclear security architecture not only at the national but also at the global level.

India is currently engaged in upgrading its detection architecture and response mechanisms to prevent and respond to any nuclear or radiological incident, anywhere in the country.

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ROLE OF EXPORT CONTROLS FOR NUCLEAR SECURITY IN INDIA

Dr. Rajiv Nayan

The very notion that denying non-state actors nuclear materials, equipment and technology will reduce the risk of nuclear terrorism connects export control to nuclear security. In fact, export control and nuclear security have an old link. For a long period, the international community feared the possibility of terrorists acquiring, transporting or using 'radioactive materials or sources in radiological dispersion or emitting devices.'[1] This resulted in making export controls more than mere safeguards to be adopted over the items included in the Nuclear Suppliers Group (NSG) 'trigger list.' Over decades, controls have become 'safeguards plus,' because of the adoption of additional tools relevant to addressing new challenges. In sum, export controls have emerged as one of the tools in fighting nuclear terrorism.

The threat of nuclear terrorism, or the possibility of non-state actors acquiring nuclear weapons, has been around for a long time. Yet the 9/11 incidents – though they did not actually involve any nuclear weapons – caught the international imagination, and forced the global community to introduce several new measures to fight the menace of nuclear terrorism. This was also the time when clandestine nuclear transactions led by Pakistan were haunting the world. The apprehension that clandestine nuclear transactions may provide an easy route to nuclear terrorism made the international community launch a joint global strategy to fight both nuclear terrorism and the clandestine proliferation network. As a result, all the initiatives instituted since then continue to take into consideration both these challenges. These initiatives include United Nations (UN) resolutions and their subsequent implementation, to the reworking of existing international law and reorienting international organisations. In all these measures, the role of export controls has been considered critical.

India has been a victim of terrorism for decades. For this reason, the Indian government decided to endorse, "all the 13 universal instruments accepted as benchmarks for a State's commitments to combat international terrorism"[2] by the International Atomic Energy Agency (IAEA). It also understands the perils of nuclear terrorism and clandestine proliferation for its national as well as international security.

India has signed and ratified both the treaties on nuclear security: the Convention on the Physical Protection of Nuclear Materials (CPPNM) and its 2005 amendment, and the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT).

India supports the Code of Conduct on the Safety and Security of Radioactive Sources. India has been actively campaigning for universality of the conventions and the code. Needless to add, its own rules and regulation reflect these two treaties and the Code. India has also supported the fifth revision of Information Circular 225 (INFCIRC/225), as also reviews and modifications of other nuclear security documents. India is a participant in IAEA's 'Incident and Trafficking Database (ITDB): Incidents of nuclear and other radioactive material out of regulatory control.' The scope of the ITDB "includes, but is not limited to, incidents involving illegal trade and movement of nuclear or other radioactive material across national borders. The scope also covers incidents involving unauthorised acquisition (e.g. through theft), supply, possession, use, transfer or disposal—intentional or unintentional—of nuclear and other radioactive material with or without crossing international borders."[3] The Indian government shares in entirety the global concern on likely cracks in nuclear security. In a statement, the Indian government stated, "We have not wavered in our commitment to global efforts to prevent the proliferation of weapons of mass destruction [WMD] and their means of delivery. India has never been a source of proliferation of sensitive materials and technologies. We are proud of our record on nuclear security and nuclear non-proliferation but we are not complacent. We are prepared to further strengthen our export control systems in line with the highest international standards."[4]

This paper examines how export control is contributing to nuclear security at the global level, as well as how the Indian export control system has been shaped to deliver nuclear security. It specifically looks at the role of UN Security Council Resolution (UNSCR) 1540, the Nuclear Suppliers Group (NSG), the Nuclear Security Summits, the IAEA, the Global Initiative to Counter Nuclear Terrorism (GICNT) and finally India's own evolving export control framework.

UNSCR 1540 – under Chapter VII of the UN charter, and resulting in the UN resolution of 28 April 2004 – remains one of the most significant initiatives ever taken.

United Nations Security Council Resolution 1540

UNSCR 1540 – under Chapter VII of the UN charter, and resulting in the UN resolution of 28 April 2004 – remains one of the most significant initiatives ever taken. A committee set up under it has been implementing its mandate. The binding resolution instructs that "all States shall refrain from providing any form of support to non-State actors that attempt to develop, acquire, manufacture, possess, transport, transfer or use nuclear, chemical or biological weapons and their means of delivery."[5] The resolution also asks for adopting and enforcing of 'appropriate effective laws,' directing member countries to formulate national laws and regulations to deal with illicit trafficking, end-user controls, brokering, transit, trans-shipment and re-export

of nuclear material, and controls on providing funds and services to terrorists.

UNSC Resolution 1540 has resulted in internationalisation of export controls. Prior to its passing, export controls were perceived as a tool used by industrially advanced countries, predominantly those from the Western bloc. The developing world was initially critical of UNSCR 1540. However, it has reconciled to the resolution because of the need to fight nuclear and other weapons of mass destruction (WMDs). Under UNSCR 1540, countries were asked to take the help of a matrix developed by the 1540 Committee and submit reports on the status of their WMD control. The cumbersome matrix, consisting of best practices, was nonetheless helpful to countries in finding gaps in their systems.

India has also been playing an active and constructive role in implementing UNSCR 1540. Admittedly, in the beginning, India was also sceptical of the resolution and sided with the Non-Aligned Movement (NAM) group of countries, which opposed it on the grounds that that the UN Security Council was not the appropriate body to make international law. However, realising the dangers of WMDs, India joined other countries in supporting the resolution and has been taking measures to implement it. A 27 April 2004 letter from India's permanent representative to the UN, addressed to the president of the Security Council, summed up Delhi's evolved position on UNSCR 1540.[6] India in the letter conveyed "unwavering commitment" to efforts in fighting WMD proliferation.

Since the passage of UNSCR 1540, India has been making efforts to strengthen it and its committee. It not only backed the formation of the 1540 Committee, but also supported different resolutions extending its tenure, such as the UNSCR 1977 that extends the Committee's term until 25 April 2021. The resolution requires the Committee to conduct two reviews every five years. The reviews, which have been conducted till 2016, had full Indian support. India supported the comprehensive review of the functioning of UNSCR 1540 as well. It also maintains that broad-based representation on the 1540 Committee would add to the Committee's strength. In particular, Delhi has supported the idea of wider representation from the NAM countries on the 1540 Committee. India has submitted reports to the UNSCR 1540 Committee. The first two reports were general in nature, but India complied when the Committee asked countries to file their national reports using the Committee's matrix. India has continuously updated its reports, taking it as a great opportunity to showcase its legislative, regulatory, and enforcement frameworks before the international community. At the same time, filing reports and subsequent assessments have also made India realise that gaps linger in its export control structure.

As to the implementation of UNSCR 1540, India had to fill in the gaps in its legislative system. To do so, it passed the WMDs and their Delivery Systems (Prohibition of Unlawful Activities) Act in 2005. On a number of occasions, Indian officials have stated: "Specifically, the WMD Act fulfils India's obligations pursuant to the UNSCR 1540 on non-proliferation of weapons of mass destruction by prohibiting the possession, manufacture, transportation, acquisition, development of nuclear weapons, chemical weapons or biological weapons by non-state actors." The very preamble of the Act makes it clear that, "India is committed to prevent a non-State actor and a terrorist from acquiring weapons of mass destruction and their delivery

systems."[7] Article 9 of the Act explicitly states: "No person shall, directly or indirectly, transfer to a non-State actor or terrorist, any material, equipment and technology notified under this Act or any other Act related to relevant activity."[8] Significantly, Article 15 of the same act lays down the provision for punishment if a supplier violates this law. Article 15 provides, "Any person who, with intent to aid any non-State actor or terrorist, contravenes the provisions of Section 9 of this Act, shall be punishable with imprisonment for a term which shall not be less than five years but which may extend to imprisonment for life, and shall also be liable to fine."[9]

This act introduced several global good practices for WMD control into the Indian regulatory system. With the WMD Act, the Indian export control system now has transit and transhipment controls, retransfer controls, technology transfer controls, brokering controls, and end-use-based controls. The act also led to changes in other laws like the Foreign Trade (Development & Regulation) Act. This amended act now incorporates technology and services within its scope. It helps India to properly implement and enforce the general objectives of UNSCR 1540 by providing statutory authority to the government's licensing and customs departments.

An Indian official stated at a seminar on UNSCR 1540 in Delhi in February 2014: "Measures for the implementation of the resolution [UNSCR 1540] should be undertaken by the states based on their national practices and processes. Assistance and cooperation for states requesting such assistance is a key element of the implementation process. Such assistance programs should be suited to the specific national or regional requirements."[10]

Nuclear Suppliers Group

The nuclear export control regime, it seems, was aware of the challenge of nuclear terrorism and the need for nuclear security since its very inception. When the Nuclear Suppliers Group (NSG) was being set up in the 1970s, the participating countries discussed tools to prevent nuclear terrorism and the possibility of the theft of nuclear materials. Actually, the famous National Security Decision Memorandum 255 signed by then US Secretary of State Henry Kissinger on 3 June 1974 had stressed the need for "… establishing agreed international guidelines, preferably based on US practice, to ensure the physical security of weapons useable and highly toxic materials whether internationally transferred or indigenously produced."[11]

Though the NSG is reorienting itself to meet nuclear security challenges, its guidelines, from the very beginning, had the provision for physical protection of nuclear materials. Para 3 of the current Part 1 NSG guidelines lays down: "(a) All nuclear materials and facilities identified by the agreed trigger list should be placed under effective physical protection levels to prevent unauthorised use and handling, consistent with the relevant International Atomic Energy Agency (IAEA) recommendations, in particular those set out in Information Circular (INFCIRC)/225. (b) The implementation of measures of physical protection in the recipient country is the responsibility of the Government of that country. However, in order to implement the terms agreed upon amongst suppliers, the levels of physical protection on which these measures have to be based should be the subject of an agreement between supplier and recipient. (c) In each case, special arrangements should be made for a clear definition of responsibilities for the transport of trigger list items."[12]

Even Para 13 of the Part 1 guidelines prescribes international co-operation in "physical security through the exchange of physical security information, protection of nuclear materials in transit, and recovery of stolen nuclear materials and equipment."[13] It encourages its participants and adherents to accept and implement international instruments such as the Convention on the Physical Protection of Nuclear Material, and the implementation of INFCIRC/225, as amended from time to time. It explicitly mentions that these measures are required for "preventing the proliferation of nuclear weapons and countering the threat of nuclear terrorism."[14]

Since the 9/11 terrorist attacks in the US, the NSG, in its plenary meetings, has been highlighting nuclear terrorism as an evolving threat, which needs to be addressed by its participating countries. The first plenary meeting of the NSG after the attacks took place on 16-17 May 2002, in which the challenge of nuclear terrorism was emphasised. The NSG plenary declared that the regime would provide "its contribution to preventing and countering nuclear terrorism."[15] The same meeting underscored the significance of "information sharing capabilities within the regime."[16] Thereafter, the fifth revised version of the NSG guidelines incorporated several elements which were considered relevant to fight nuclear terrorism.[17] In fact, the 2002 plenary documented: "… effective export controls are an important tool to combat the threat of nuclear terrorism."[18] Later, in 2013, too, the NSG plenary issued a press release in which it informed that the plenary "agreed to amend relevant part of Paragraph 3.a and Annex C of the Part 1 Guidelines to reference recognized IAEA recommendations for physical protection…."[19] The NSG asked its participant countries to incorporate several measures such as transit and brokerage controls in their export control systems.[20] Writings on the subject have consistently highlighted the importance of these issues in the context of nuclear security.[21] In 2009, the plenary decided to develop best-practice guides to manage intangible transfer of technology (ITT) and end-use control.[22] The NSG has continuously been promoting outreach activities, and has also decided to develop a best practice guide for outreach activities.

What has India done vis-à-vis the NSG? As discussed, the NSG, over the years, has incorporated elements for terrorism-related controls. India has completely harmonised its export controls guidelines and its Special Chemicals, Organism, Material, Equipment and Technology (SCOMET) list with those of the NSG. The Indian licensing system ensures that an item on the SCOMET list does not fall into wrong hands. The procedure for processing of applications for licence for export of SCOMET items asks licensing authorities to assess risk, so that exported items do not fall into "hands of terrorists, terrorist groups, and non-State actors."[23]

Paragraph 2 of the Indian "Guidelines for Nuclear Transfers (Exports)" reflects the NSG guidelines.[24] It bans export of any material which may lead to development of nuclear weapons. When items are transferred for peaceful purposes, the guidelines prescribe "effective physical protection to prevent unauthorized use and handling." This paragraph also recommends fixing of responsibilities when any item is transported. The subparagraphs of the para 2 lay down: (i) "The levels of physical protection to be ensured in relation to the type of materials, equipment and facilities, shall be as per the recommendations of Government of India or as agreed upon in the international conventions, to

which India is a party."; (ii) The implementation of measures of physical protection in the recipient country is the responsibility of the government of that country. However, the levels of physical protection on which these measures have to be based, shall be the subject of an agreement between the supplier and the recipient."[25]

Nuclear Security Summits

The Nuclear Security Summit (NSS) process also underscored the need for export control to fight nuclear terrorism and promote nuclear security. All the four nuclear security summits starting with the Washington summit of 2010 and culminating with the Washington Summit of 2016 documented the need for export control for nuclear security. For example, the 2012 NSS communiqué writes:

> "Noting that several countries have passed export control laws to regulate nuclear transfers, we encourage further utilisation of legal, intelligence and financial tools to effectively prosecute offenses, as appropriate and consistent with national laws. In addition, we encourage States to participate in the IAEA Illicit Trafficking Database program and to provide necessary information relating to nuclear and other radioactive materials outside of regulatory control. We will work to strengthen cooperation among States and encourage them to share information, consistent with national regulations, on individuals involved in trafficking offenses of nuclear and other radioactive materials, including through INTERPOL's radiological and Nuclear Terrorism Prevention Unit and the World Customs Organization.[26]

India has participated in all the four Nuclear Security Summits. On three occasions, its delegations were led by the Prime Minister. The Indian government participated constructively in the preparatory/Sherpa meetings for the Summits. In these meetings, the Indian government supported the consensus-based communiqués. These communiqués prescribed strengthening of export control mechanisms to fight nuclear terrorism. The Indian government has also submitted National Progress Reports, in which it enumerated steps it had taken to strengthen nuclear security. Of late, it has also started participating in gift baskets such as Joint Statement on Sustaining Action to Strengthen Global Nuclear Security Architecture and Joint Statement on Countering Nuclear Smuggling.

Among the many announcements made by the Indian government at the NSS in 2010, the one to set up the Global Centre for Nuclear Energy Partnership (GCNEP) is significant. The GCNEP has five schools. One of these is the School of Nuclear Security Studies. The school wants to develop as a "world class research and development, test and evaluation, information security, training and exercise facility for different areas of nuclear security to national and international audience. Further, in this age of rapid technological developments, constant research and development is the most important requirement to keep abreast with the latest technology."[27] For sure, this kind of technology will be helpful in detecting clandestine transactions. False declaration has been one of the challenges of export control implementation throughout the world.

The GCNEP courses train security personnel in legal and regulatory systems and best practices.[28] Personnel and material access control, security for transport of radioactive material practices

in India;[29] detection, interdiction and response to nuclear security threats; guidelines for preparation of Standard Operating Procedures for detection and interception; prevention and responses to radiological and radiation threats; a multi-agency approach to react to nuclear security threats;[30] physical protection of nuclear facilities, including vulnerability analysis; guiding principles for applying computer security controls, are some of the themes covered in the GCNEP courses. The GCNEP has also organised nine workshops to impart training on physical protection, including one for the Bangladesh Atomic Energy Commission; eight workshops for prevention and responses to radiological and radiation threats and incidents; and a few more on insider threats, nuclear forensics and nuclear security culture. A number of Asian and non-Asian participants attended these workshops. The GCNEP collaborated with foreign partner organisations in the conduct of some of them.

International Atomic Energy Agency

The IAEA has also been active in promoting nuclear security for a long period. In fact, even before the summit process started, the IAEA had done some remarkable work. Now that the summit process has ended, there is a large section of the international community that calls for the centrality of the IAEA in nuclear security. It has already been holding meetings, including ministerial-level meetings, and publishing the nuclear security series, including the nuclear security plans which are extremely useful.

The IAEA promotes guidance on export/import of radioactive sources and guidelines of the NSG. The 'Code of Conduct on the Safety and Security of Radioactive Sources' published and promoted by the IAEA, underlines the significance of export controls.[31] One of the two treaties for nuclear security, The Convention on the Physical Protection of Nuclear Material, in Article 4.1 maintains that "Each State Party shall not export or authorize the export of nuclear material unless the State Party has received assurances that such material will be protected during the international nuclear transport at the levels described in Annex I."[32] The Treaty also has other provisions such as transit and transhipment control. The Amendment of the Convention also emphasises export control for nuclear security.[33]

Under the aegis of the IAEA, India has been organising training courses on physical protection of nuclear installations and other issues of nuclear and radiological material security. India is also prepared to share its expertise with any country that voices interest and in addition, has offered its facilities for training officials from Asia. In his submission to the IAEA in December 2016, the Minister of State for External Affairs, M. J. Akbar, informed that India was willing to provide human and financial resources to capacity building and outreach programmes.[34] He also said that Indian experts are active in international, regional and national training programmes of different facets of nuclear security.[35] Quite naturally, export control is receiving adequate attention and may get even more enhanced attention in the future.

Global Initiative to Combat Nuclear Terrorism

The Global Initiative to Combat Nuclear Terrorism (GICNT) is an important initiative involving 86 countries. Five international organisations also participate in its activities

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for "strengthening global capacity to prevent, detect, and respond to nuclear terrorism."[36] Its Statement of Principles mentions the need for "improving the ability to detect nuclear and other radioactive materials and substances in order to prevent illicit trafficking in such materials and substances, to include cooperation in the research and development of national detection capabilities that would be interoperable…."[37] The GICNT promotes capacity building of its member countries to strengthen their systems to prevent the 'acquisition of nuclear materials and know-how by terrorists.'[38] It also encourages information sharing and law enforcement cooperation among its members. The GICNT favours development of 'appropriate legal and regulatory frameworks' to prevent nuclear terrorism. A number of workshops have been organised under the GICNT, on issues such as accession to international counterterrorism conventions and protocols and cooperation on intelligence, security and law enforcement services in detection, prevention and investigation of acts of nuclear terrorism.[39] These workshops have been useful for industry and other agencies relevant in fighting nuclear terrorism.

India is a participant in the GICNT. And as a participant, it works to fight clandestine nuclear transactions and build capacities of other participating countries in doing so. In February 2017, India hosted a meeting of the Implementation and Assessment Group (IAG) of the GICNT. At present, the Netherlands is the coordinator of the IAG. India is committed to contributing to development of best practices for nuclear security, and export controls remain one of the best practices for nuclear security. India is supportive of all of GICNT's activities. In recent years, India has been working with other countries and has strengthened information sharing practices.

Evolving Indian Export Control Framework

Like other responsible countries, India has adapted its export control system to strengthen nuclear security. India has evolved its legal and regulatory frameworks for export controls, which have special provisions to prevent transfer of WMD goods to non-state actors. India's nuclear security culture too has helped in controlling the spread of these items. On 24 April 2017, India carried out drastic reforms in its export control systems. Among other changes, it issued a new notification on the consolidated SCOMET list. Now the Indian system has been harmonised with all the four export control regimes – the Missile Technology Control Regime (MTCR), the NSG, the Wassenaar Arrangement (WA) and the Australia Group (AG). The Indian government has also amended its Handbook of Procedures. One of the official documents released notes: "Para 2.72(b) of the Handbook of

Procedures as amended … provides that export can be regulated if the exporter has been notified in writing by Director General of Foreign Trade (DGFT), or he knows or has reason to believe, that an item not covered in the SCOMET list has a potential risk of use in or diversion to weapons of mass destruction or in their missile system or military end use (including by terrorists and non-state actors). In such a case, the process for authorising export would be similar to the one for SCOMET."[40] The Indian government maintains that government and industry have a joint accountability to guarantee that "Indian exports are not accessed by proliferators, terrorist groups and non-state actors. Any export that inadvertently lands up in the wrong hands may have implications for our national security and affect Brand India. These regulations are an important step to address such concerns."[41]

The decision regarding licensing of a SCOMET item taken at the Inter-Ministerial Working Group is based on consensus. Although like any other country with an advanced export control system, India balances its security and commercial interests, it has zero tolerance for proliferation and nuclear terrorism. The Indian export control system has laid down certain preventive steps for SCOMET items. Licensing authorities are supposed to consider the following before granting license of a SCOMET item:

- Credentials of end-user
- Credibility of declarations of end-use of the item or technology
- Integrity of chain of transmission of item from supplier to end-user
- Potential of item or technology, including timing of its export, to contribute to end uses that are not in conformity with
  - India's national security or foreign policy goals and objectives,
  - objectives of global non-proliferation, or
  - its obligations under treaties to which it is a state party
- Assessed risk that exported items will not fall into hands of terrorists, terrorist groups, and non-State factors
- Export control measures instituted by recipient state
- Capabilities and objectives of programmes of recipient state relating to weapons and their delivery
- Assessment of end-uses of item(s)
- Applicability to an export license application of relevant bilateral or multilateral agreements to which India is a party

As enforcement is considered extremely relevant for both export controls and nuclear security, India has taken steps to strengthen its enforcement machinery. At the national level, it has set up a Counter Nuclear Smuggling Team drawn from 'concerned ministries/ departments/ agencies.'[42] The Indian national report to the NSS highlighted the activities of the group, which holds regular meetings including "table top exercises for effective and coordinated response to threats involving use of nuclear and radioactive material for malicious purposes." Besides, India's enforcement machinery has immensely benefited from international cooperation.

As enforcement is considered extremely relevant for both export controls and nuclear security, India has taken steps to strengthen its enforcement machinery.

Recommendations

India and the global nuclear community need to work together to resolve all the complex issues that remain stumbling blocks in enforcing nuclear security. Some of the recommendations to improve the export control mechanism to address nuclear security are as follows:

- *Best practices to appropriate practices*: Several national export control systems have become better but many have turned out to be unnecessarily burdensome. The next level of exercise should aim at designing appropriate practices suited to local conditions instead of adopting irrelevant practices in the name of adopting best practices.
- *Implementation issues*: There are some provisions, such as ultimate end-user and intangible technology controls, which appear very relevant, but are proving difficult to implement. In export control, it has become a dominant practice to demand information about the last or ultimate end-user. But that is difficult to provide when a company purchases an item to manufacture a product. At the time of manufacturing the product, the company may not know the buyer of the product. It may find a buyer later. In this situation, it is difficult to arrange an ultimate end-user. Similarly, intangible technology controls are becoming difficult to control because of transmission of information and knowledge by electronic and other means. The traditional border control through customs points cannot prevent this type of transfer. This is a problem faced by both the developed and developing countries.
- *State-denial to non-state denial*: The UNSCR 1540 contributed to the internationalisation of export controls. Almost all countries of the international community support the norm of export controls and most countries have adopted the best practices for export controls. But most of the practices are geared to stem proliferation in which state actors are involved. Existing controls designed following UNSCR 1540, or even before the advent of UNSCR 1540, are pertinent for merely those non-state actors which are supported by the proliferation of state actors. The need is to develop focused control of items which may directly contribute to nuclear terrorism.
- *Transition from Nuclear Security Summit*: The NSS process brought a great deal of awareness regarding the importance of nuclear security. More significantly, the process used existing institutions like the IAEA, and at the same time, created several new Centres of Excellence. Now the centrality of IAEA may be maintained and other institutions or Centres of Excellence can work under the aegis of IAEA. This will help in optimising resources with the institutions playing complementary roles.
- *More proactive role for security agencies through new departments*: Strategic trade is generally managed by the trade or commerce ministries, though security agencies of a country (should?) play a role by sitting in on inter-ministerial committees. However, even the countries which have the old export control systems maintain that a country must have a secretariat in which security agencies can work closely with trade or commerce bodies.
- *Outreach*: Training of licensing and enforcement authorities is indispensable for the effectiveness of the export controls system to fight nuclear terrorism. Experience shows that experts with an academic background who worked on

export controls contributed significantly to outreach activities. Academia along with industry needs to be mobilised for the cause. A training the trainer module could be supported by the international community for this purpose, especially for new export control countries like India.

- *NSG membership for India*: As discussed, the NSG played a valuable role in fighting nuclear terrorism. After the 9/11 events, each year the plenary meetings of the group has discussed ways to fight terrorism. India has applied for membership of the NSG. A number of countries, including the Netherlands and the US are supporting Indian membership. The supporting countries should push for India's membership. India can then share its own experience of using export controls for nuclear security and at the same time, it may gain from information sharing and other deliberations within the NSG.

Conclusion

Export controls are an important tool of nuclear security. In recent years, they have evolved and become sophisticated in fighting nuclear terrorism. Yet, there are serious problems, which need to be addressed at the international level. India is serious about global governance of export controls and nuclear security. Over the years, India has adopted global best practices for export controls, which may have implications for nuclear security. It has developed legal, regulatory and institutional frameworks to control exports. The laws, the regulatory mechanisms and the institutions of export controls have provisions for controlling sensitive items which may contribute to nuclear terrorism. India has been updating its guidelines and control lists regularly. Quite significantly, it

Export controls are an important tool of nuclear security. In recent years, they have evolved and become sophisticated in fighting nuclear terrorism.

has a nuclear security culture that does not allow for complacency. India's enforcement machinery is also active and is working with international organisations and friendly countries to intercept clandestine and unauthorised transactions. India's further integration and accommodation in bodies like the NSG will be highly useful in developing export controls to fight terrorism.

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EVOLVING A GLOBAL NUCLEAR SECURITY REGIME

Future Institutions and Mechanisms

Dr. Rajeswari Pillai Rajagopalan

Nuclear security has been the subject of intense global attention in the past decade, as is evident in the Nuclear Security Summit (NSS) process. The issue however, is not new. It can be traced back to the period immediately after the end of the Cold War and the disintegration of the Soviet Union in 1991. The fears of nuclear materials from the collapsing Soviet Union falling into wrong hands, as well as unauthorised transfer of nuclear know-how by the Soviet scientific community, raised alarm bells. These fears paved the way for new initiatives such as the US' Civilian Research and Development Foundation (CRDF) Global for the independent states of the former Soviet Union[1] and the US Threat Reduction programme.[2]

Even so, it was not until the 9/11 terrorist attacks in the US that the issue of nuclear terrorism was approached with a focused attention. The fear of terrorists getting hold of nuclear and radiological materials raised the threat to a new level. While terrorists have so far not managed to acquire such materials, the threat cannot be taken lightly, given the enormity of the consequences. Global terrorist outfits such as al Qaeda and ISIS have shown interest in gaining access to such materials to create large-scale disruption. Osama Bin Laden had gone on record to say that it was his "Islamic duty" to get hold of and use weapons of mass destruction (WMDs).[3] This message was replayed in a 2007 video.

More recently, the threat to Europe has been evolving. Media reports have suggested that the original terrorist target of the November 2015 Paris attacks was Belgium's nuclear facility.[4] An ISIS associate was captured with 10 hours of surveillance footage of a high-ranking Belgian nuclear official in his possession.[5] In yet another incident, just days after the Brussels bombing in early 2016, the Belgian authorities learnt that a security guard at one of their nuclear medical research facilities had been murdered, and his identity card reported stolen.[6] Thereafter, the British Defence Secretary went on to claim that ISIS acquiring nuclear weapons posed "a new and emerging threat."[7]

The empirical evidence in terms of unauthorised activities involving these materials is

compelling. According to the IAEA's Incident and Trafficking Database (ITDB), in 2016 alone, there were 189 incidents of unauthorised activities/events involving nuclear and other radioactive material, reported to the ITDB by 34 States. These incidents included both unauthorised as well as malicious use of such material. According to the Database, between 1993 and 2016, there were a total of 3,068 confirmed incidents reported by participating states.[8] The imperative for concerted global action is evident. It is also obvious that it is not a problem that can be resolved within the boundaries of a nation-state. Given the trans-national nature of the problem, all states, especially the nuclear ones, should be part of global conversations on the subject.

This essay is divided into three major sections. After setting the context and imperative for nuclear security, it goes on to examine the global nuclear security architecture, both the legal and institutional architecture, as well as the processes that are in play. Given the enormity of the challenges and the lacunae in existing mechanisms, the second part delves into the future of nuclear security, especially looked at from a nuclear security regime perspective. With shifting balance of power in play, the challenges of rule-making are enormous, which should drive states to adopting temporary, technical measures as a way to avoid disasters. Thus, the last section provides certain recommendations that can be followed in the short- and medium-term which could potentially build the necessary confidence between States and take the process of developing a more binding nuclear security regime forward.

Imperatives – Why Pursue Nuclear Security?

Even as nuclear terrorism looms large in the nuclear security narrative, the salience of nuclear – both from a civilian and weapons perspective – is compelling. From a civilian perspective, given the climate change dynamics and the need to pursue clean energy options, nuclear, as part of the energy mix, is here to stay.[9] India, for one, is increasing the share of nuclear in its overall energy matrix. In India, current nuclear utilisation as part of its electricity consumption is fairly small at 3.6 percent. Nuclear capacity, in terms of electricity production, stands at 5,780 MW, estimated at 1.91 percent of the total energy mix.[10] If current projects go as per plan and are completed, India should be able to raise production levels to 10,080 MW.[11] As per India's plans to expand its reliance on nuclear energy, estimates suggest that India will increase power generation through the nuclear option to 60,000 MW by 2030.[12] This is sought to be achieved through a mix of India's Pressurised Heavy Water Reactors, foreign-sourced Light Water Reactors and indigenously-developed Fast Breeder Reactors.[13]

Increasing dependence on nuclear power to meet growing energy security requirements is not limited to India alone. Despite unfortunate events like the Fukushima accident, the nuclear component has become a critical input even in countries like Japan. While the large-scale protests against nuclear plants have had some dampening effect, the current non-feasibility of sufficient alternative clean energy options in Japan has pushed it back to opening its nuclear power plants for now.

Security-related compulsions also prompt states to pursue nuclear weapons in a

determined manner. There are several important contextualising factors including the shifting global and Asian balance of power, weakness of conventional military capabilities that raise the salience of nuclear weapons in overall strategic thinking. This is not to play down the dangers of nuclear materials. Terrorists need not even get hold of a full weapon but sufficient material to create a dirty bomb and the consequences can be huge. Going by the density of population of major cities around the world, especially cities in Asia, the levels of human devastation and environmental impact at a secondary level will be severe. The adverse effect will be felt also in terms of public support to nuclear energy, and it could have a longer-term negative impact on the economies of countries, affecting foreign investment as well as tourism.

Security-related as well as energy compulsions suggest that nuclear materials and technologies, despite their inherent dangers, will not disappear for the near future. Hence, there is need to institute new institutions and process to avoid any vulnerabilities. Even as threats and challenges to nuclear security grow, there is very little by way of a nuclear security regime that is effective and comprehensive. At present, the various measures in play are simply guidelines. There are UN Security Council resolutions, national pledges and voluntary steps, but there is no regime that is politically or legally binding upon states.

Global Nuclear Security – Initiatives and Processes

The security of nuclear and radiological materials is a relatively new threat. It is different from the issue of the proliferation of nuclear weapons, which has remained a pre-occupation of major powers since the late 1960s. The legal and institutional mechanisms to deal with nuclear security are in a nascent stage. Today a large number of actors – including non-state players such as educational institutions and private sector players – also possess nuclear materials and technologies. Finding an agreement among such a diverse set of players makes the challenge more problematic. Further, some of the traditional platforms, such as the Conference on Disarmament (CD) in Geneva – where much of the arms control negotiations happen – have remained stalemated for more than two decades now. While there have been some initiatives, involving civil society discussions, these have not gone very far. CD continues to be at a standstill with not even an agreement on a work plan.

Legal Architecture

Much like other emerging security issues, nuclear security lacks an effective regime. While some measures are in place, in particular the Convention on the Physical Protection of Nuclear Materials (CPPNM), or the International Convention on the Suppression of Acts of Nuclear Terrorism (ICSANT), they are not sufficiently comprehensive to tackle the entire range of issues associated with nuclear security, covering the civilian and weapons domain. CPPNM is the only legally binding mechanism that exists in the area of physical protection of nuclear materials. CPPNM, which opened for signatures in March 1980, entered into force in February 1987. However, the CPPNM, as it stands, relates only to nuclear materials in the peaceful and civilian domain, and during an international nuclear shipment. The CPPNM is not applicable to nuclear materials used in the military domain, or those in the peaceful

The change in threat perception following the 9/11 terrorist attacks made it imperative to review the CPPNM's scope, related to the physical protection of nuclear material in domestic use, storage, and transport, and the protection of nuclear materials and facilities, against sabotage.

domain that are not involved in international transport.[14] The International Atomic Energy Agency's (IAEA) Information Circular 225 (INFCIRC/225/) Revision 4 recommendations for the physical protection of nuclear materials, deals with these aspects.[15] The limitation of the CPPNM is the assumption that physical protection of nuclear materials is truly a domestic and national responsibility.

The change in threat perception following the 9/11 terrorist attacks made it imperative to review the CPPNM's scope, related to the physical protection of nuclear material in domestic use, storage, and transport, and the protection of nuclear materials and facilities, against sabotage.[16] A diplomatic conference convened in July 2005, to bring into effect additions to the CPPNM, adopted this as an Amendment to CPPNM. The Amendment also sought to expand and include cooperation among states and the IAEA to locate and recover stolen nuclear material. However, the Amendment could not enter into force until two thirds of the State Parties to the CPPNM ratified it. This took until 8 May 2016.

The International Convention on the Suppression of Acts of Nuclear Terrorism (ICSANT) is an important mechanism exploring nuclear security in the context of international terrorism. Russia introduced the draft Convention in 1996 while underlining the weaknesses and gaps in the CPPNM, especially as it relates to the dangers of nuclear terrorism. Therefore, ICSANT was proposed as a means for "combating new and dangerous manifestations of terrorism, stimulating the adoption of effective preventive measures… and establishing a reliable international legal mechanism for cooperation at all stages of combating nuclear terrorism."[17] The Russian Federation in its explanatory note stated, "The draft convention was particularly significant in that it was the first international legal instrument in the area of anti-terrorist activities that was specially designed as a 'pre-emptive instrument.'" Despite the broad agreement for fighting nuclear terrorism, there are several concerns, especially about Article IV of ICSANT. Many non-nuclear weapon States (NNWS), mostly from the Non-Aligned Movement (NAM), for instance, were opposed to any language that would legitimise the use of nuclear weapons by the Nuclear Weapon States (NWS). This led to the amendment of Article IV, wherein it is clarified that the Convention cannot be construed or seen as legitimising the use or threat of use of nuclear weapons. There were other issues, including the absence of a commonly agreed definition of terrorism, which delayed adopting the Convention. Almost a decade later, in April 2005, the UN General Assembly finally approved the ICSANT.[18] It was opened for signature from September 2005 to December 2006. With 22 countries ratifying it, the ICSANT entered into force in July 2007.

Currently, there are 115 signatories and 99 Parties. There are 16 signatory countries that have not ratified it yet.

Major provisions of ICSANT include: "A wider definition on materials and facilities covering both military and peaceful applications; the criminalization of planning, threatening, or carrying out acts of nuclear terrorism; it also requires states to criminalize these offenses via national legislation and to establish penalties in line with the gravity of such crimes; guidelines for extradition and other measures of punishment; The requirement for tates to take all practicable measures to prevent and counter preparations for offenses to take place inside or outside of their territories."[19] In addition, ICSANT uses a fairly broad and comprehensive definition of nuclear terrorism, to include, "the use or threat to use nuclear material, nuclear fuel, radioactive products or waste, or any other radioactive substances with toxic, explosive, or other dangerous properties."[20] The definition extends to "the use or threat to use any nuclear installations, nuclear explosive, or radiation devices in order to kill or injure persons, damage property, or the environment, or to compel persons, States, or international organizations to do or to refrain from doing any act. The unauthorized receipt through fraud, theft, or forcible seizure of any nuclear material, radioactive substances, nuclear installations, or nuclear explosive devices belonging to a State Party, or demands by the threat or use of force or by other forms of intimidation for the transfer of such material would also be regarded as acts of nuclear terrorism."[21] However, critics argue that there is no mechanism to verify the effectiveness of the implementation of either the CPPNM or the ICSANT.[22]

IAEA's Convention on Nuclear Safety (CNS) is also an important instrument in this regard. Though the Convention is applicable only to the safety[23] and not *security* of nuclear materials, it is possibly a good model to build on and develop a similar mechanism for nuclear security. The CNS came into force in October 1996 and has 80 Contracting Parties. The Convention obligates state parties to implement certain safety standards and regulations for nuclear power plants. Some of the major items covered under the Convention include site selection, design and construction, operation and safety verification, and emergency preparedness. To have a globally acceptable set of nuclear safety standards and regulations has a larger binding effect on states to strengthen their nuclear security policies and practices.

To have a globally acceptable set of nuclear safety standards and regulations has a larger binding effect on states to strengthen their nuclear security policies and practices.

Another important initiative around nuclear security is the Global Initiative to Combat Nuclear Terrorism (GICNT).[24] The GICNT is a voluntary, international platform of 86 countries and five international organisations, with a commitment to augmenting global capacity to prevent, detect and respond to nuclear terrorism. The partner countries have committed to executing the GICNT Statement of Principles (SOP) related to deterrence, prevention, detection and response objectives. These are in line with the existing international agreements including the International Convention for the Suppression

of Acts of Nuclear Terrorism, the Convention on the Physical Protection of Nuclear Material, and UN Security Council Resolutions 1373 and 1540.

GICNT is a vibrant mechanism and keeps up the momentum around nuclear security.[25] For instance, the GICNT in its Implementation and Assessment Group (IAG) meeting held in New Delhi in February 2017 (with the Netherlands as the IAG coordinator), brought together 152 technical experts and policy representatives from 41 partner nations. The GICNT meeting focused its work through three working group sessions: Nuclear Detection Working Group (chaired by Finland); the Nuclear Forensics Working Group (chaired by Australia); and the Response and Mitigation Working Group (chaired by Morocco). Their work was meant to "test and improve national and international capabilities, strengthen and unify a community of nuclear security specialists, increase coordination and interoperability among agencies, equipment, and information, and address sustainability challenges."[26]

Future Processes, Mechanisms and Limitations

Despite the general stagnancy in rule-making on international security, nuclear security is an area that has been somewhat of an exception. Even as there was scepticism in certain parts of the world, the Nuclear Security Summit (NSS) process that started in Washington DC in 2010 proved to be a successful project. This is partly because nuclear security is seen as a common threat shared across a large number of states, including those that have sponsored terrorism. Another important consideration for states is that nuclear security is perceived as a problem that primarily emanates from non-state actors such as terrorists, and therefore states have been generally inclined to play an active role in dealing with the issue.

The four Summits between 2010 and 2016 clearly strengthened the awareness level and responsiveness of states to the issue of nuclear security.[27] There was near universal agreement in acknowledging the nuclear security threat. The NSS process got States to contemplate nuclear security policies and practices in a new light, overcoming their complacency regarding nuclear terrorism and sabotage and providing possible new solutions at the national and global levels. One such proactive measure resulted in "Gift Baskets," which were essentially country pledges and commitments on several areas such as nuclear forensics, insider threats, nuclear terrorism, nuclear security regulation, and physical protection of nuclear materials.

The most pertinent factor that made the NSS process work was the US's leadership on the issue. The US heading the effort was critical in bringing about large-scale participation. Unfortunately, today American leadership is generally lacking on several international security issues, including nuclear security. Today, President Donald Trump's 'America first' policy offers very few alternatives, and could lead to a stalemate. Other countries and regions may take some initiatives to break the current logjam, but if there has to be meaningful progress in this regard, it would require the US to take on the leadership mantle.

Following the four Summits, the contact group within the IAEA is making efforts to keep up the momentum, despite American leadership being lacking. Its participation at the level of mid-level bureaucracy, and not at the highest

level of political leadership, does not really advance the cause. However, it is also time to get realistic about what is feasible rather than what is desirable. Many countries have argued for a more central role for the IAEA in nuclear security. While the IAEA has remained central to many global efforts, it has had shortcomings, both in terms of software and hardware to strengthen nuclear security implementation. For one, the lack of funding to carry out the extensive range of missions the IAEA needs to is a problem. Availability of qualified human resources has been an issue as well. If these two issues are not addressed, the call to IAEA to play a larger role will remain purely rhetorical.

Though US leadership is critical in reimagining nuclear security in the global context, the role of informal discussions and regional efforts cannot be understated. The leadership role that the EU played in the area of outer space, for instance, is commendable. The EU-initiated International Code of Conduct for Outer Space Activities (ICoC) has not reached its meaningful conclusion yet; nevertheless, it proved its utility in kick-starting serious global debates on the governance of the global commons. The fact that it brought together more than 100 states in three Open Ended Consultations, and organised a number of regional meetings in the backdrop of the ICoC, need to be acknowledged.

Also to be borne in mind is the geopolitical context of the day, and how the shifting global balance of power will have an impact on global rules of the road. The fact that power is somewhat more equally spread today makes it more challenging to write new rules of engagement. Writing international rules or developing norms require the key great powers to take the lead, for rarely are such rules made without their participation. For example, when the Non-Proliferation Treaty (NPT) and associated mechanisms were designed, there was consensus between the two key great powers – the US and the Soviet Union – that the spread of nuclear weapons was a danger and that they should cooperate to prevent it. Today, the US, despite being the sole superpower, does not have the level of dominance to ensure the promotion of these rules, especially given the lack of consensus on these issues with other powers such as Russia and China. Proliferation of technology and expertise across a large stakeholder base again does not help the case.

Lastly, the success of any initiative rests on understanding and appreciating its limits. Around nuclear issues, many of the, difficulties are broadly rooted in real political and historical problems and national security and thus may not be entirely resolvable in the short term, but they should not be dismissed. States can take a few actionable steps, which would help to set the agenda for the short- and medium-term. These measures, if adopted by States, could help to avoid possible disasters, and the process would instil greater confidence among States that remains critical for developing an effective nuclear security regime.

Agenda for the Short and Medium Term:

Need to codify standards and regulations: The need to codify global standards and regulations covering both civilian and military nuclear materials through a comprehensive instrument such as an International Convention on Nuclear Security is real. Even as a handful of measures such as the CPPNM exist, the lack of an overarching legal and institutional mechanism to lay out a set of standards could harm global

nuclear security endeavours. Global regulations and standards with national-level implementation plans, and an annual or a bi-annual reporting system must be conceived.

Expand the number of nuclear security stakeholders: CPPNM and ICSANT provide certain broad guidelines for nuclear security policy implementation, but there is a need to go beyond state apparatuses as the sole stakeholders in ensuring nuclear security. The NSS was a useful process in this regard. The large-scale participation of experts and the non-governmental organisations' (NGO) sector, as well as industry, provided for widening the scope of discussions around nuclear security. While so far only industry from the West has participated, this could possibly change, with more active and independent participation of Asian industry in the civil nuclear sector. Countries like India and China in particular will endorse such expansion as it would lead to technology diffusion among a larger pool of players, and because there is greater demand, which the state alone may not be able to cater to. This should call for more active engagement and conversations between the multiple agencies and stakeholders, including industry.

Instil strong sense of nuclear security culture: Security culture is one of the most critical factors in assessing and improving nuclear security practices, be it in the civil or the weapons domain. Security culture has a particularly important role in tackling insider threats, whether they manifest in the form of cyber threats or physical protection. Security culture is also vital in the context of dealing with complacency issues. This should result in targeted training programmes and modules on nuclear security culture, involving everyone from facility janitor and lab researcher to technician, control room operators and security guards (at multiple levels appropriate to their levels and security clearance). A trustworthiness programme, to periodically validate the reliability of every single employee, must also be strengthened. It must also be kept in mind that these modules and programmes to strengthen security culture should be dynamic in nature – it cannot be that a plant has developed a certain module which has not been reviewed and amended as per the changes in threat perception. States could also think about a nuclear security culture initiative where they share their security lapses (primarily due to complacency), lessons learnt and action taken – this will prove particularly useful in avoiding pitfalls arising out of complacency.

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Institute better accounting and auditing mechanisms and practices:[28] Nuclear materials that are not properly accounted for and audited can pose serious risks to many countries and the world at large. There must be, therefore, better accounting standards and practices. It is suggested in the form of a mechanism within the IAEA involving all nuclear material possessing states giving an account of their accounting and auditing policies and practices without divulging any sensitive information. Additionally, it could go to strengthen some of the existing IAEA processes such as peer reviews, outlining of nuclear security measures and practices, and

how lapses and breaches have been assessed and resolved.

Increase state support to the IAEA: Strengthening state support through sustained resources to the IAEA is vital for it to execute the extensive range of missions efficiently. States need to increase their financial contribution, as also be willing to send their scientific and technical experts on deputation to the IAEA so that it is able to fulfil its missions .

International cooperation on nuclear security best practices: Nuclear security, due to the catastrophic consequences, is too critical an area for error. There should be literally no scope for mistakes. It must also be acknowledged that no country may have all the solutions to every single problem confronted in this regard – sharing of good practices, shared through controlled channels, the existing vulnerabilities, lapses and breaches and how they may be contained or dealt with in case of a breach will prove to be valuable to other states which could face such a scenario in the future.

Standardisation of minimum standards: While the IAEA has issued several guidelines and standards for strengthening nuclear security implementation, a commonly accepted minimum standard must be prescribed as mandatory. These could include National Design Basis Threats, Personnel Reliability Programme, Nuclear Security Culture modules, being party to existing nuclear security treaties and instruments such as CPPNM and the 2005 Amendment, ICSANT, UN Security Council resolution 1540.

Sustain the NSS momentum: The NSS process every two years helped to raise awareness levels across a large number of states in addition to help tackling complacency issues, political hurdles, and in bringing a larger community and expanding the nuclear security stakeholders involved. A meeting of the NGO and expert community and a similar engagement among the industries had expanded the number of interested parties in strengthening nuclear security implementation. The IAEA Contact Group process, the follow-up mechanism, is a useful one and it could keep up with some of the progress made at the Summits. But the utility of a more informal and multiple level engagement need to be appreciated. The NSS held every two years brought in certain amount of accountability, peer pressure to adopt and adapt nuclear security policies and practices.

Strengthening contingency response measures: The goal of the nuclear security regime is to prevent nuclear incidents, intentionally or otherwise. Nuclear incidents are in the category of high impact, low probability. Given the catastrophic consequences, states need to prepare for all contingencies. International cooperation and sharing of best practices is essential in keeping the world safe and secure.

Use regional Centres of Excellence wisely: Nuclear security is a subject that must be tackled at the global level. Training missions, simulation exercises and such other efforts on a global scale can only be undertaken by regional Centres of Excellence, such as the Global Centre for Nuclear Energy Partnership (GCNEP) in India and Centre of Excellence on Nuclear Security in China.

Endnotes

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There has been a renewed effort to strengthen old international rules and regimes on nuclear security as well as to establish new ones. The Netherlands and India share concerns on nuclear security, given the threats both countries have to contend with. The Netherlands hosted the Nuclear Security Summit in March 2014, and is currently the international coordinator for the Global Initiative to Combat Nuclear Terrorism. India is planning to host a WMD Terrorism Summit before the end of 2018, a commitment the Indian Prime Minister made at the 4th Nuclear Security Summit (NSS).

This volume brings together four Indian scholars and four Dutch scholars to examine the issue of nuclear security from multiple perspectives, including theoretical and policy prisms. The primary objective of this volume is to understand and share Indian and Dutch knowledge, views and expertise related to global nuclear security issues generally, and specifically to continue the conversation after the 4th (and final) NSS.